



## COURSE OVERVIEW PE0897 Rotating Equipment for Operation

### Course Title

Rotating Equipment for Operation

### Course Date/Venue

Session 1: April 06-10, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: September 08-12, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE



### Course Reference

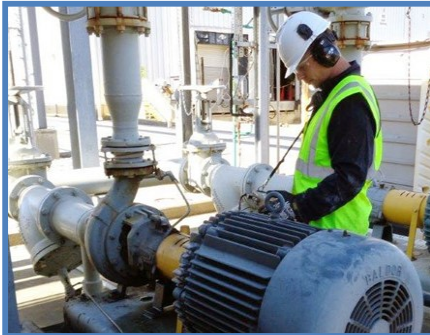
PE0897



### Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

### Course Description



***This hands-on, highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.***



This course is designed to provide participants with a detailed and up-to-date overview of rotating equipment operation and troubleshooting. It covers the fundamentals of rotating equipment, pump types and terminology; the simple centrifugal pumps; the elements of minimum continuous safe flow (MCSF); the complex centrifugal pumps; the compression packing, molded (automatic) packing and the basic principles of mechanical seals; the face materials, secondary seal materials, single mechanical seals, single mechanical seal flushing plans and dual sealing systems and flushing plans; and the API 682 reference guide.



Further, the course will also discuss the mechanical seal selection strategies, failure analysis, mechanical seal troubleshooting, determining leakage rates, ascertaining seal stability and troubleshooting hydraulic instability; the bellows seal repair, cartridge seal installation and management; the steam turbines theory, turbine sections, component descriptions and basic steam cycle; the lubricating oil systems, gland steam and water seal systems and hydraulic power unit; and the eccentricity, speed detection, valve positioning, shell expansion, differential expansion, vibration and metal temperatures.



During this interactive course, participants will learn the function and assembly of the major components of a steam turbine and the fundamentals of steam turbine controls; the speed control, load control, limiters and flow control; the extraction turbines, overspeed and reset system, overspeed trip and controls section; the purpose and function of the controls system, including protective functions of the turbine; the reciprocating pump and NPSH requirement including rotary the pump theory and operation, PD pumps in the operating system and selection of progressing cavity pumps; and the fluid metering system design and options.

### **Course Objectives**

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

- Apply systematic techniques on rotating equipment operation and troubleshooting
- Discuss the fundamentals of rotating equipment, pump types and terminology
- Describe simple centrifugal pumps covering theory, operating characteristics, operation, cavitations and NPSH
- Identify the elements of minimum continuous safe flow (MCSF), how to calculate MCSF and the types of centrifugal pumps
- Illustrate complex centrifugal pumps comprising of parts, bearings, seals and balancing desks and installation and startup
- Troubleshoot multistage centrifugal pumps, inspect centrifugal pump components for wear and perform multistage centrifugal pump overhauling
- Apply compression packing, molded (automatic) packing including the basic principles of mechanical seals
- Recognize face materials, secondary seal materials, single mechanical seals, single mechanical seal flushing plans and dual sealing systems and flushing plans
- Discuss the API 682 reference guide, gas barrier seal technology and tough applications that include slurries, pulp and paper, abrasives, crystallizing fluids, high temperature fluids, autoclaves, mixers and reactors
- Employ mechanical seal selection strategies, failure analysis, mechanical seal troubleshooting, determining leakage rates, ascertaining seal stability and troubleshooting hydraulic instability
- Carryout bellows seal repair, cartridge seal installation and management, seal face care, seal consolidation and standardization programs
- Discuss steam turbines (pump drivers) covering theory, turbine sections, component descriptions and basic steam cycle
- Recognize lubricating oil systems, gland steam and water seal systems, hydraulic power unit and abnormal operations
- Employ eccentricity, speed detection, valve positioning, shell expansion and differential expansion
- Explain the function and assembly of the major components of a steam turbine and the fundamentals of steam turbine controls
- Implement speed control, load control, limiters and flow control



- Recognize extraction turbines, overspeed and reset system, overspeed trip and controls section
- Describe the purpose and function of the controls system, including protective functions of the turbine
- Describe reciprocating pump and NPSH requirement including rotary pump theory and operation, PD pumps in the operating system and select progressing cavity pumps
- Discuss fluid metering system design and options and identify PD metering pumps, plunger pumps, diaphragm pumps, rotary metering pumps as well as control pulsation and surge

**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 of rotating equipment for operators.

**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 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.

-  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 **NGL Recovery & NGL Fractionation, Gas Processing LNG/NGL, 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 (AAACE-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 – 0900	<b>Fundamentals of Rotating Equipment</b> Centrifugal Pumps • Positive Displacement Pumps • Centrifugal Compressors • Displacement Compressors • Steam Turbines • Expanders • Gas Turbines & Engines • Fans • Blowers • Electric Motors • Gears • Transmission Equipment
0900 – 0930	<b>Pump Types &amp; Terminology</b> Pumps • Pump Terminology • Nomenclature & Definitions • Pump Types
0930 – 0945	Break
0945 – 1100	<b>Simple Centrifugal Pumps</b> Centrifugal Pump Theory • Operating Characteristics • Centrifugal Pump Operation • Cavitations & NPSH
1100 – 1230	<b>Simple Centrifugal Pumps (cont'd)</b> Elements of Minimum Continuous Safe Flow (MCSF) • How to Calculate MCSF • Types of Centrifugal Pumps
1230 – 1245	Break
1245 – 1420	<b>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> Parts of Centrifugal Pumps • Bearings Basics • Seals • Balancing Desks • Installation & Startup
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>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> <b>(cont'd)</b> Troubleshooting Multistage Centrifugal Pumps • Inspecting Centrifugal Pump Components for Wear • Multistage Centrifugal Pump Overhaul • Case Studies
0830 – 0930	<b>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> <b>(cont'd)</b> Compression Packing • Molded (Automatic) Packing • Basic Principles of Mechanical Seals • Face Materials • Secondary Seal Materials • Single Mechanical Seals • Single Mechanical Seal Flushing Plans
0930 – 0945	Break
0945 – 1100	<b>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> <b>(cont'd)</b> Dual Sealing Systems and Flushing Plans • API 682 Reference Guide • Gas Barrier Seal Technology • Tough Applications: Slurries, Pulp and Paper, Abrasives, Crystallizing Fluids, High Temperature Fluids, Autoclaves, Mixers and Reactors • Mechanical Seal Selection Strategies



1100 – 1230	<b>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> <b>(cont'd)</b> Failure Analysis • Mechanical Seal Troubleshooting • Determining Leakage Rates • Ascertaining Seal Stability • Troubleshooting Hydraulic Instability
1230 – 1245	Break
1245 – 1420	<b>Complex Centrifugal Pumps (Multistage, Hot, Cold, Special Seals...)</b> <b>(cont'd)</b> Bellows Seal Repair • Cartridge Seal Installation and Management • Seal Face Care • Seal Consolidation and Standardization Programs
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>Steam Turbines (Pump Drivers)</b> Theory • Turbine Sections • Component Descriptions • Basic Steam Cycle
0830 – 0930	<b>Steam Turbines (Pump Drivers) (cont'd)</b> Lubricating Oil Systems • Gland Steam & Water Seal Systems • Hydraulic Power Unit • Abnormal Operations
0930 – 0945	Break
0945 – 1100	<b>Steam Turbines (Pump Drivers) (cont'd)</b> Eccentricity • Speed Detection • Valve Position • Vibration • Shell Expansion • Differential Expansion • Metal Temperatures • Function & Assembly of the Major Components of a Steam Turbine
1100 – 1230	<b>Steam Turbines (Pump Drivers) (cont'd)</b> Fundamentals of Steam Turbine Controls • Speed Control • Load Control • Limiters • Flow Control • Extraction Turbines • Overspeed & Reset System • Overspeed Trip • Controls Section to Describe the Purpose & Function of the Controls System, Including Protective Functions of the Turbine
1230 – 1245	Break
1245 – 1420	<b>Positive Displacement Pumps</b> Reciprocating Pumps • NPSH Requirement for Reciprocating Pumps • Rotary Pump Theory and Operation
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 3**

0730 – 0830	<b>Positive Displacement Pumps (cont'd)</b> PD Pumps in the Operating System • How to Select Progressing Cavity Pumps
0830 – 0930	<b>Positive Displacement Pumps (cont'd)</b> Fluid Metering System Design and Options • PD Metering Pumps, Plunger Pumps, Diaphragm Pumps, Rotary Metering Pumps
0930 – 0945	Break
0945 – 1100	<b>Positive Displacement Pumps (cont'd)</b> Controlling Pulsation and Surge • Operation • Reciprocating (Power) Pump Liquid End Maintenance



1100 – 1230	<b>Positive Displacement Pumps (cont'd)</b> Reciprocating Pump Valve Repair • Power End Maintenance • Stuffing Box Design and Upgrading • Case Studies
1230 – 1245	Break
1245 – 1420	<b>Positive Displacement Pumps (cont'd)</b> Elements of Required Head • Calculation of System-Head Curves • Pump Performance Curves • Affinity Law
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 5**

0730 – 0830	<b>Positive Displacement Pumps (cont'd)</b> Specific Speed Concept • Rating Curves • Limitation of Suction Conditions • Effect of Viscosity on Pump Performance
0830 – 0930	<b>Positive Displacement Pumps (cont'd)</b> Operation at Off-Design Conditions • Internal Recirculation in Impeller • Pumps and Energy Conservation • Basic Configurations and Classification
0930 – 0945	Break
0945 – 1030	<b>Positive Displacement Pumps (cont'd)</b> Hydraulic Components (Impellers, Collectors, Wearing Rings, Axial Thrust Balancing) • Pressure Containment (Casings, Shaft Seals) • Rotor Support (Shafts, Bearings, Bearing Housings) Turning gear
1030 – 1230	<b>Positive Displacement Pumps (cont'd)</b> Jacking oil system • Lubrication system • Governing valves • Emergency Stop Valves • Reheat Emergency Stop Valves • Intercept Valves
1230 – 1245	Break
1245 – 1345	<b>Positive Displacement Pumps (cont'd)</b> Feedwater Heating • Open or Direct-Contact Feedwater Heaters • Closed-Type Feedwater Heater with Drains Cascaded Backwards • Efficiency and Heat Rate of Power Plants
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course





**Practical Sessions**

This hands-on, highly-interactive course includes real-life case studies and exercises:-



**Course Coordinator**

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