

**COURSE OVERVIEW ME1186**  
**Fundamentals of Pump & Compressor Systems**

**Course Title**

Fundamentals of Pump & Compressor Systems

**Course Date/Venue**

Session 1: July 12-16, 2026/TBA Meeting Room,  
 Dusit D2 Salwa, Doha, Qatar or, TBA  
 Meeting Room, Royal Tulip Hotel,  
 Muscat, Oman

Session 2: August 02-06, 2026/TBA Meeting Room,  
 Dusit D2 Salwa, Doha, Qatar or, TBA  
 Meeting Room, Royal Tulip Hotel,  
 Muscat, Oman



**Course Reference**

ME1186

**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 Fundamentals of Pump and Compressor Systems. It covers the pump and compressor systems, fluid mechanics fundamentals and pump compressor fundamentals; the pump and compressor components, engineering units and performance parameters; the centrifugal pumps, positive displacement pumps and pump performance curves; the pump system design, operation and control and pump problems and troubleshooting; and the reciprocating compressors, rotary compressors, dynamic compressors and compressor performance.



During this interactive course, participants will learn the compressor auxiliary systems and compressor operational problems; the preventive maintenance, condition monitoring and mechanical failures; the reliability improvement, safety in pump, compressor systems and environmental considerations; the energy efficiency, system optimization and performance evaluation; the smart pumps and compressors, digital monitoring systems and industrial internet of things (IIoT); and the predictive maintenance technologies.

**Course Objectives/Outcomes & Benefits for the Participants**

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

- Apply and gain a fundamental knowledge on of pump and compressor systems
- Discuss pump and compressor systems, fluid mechanics fundamentals and pump compressor fundamentals
- Recognize pump and compressor components as well as engineering units and performance parameters
- Explain centrifugal pumps, positive displacement pumps and pump performance curves
- Apply pump system design, operation and control and discuss pump problems and troubleshooting
- Identify reciprocating compressors, rotary compressors, dynamic compressors and compressor performance
- Recognize compressor auxiliary systems and compressor operational problems
- Apply preventive maintenance and condition monitoring and identify mechanical failures
- Employ reliability improvement, safety in pump and compressor systems and environmental considerations
- Implement energy efficiency, system optimization and performance evaluation
- Discuss smart pumps and compressors, digital monitoring systems, industrial internet of things (IIoT) and predictive maintenance technologies

**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 pump and compressor systems for mechanical and maintenance engineers, rotating equipment engineers, process and plant engineers, maintenance technicians and supervisors, operations and production personnel, reliability and asset integrity engineers, utility and facility engineers, field service and workshop technicians, project and commissioning engineers, anyone seeking foundational knowledge of pump and compressor systems operation, maintenance and performance.

**Course Fee**

Muscat	<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.
Doha	<b>US\$ 6,000</b> per Delegate. 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:

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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**. 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.

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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.

**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 Maintenance Engineer** with over **25 years** of extensive experience within the **Oil & Gas, Refinery, Petrochemical & Power** industries. His expertise widely covers in the areas of **Mechanical Pumps & Rotating Equipment, Centrifugal & Reciprocating Pump Installation & Repair, Pump & Compressor Systems, Centrifugal & Reciprocating Compressor, Screw Compressor Troubleshooting, Ammonia Manufacturing & Process Troubleshooting, Distillation Towers, Crude Oil Distillation, Ammonia Storage & Loading Systems, Operational Excellence in Ammonia Plants, Fertilizer Storage Management (Ammonia & Urea), Fertilizer Manufacturing Process Technology, Sulphur Recovery, Phenol Recovery & Extraction, Refining Process & Petroleum Products, Refinery Planning & Economics, Hydrotreating & Hydro-processing, Separators in Oil & Gas Industry, Gas Testing & Energy Isolations, Industrial Liquid Mixing, Extractors, Fractionation, Water Purification, Water Transport & Distribution, Environmental Emission Control, Process Plant Troubleshooting & Engineering Problem Solving, Process Plant Performance, Plant Startup & Shutdown, Process Troubleshooting Techniques and Oil & Gas Operation/Surface Facilities.** Further, he is also well-versed in **Rotating Machinery (BRM), Rotating Equipment Operation & Troubleshooting, Root Cause Analysis (RCA), Process Plant Shutdown, Turnaround & Troubleshooting, Planning & Scheduling Shutdowns & Turnarounds, Optimizing Equipment Maintenance & Replacement Decisions, Maintenance Planning & Scheduling, Material Cataloguing, Maintenance, Reliability & Asset Management Best Practices, Storage Tanks Operations & Measurements, Tank Inspection & Maintenance, Pressure Vessel Operation, Flare & Relief System, Flaring System Operation, PSV Inspection & Maintenance, Heat Exchanger Overhaul & Testing, Pipe Stress Analysis, Control Valves & Actuators, Vent & Relief System, Heat Exchanger Troubleshooting & Maintenance, Steam Trapping & Control, Control & ESD System and Detailed Engineering Drawings, Codes & Standards.**

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.

### Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

### Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

#### **Day 1**

0730 – 0800	<i>Registration &amp; Coffee</i>
0800 – 0815	<i>Welcome &amp; Introduction</i>
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction to Pump &amp; Compressor Systems</b> <i>Role of Pumps &amp; Compressors in Industrial Facilities • Applications Across Oil &amp; Gas, Petrochemical &amp; Utility Industries • Types of Fluid Handling Equipment • System Components &amp; Overall Operating Principles</i>
0930 – 0945	<i>Break</i>
0945 – 1030	<b>Fluid Mechanics Fundamentals</b> <i>Properties of Liquids &amp; Gases • Pressure, Flow Rate &amp; Velocity • Head, Energy &amp; Bernoulli's Principle • Density, Viscosity &amp; Specific Gravity</i>
1030 – 1130	<b>Pump Fundamentals</b> <i>Classification of Pumps • Positive Displacement versus Dynamic Pumps • Pump Operating Principles • Typical Industrial Applications</i>
1130 – 1215	<b>Compressor Fundamentals</b> <i>Classification of Compressors • Positive Displacement versus Dynamic Compressors • Gas Compression Principles • Industrial Applications of Compressors</i>
1215 – 1230	<i>Break</i>
1230 – 1330	<b>Pump &amp; Compressor Components</b> <i>Casings, Impellers, Pistons &amp; Rotors • Shafts, Bearings &amp; Couplings • Mechanical Seals &amp; Packing Systems • Drivers, Motors &amp; Auxiliary Equipment</i>



1330 – 1420	<b>Engineering Units &amp; Performance Parameters</b> Pressure Units & Conversion • Flow Rate Measurement • Power, Torque & Efficiency • Introduction to Performance Curves
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 – 0830	<b>Centrifugal Pumps</b> Construction & Internal Components • Operating Principle • Pump Characteristics • Industrial Applications
0830 – 0930	<b>Positive Displacement Pumps</b> Gear Pumps • Screw Pumps • Piston & Plunger Pumps • Diaphragm Pumps
0930 – 0945	Break
0945 – 1100	<b>Pump Performance Curves</b> Head versus Flow Curve • Efficiency Curve • Power Consumption Curve • Net Positive Suction Head (NPSH)
1100 – 1215	<b>Pump System Design</b> Suction & Discharge Piping • Static & Dynamic Head • Friction Losses • System Curve Analysis
1215 – 1230	Break
1230 – 1330	<b>Pump Operation &amp; Control</b> Start-Up Procedures • Shutdown Procedures • Flow Control Methods • Variable Speed Drive Applications
1330 – 1420	<b>Pump Problems &amp; Troubleshooting</b> Cavitation • Air Binding & Loss of Prime • Excessive Vibration & Noise • Low Capacity & Reduced Performance
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>Reciprocating Compressors</b> Construction & Working Principle • Compression Cycle • Capacity Control Methods • Typical Applications
0830 – 0930	<b>Rotary Compressors</b> Screw Compressors • Rotary Vane Compressors • Lobe Compressors • Scroll Compressors
0930 – 0945	Break
0945 – 1100	<b>Dynamic Compressors</b> Centrifugal Compressors • Axial Compressors • Performance Characteristics • Industrial Applications
1100 – 1215	<b>Compressor Performance</b> Compression Ratio • Volumetric Efficiency • Power Requirements • Isothermal, Adiabatic & Polytropic Compression
1215 – 1230	Break

1230 – 1330	<b>Compressor Auxiliary Systems</b> <i>Lubrication Systems • Cooling Systems • Intercoolers &amp; Aftercoolers • Air Intake Filtration</i>
1330 – 1420	<b>Compressor Operational Problems</b> <i>Overheating • Surge &amp; Stall • Excessive Vibration • Leakage &amp; Capacity Loss</i>
1420 – 1430	<b>Recap</b> <i>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</i>
1430	<i>Lunch &amp; End of Day Three</i>

**Day 4**

0730 – 0830	<b>Preventive Maintenance</b> <i>Maintenance Planning • Routine Inspection Procedures • Lubrication Management • Maintenance Documentation</i>
0830 – 0930	<b>Condition Monitoring</b> <i>Vibration Monitoring • Temperature Monitoring • Oil Analysis • Performance Trending</i>
0930 – 0945	<i>Break</i>
0945 – 1100	<b>Mechanical Failures</b> <i>Bearing Failures • Seal Failures • Shaft Misalignment • Impeller &amp; Rotor Damage</i>
1100 – 1215	<b>Reliability Improvement</b> <i>Root Cause Failure Analysis (RCFA) • Mean Time Between Failures (MTBF) • Reliability-Centered Maintenance (RCM) • Equipment Life Extension</i>
1215 – 1230	<i>Break</i>
1230 – 1330	<b>Safety in Pump &amp; Compressor Systems</b> <i>Safe Operating Procedures • Isolation &amp; Lockout/Tagout (LOTO) • Pressure Hazards • Emergency Shutdown Systems</i>
1330 – 1420	<b>Environmental Considerations</b> <i>Leak Prevention • Energy Loss Reduction • Emission Control • Sustainable Equipment Operation</i>
1420 – 1430	<b>Recap</b> <i>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</i>
1430	<i>Lunch &amp; End of Day Four</i>

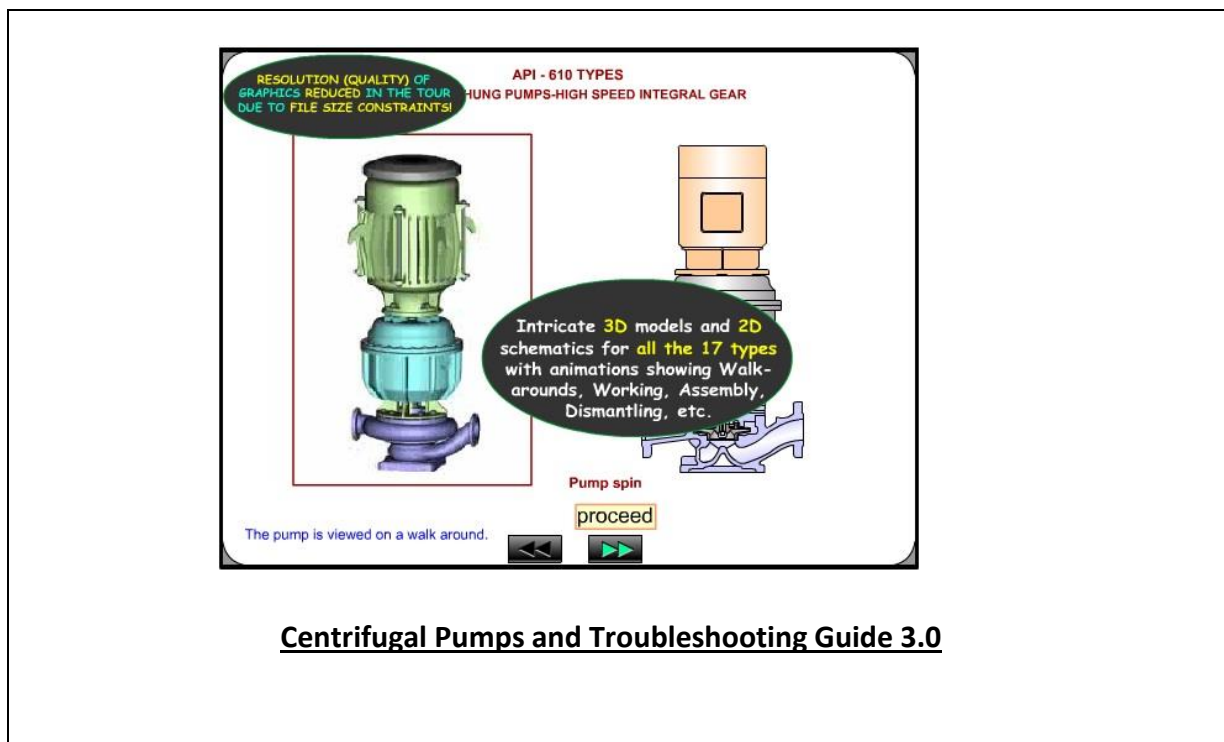
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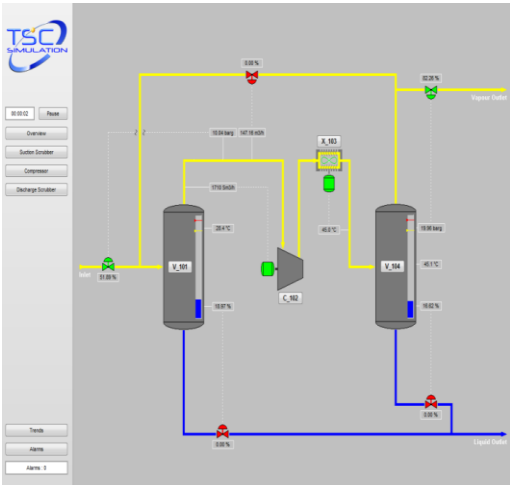
0730 – 0830	<b>Energy Efficiency</b> <i>Pump Efficiency Improvement • Compressor Energy Optimization • Variable Speed Drives (VSDs) • Reducing Energy Losses</i>
0830 – 0930	<b>System Optimization</b> <i>Equipment Selection Criteria • Matching Equipment to Process Requirements • Capacity Optimization • Process Integration</i>
0930 – 0945	<i>Break</i>
0945 – 1100	<b>Performance Evaluation</b> <i>Key Performance Indicators (KPIs) • Performance Testing • Benchmarking Equipment Performance • Operational Audits</i>

1100 – 1215	<b>Modern Technologies</b> Smart Pumps & Compressors • Digital Monitoring Systems • Industrial Internet of Things (IIoT) • Predictive Maintenance Technologies
1215 – 1230	Break
1230 – 1345	<b>Troubleshooting Workshop</b> Structured Troubleshooting Methodology • Analysis of Common Field Problems • Case Studies on Equipment Failures • Corrective Action Planning
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

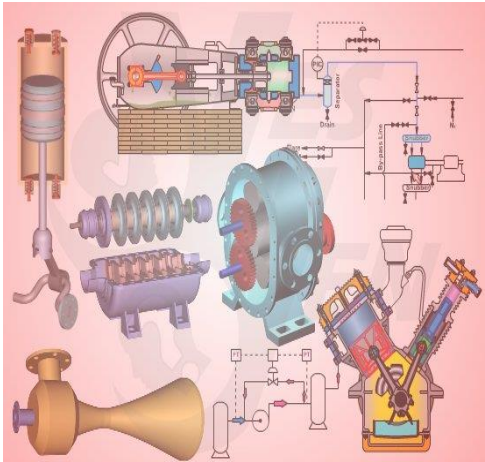
### **Simulator (Hands-on Practical Sessions)**

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 simulators “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor” and “CBT on Compressors”.





**SIM 3300 Centrifugal Compressor Simulator**



**CBT on Compressors**

**Course Coordinator**

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