



COURSE OVERVIEW PE0896 Lubrication of Rotating Equipment

Course Title

Lubrication of Rotating Equipment

Course Date/Venue

Session 1: April 28-May 02, 2025/Fujairah
Meeting Room, Grand Millennium
Al Wahda Hotel, Abu Dhabi, UAE

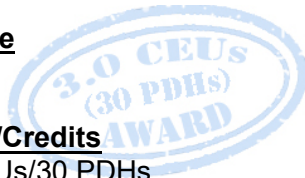
Session 2: October 26-30, 2025/Boardroom 1,
Elite Byblos Hotel Al Barsha,
Sheikh Zayed Road, Dubai, UAE

Course Reference

PE0896

Course Duration/Credits

Four days/3.0 CEUs/30 PDHs



Course Description



This practical 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 the operation of rotating machinery pumps, compressors, turbines and lubrication techniques. It covers the philosophy behind the specific rotating machineries selection to suit the process requirements; the rotating machinery technology which focus on major/minor parts of the specific equipment; the common/un-common problems and the structured way to identify the problem and the counter-measure; the various lubrication and sealing system; the details of how each and every parts of the equipment works in order to achieve its objectives; the common problems and troubleshooting; and the routine checks and analytical thinking of abnormalities



Further, the course will also discuss the centrifugal and positive displacement pumps; the technology of pumps; the start-up and operation monitoring of centrifugal and positive displacement pumps; the reciprocating compressor architecture; the technology of main components and ancillaries of reciprocating compressors; the influence of process condition on compressor performance; the flow control of specific safety devices and start-up philosophy; and the multi-stage centrifugal compressor.





During this interactive course, participants will learn the specific precaution for startup, detailed operation procedures, safety practices, troubleshooting, daily routine checks and do's and don'ts for each specific equipment; the operating principles and mechanical design of turbines; the application ranges, configurations and application constraints; the turbine motors, blading, diaphragms, nozzles, steam chests, glands and gland systems, bearings, balancing and rotor dynamics; the governing systems, lube oil management, steam (water) rates, condensing and backpressure turbines, single and multistage types and process considerations; the commissioning, startup, run-in and shut-down, surveillance and health monitoring, performance measurement and monitoring and tracking; the lubrication techniques; the fluid and hydro-dynamic lubrication, boundary lubrication, characteristics of the lubricants under different operating conditions, and different types of lubricants for different applications; the lubricant's viscosity, flashpoint, volatility, oxidation and thermal stability; and the demulsibility, foaming and gas solubility, corrosion prevention and compatibility.

Course Objectives

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

- Apply a comprehensive overview of the various types of rotating equipment in oil and gas industry
- Explain the philosophy behind the specific rotating machineries selection to suit the process requirements
- Discuss rotating machinery technology which focus on major/minor parts of the specific equipment
- Troubleshoot session which focus on common/un-common problems and the structured way to identify the problem and the counter-measure
- Recognize the various lubrication and sealing system which can be found within the equipment
- Explain the details of how each and every parts of the equipment works in order to achieve its objectives
- Identify the common problems and troubleshooting
- Carryout routine operation checks and analytical thinking of abnormalities
- Identify centrifugal and positive displacement pumps including its types and applications in the refinery
- Discuss the technology of pumps and its architectures, NPSH, mechanical seals and operating limits
- Apply start-up and operation monitoring of centrifugal and positive displacement pumps
- Illustrate reciprocating compressor architecture covering the number of stages, cylinders, overall layout and typical applications
- Discuss the technology of main components and ancillaries as well as the influence of process condition on compressor performance
- Carryout flow control of specific safety devices and start-up philosophy
- Describe a multi-stage centrifugal compressor, the pressure increase process for a compressor stage, operating window and flow regulation



- Employ specific precaution for startup, detailed operation procedures, safety practices, troubleshooting, daily routine checks and do's and don'ts for each specific equipment
- Discuss operating principles and mechanical design of turbines including impulse turbines and reaction turbines
- Recognize the application ranges, configurations and application constraints
- Determine turbine motors, blading, diaphragms, nozzles, steam chests, glands and gland systems, bearings, balancing and rotor dynamics
- Identify governing systems, lube oil management, steam (water) rates, condensing and backpressure turbines, single and multistage types and process considerations
- Employ commissioning, startup, run-in and shut-down, surveillance and health monitoring, performance measurement and monitoring and tracking
- Apply lubrication techniques and identify its composition, crude oil derived lubricants, synthetic lubricants, cause of friction, heat and water
- Identify fluid and hydro-dynamic lubrication, boundary lubrication, characteristics of the lubricants under different operating conditions, and different types of lubricants for different applications
- Explain lubricant's viscosity, flashpoint, volatility, oxidation and thermal stability
- Recognize demulsibility, foaming and gas solubility, corrosion prevention and compatibility

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 the operation of rotating machinery pumps, compressors, turbines and lubrication techniques for mechanical engineers, rotating equipment engineers, supervisors and other technical staff. Further, the course is suitable to all other engineering disciplines who are dealing with rotating equipment such as process engineers, chemical engineers, electrical engineers, plant engineers, project engineers and instrumentation engineers.

Accommodation


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

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: -

- 
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.

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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.

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 Syntfuels, 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 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 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	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 - 0930	Rotating Machinery Operation <i>Basic Principles of Rotating Equipment Installation, Design & Maintenance & Consequently Apply those Principles to the Safe & Reliable Operation of the Mentioned Equipment • Various Types of Rotating Equipment which Commonly Used in Refinery & Petrochemical Plants • The Effect of Process & Environment Change Towards the Rotating Equipment in Operation • The Do's & the Don'ts while Handling those Rotating Machinery</i>
0930 – 0945	<i>Break</i>
0945 – 1130	Rotating Machinery Operation (cont'd) <i>The Rotating Machineries Working Principles • The Common Procedure to Start, Shutdown & Handing Over to Maintenance • Typical Problem for each Type of Rotating Equipment, The Cause & the Effects • The Function of Each Major/Minor Parts of the Rotating Machineries</i>
1130 – 1230	Centrifugal & Positive Displacement Pumps <i>Different Types of Pumps & Applications in the Refinery • NPSH • Technology of Pumps & Different Architectures • Mechanical Seals: Different Arrangements, Related Ancillary Systems, Lube Oil System</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Centrifugal & Positive Displacement Pumps (cont'd) <i>Operating Limits: Cavitation, Hammer Shock, Priming Issues, Case of 2 Pumps Running Together • Start-Up & Operation Monitoring: Specific Case of Hot pumps, LPG Pumps, Vacuum Pumps • Troubleshooting Common Failures</i>
1420 – 1430	Recap <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 & End of Day One</i>

Day 2

0730 – 0930	Reciprocating Compressors Reciprocating Compressor Architecture: Number of Stages, Cylinders, Overall Layout, Typical Applications • Technology of Main Components & Ancillaries
0930 – 0945	Break
0945 – 1130	Reciprocating Compressors (cont'd) Influence of Process Conditions on Compressor Performance: Suction or Discharge Pressure, Suction Temperature, Gas Composition • Case of multi Stage Compressor
1130 - 1230	Reciprocating Compressors (cont'd) Flow Control, Specific Safety Devices
1230 – 1245	Break
1245 – 1420	Reciprocating Compressors (cont'd) Start-up Philosophy
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3

0730 – 0930	Centrifugal Compressors Description of a Multi-Stage Centrifugal Compressor • Technology of Main Components & Ancillaries • Pressure Increase Process for a Compressor Stage
0930 – 0945	Break
0945 – 1130	Centrifugal Compressors (cont'd) Overview of Operating Window: Low & High Speed Limits, Stonewall, Surge, Typical Anti Surge Protection Systems • Flow Regulation: Control Valve, Speed Variation, Inlet Guide Vanes
1130 - 1230	Centrifugal Compressors (cont'd) Specific Precautions for Start-Up • Detailed Operation Procedures, Safety Practices, Troubleshooting
1230 – 1245	Break
1245 – 1420	Centrifugal Compressors (cont'd) Daily Routine Check • Do's & Don'ts for Each Specific Equipment
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 4

0730 – 0930	Turbines Operating Principles & Mechanical Design • Impulse Turbines • Reaction Turbines • Application Ranges • Configurations • Application Constraints • Turbine Rotors • Blading • Diaphragms
0930 – 0945	Break
0945 – 1100	Turbines (cont'd) Nozzles • Steam Chests • Glands and Gland Systems • Bearings • Balancing • Rotor Dynamics
1100 – 1215	Turbines (cont'd) Governing Systems • Lube Oil Management • Steam (Water) Rates • Condensing and Backpressure Turbines • Single and Multistage Types • Process Considerations
1215 – 1230	Break



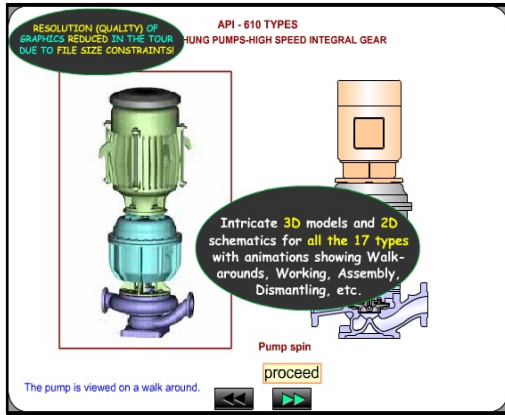
1230 – 1420	Turbines (cont'd) <i>Commissioning • Startup • Run-In and Shut-down • Surveillance and Health Monitoring • Performance Measurement • Monitoring and Tracking</i>
1420 – 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day Three</i>

Day 5

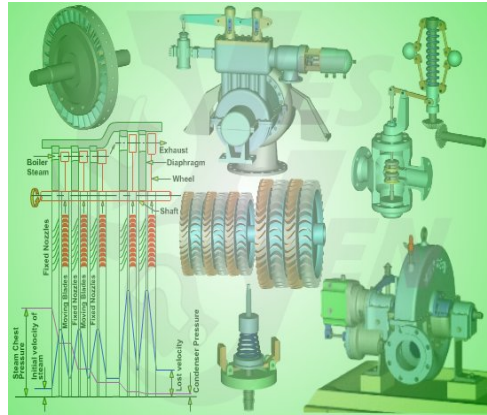
0730 – 0930	Lubrication Techniques <i>Composition of Lubricants • Crude Oil Derived Lubricants • Synthetic Lubricants • Cause of Friction • Heat and Wear</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Lubrication Techniques (cont'd) <i>Fluid and Hydro-Dynamic Lubrication • Boundary Lubrication • The Characteristics of the Lubricants Under Different Operating Conditions, E.G. Material Surfaces, Temperature Conditions, Load and Viscosity of the Lubricant • Different Types of Lubricants for Different Applications</i>
1100 – 1215	Lubrication Techniques (cont'd) <i>Lubricant's Viscosity • Flashpoint and Volatility • Oxidation and Thermal Stability</i>
1215 – 1230	<i>Break</i>
1230 – 1345	Lubrication Techniques (cont'd) <i>Demulsibility • Foaming and Gas Solubility • Corrosion Prevention • Compatibility</i>
1345 – 1400	Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i>
1400 – 1415	POST-TEST
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>

Simulator (Hands-on Practical Sessions)

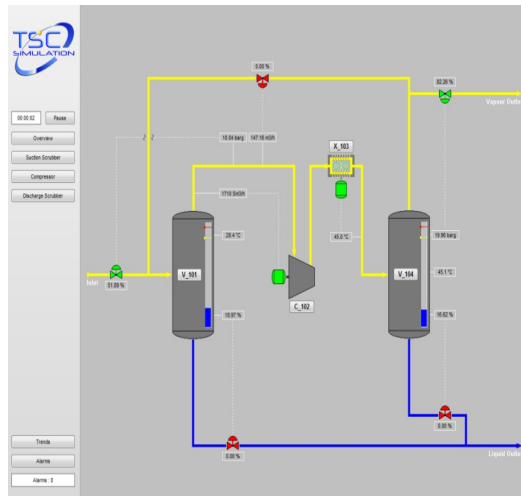
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carry out various exercises using our state-of-the-art simulators “Centrifugal Pumps and Troubleshooting Guide 3.0”, “Steam Turbine & Governing System”, “SIM 3300 Centrifugal Compressor”, “CBT on Compressors”, “Single Shaft Gas Turbine Simulator” and “Two Shaft Gas Turbine Simulator”.



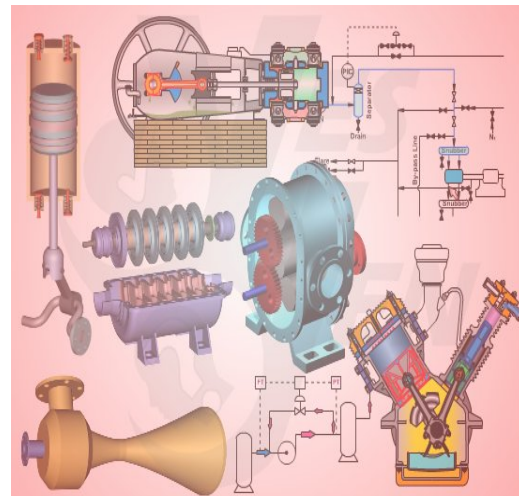
Centrifugal Pumps and Troubleshooting Guide 3.0



Steam Turbine & Governing System



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors



Single Shaft Gas Turbine Simulator

Two Shaft Gas Turbine Simulator

Course Coordinator

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