

**COURSE OVERVIEW ME0577**  
**Fluid Flow & Rotating Machinery**

**Course Title**

Fluid Flow & Rotating Machinery

**Course Date/Venue**

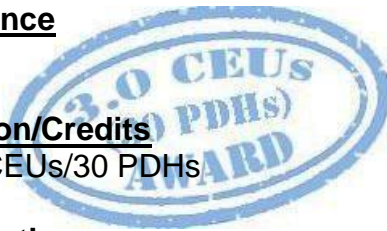
December 22-26, 2024/ Boardroom 1, Elite  
 Byblos Hotel Al Barsha, Sheikh Zayed Road,  
 Dubai, UAE

**Course Reference**

ME0577

**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 delegates with a detailed and up-to-date knowledge on fluid flow and rotating machinery. It covers the basic concepts of fluid flow, properties of fluids, pressure and fluid statics and fluid kinematics; the mass, bernoulli and energy equations, momentum analysis of flow systems, dimensional analysis and modeling; the flow in pipes, differential analysis of fluid flow and approximate solutions of the navier-strokes equation; the flow over bodies, compressible flow and computational fluid dynamics; the centrifugal and positive displacement pumps; the different types of pumps and applications in industry; and the technology of pumps and different architectures, mechanical seals and operating limits.



During this interactive course, participants will learn the start-up, operation monitoring and troubleshooting of common failures; the reciprocating compressor architecture and the technology of main components and ancillaries; the influence of process conditions on compressor performance, flow control, specific safety devices and start-up philosophy; the multi-stage centrifugal compressor, technology of main components and ancillaries; and the pressure increase process for a compressor stage.

### Course Objectives

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

- Apply and gain an in-depth knowledge on fluid flow and rotating machinery
- Discuss basic concepts of fluid flow, properties of fluids, pressure and fluid statics and fluid kinematics
- Explain mass, bernoulli and energy equations, momentum analysis of flow systems, dimensional analysis and modeling
- Describe flow in pipes, differential analysis of fluid flow and approximate solutions of the navier-strokes equation
- Discuss flow over bodies, compressible flow and computational fluid dynamics
- Identify centrifugal and positive displacement pumps including the different types of pumps and applications in industry
- Determine the technology of pumps and different architectures, mechanical seals and operating limits
- Carryout start-up and operation monitoring and troubleshooting common failures
- Describe reciprocating compressor architecture and the technology of main components and ancillaries
- Discuss the influence of process conditions on compressor performance, flow control, specific safety devices and start-up philosophy
- Describe multi-stage centrifugal compressor, technology of main components and ancillaries and pressure increase process for a compressor stage
- Discuss operating window, flow regulation and specific precautions for start-up
- Employ detailed operation procedures, safety practices and troubleshooting including daily routine check and do's and don'ts for each specific equipment

### Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Howard Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

### Who Should Attend

This course provides an overview of all significant aspects and considerations of fluid flow and rotating machinery for process engineers, mechanical engineers, chemical engineers, design engineers, project engineers, control engineers, automation engineers and instrumentation engineers.

### Course Fee

**US\$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Howard Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

### 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:-


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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.

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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**. 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.

### 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 **Maintenance Planning, Maintenance & Reliability** Management, **Material Cataloguing, Equipment Maintenance, Root Cause Failure Analysis (RCFA), Rotating Machinery Troubleshooting, Maintenance Auditing & Benchmarking, Condition Monitoring** Techniques, **Machinery Lubrication Technology, Lubricant Oil & Grease Testing & Analysis,**

**Crude Oil Storage & Management, Ammonia Manufacturing & Process Troubleshooting, Crude Oil Distillation, Distillation Operation and Troubleshooting, Ammonia Storage & Loading Systems, Fertilizer Storage Management (Ammonia & Urea), Sulphur Recovery, Nitrogen Fertilizer Production, Refining Process & Petroleum Products, Safe Refinery Operations, Hydrotreating & Hydro-processing, Fractionation, Process Plant Operations, Storage Tanks Operations & Measurements, Process Plant Troubleshooting & Engineering Problem Solving, Process Plant Performance, Process Troubleshooting Techniques, Pressure Vessel Operation, Process Equipment Performance & Troubleshooting, Plant Startup & Shutdown and Flare & Relief System.** Further, he is also well-versed in **Compressors & Turbines Maintenance, Heat Exchanger Overhaul & Testing Techniques, Balancing of Rotating Machinery (BRM), Pipe Stress Analysis, Valves & Actuators Technology, Control Valve Engineering, Tank Design, Material Cataloguing, Specifications, Handling & Storage, Steam Trap Design, Operation, Maintenance & Troubleshooting, Steam Trapping & Control, Column, Pump & Exchangers, Troubleshooting & Design, Detailed Engineering Drawings, Codes & Standards, 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.

### 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 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: Sunday 22<sup>nd</sup> of December 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction &amp; Basic Concepts of Fluid Flow</b>
0930 – 0945	Break
0945 – 1045	<b>Properties of Fluids</b>
1045 – 1130	<b>Pressure &amp; Fluid Statics</b>
1130 – 1230	<b>Fluid Kinematics</b>
1230 – 1245	Break
1245 – 1330	<b>Mass, Bernoulli &amp; Energy Equations</b>
1330 – 1420	<b>Momentum Analysis of Flow Systems</b>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

#### **Day 2: Monday 23<sup>rd</sup> of December 2024**

0730 – 0830	<b>Dimensional Analysis &amp; Modeling</b>
0830 – 0930	<b>Flow in Pipes</b>
0930 – 0945	Break
0945 – 1045	<b>Differential Analysis of Fluid Flow</b>
1045 – 1130	<b>Approximate Solutions of the Navier-Stokes Equation</b>
1130 – 1230	<b>Flow Over Bodies</b> Drag • Lift
1230 – 1245	Break
1245 – 1330	<b>Compressible Flow</b>
1330 – 1420	<b>Introduction to Computational Fluid Dynamics</b>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

#### **Day 3: Tuesday 24<sup>th</sup> of December 2024**

0730 – 0930	<b>Centrifugal &amp; Positive Displacement Pumps</b> Different Types of Pumps & Applications in Industry • NPSH
0930 – 0945	Break



0945 – 1130	<b>Centrifugal &amp; Positive Displacement Pumps (cont'd)</b> Technology of Pumps & Different Architectures • Mechanical Seals: Different Arrangements, Related Ancillary Systems, Lube Oil System
1130 – 1230	<b>Centrifugal &amp; Positive Displacement Pumps (cont'd)</b> Operating Limits: Cavitation, Hammer Shock, Priming Issues, Case of 2 Pumps Running Together
1230 – 1245	Break
1245 – 1420	<b>Centrifugal &amp; Positive Displacement Pumps (cont'd)</b> Start-Up & Operation Monitoring: Specific Case of Hot pumps, LPG Pumps, Vacuum Pumps • Troubleshooting Common Failures
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4: Wednesday 25<sup>th</sup> of December 2024**

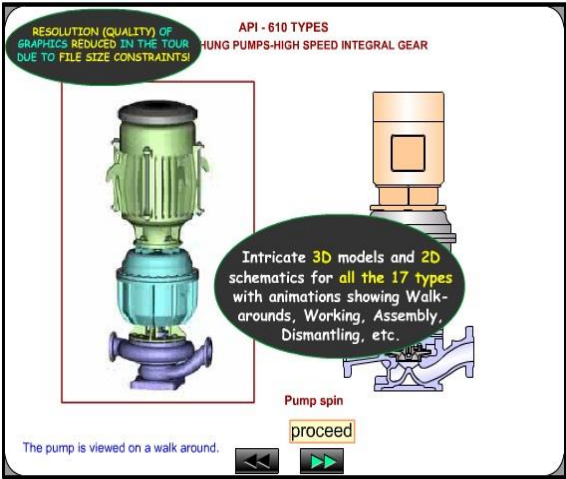
0730 – 0930	<b>Reciprocating Compressors</b> Reciprocating Compressor Architecture: Number of Stages, Cylinders, Overall Layout, Typical Applications • Technology of Main Components & Ancillaries
0930 – 0945	Break
0945 – 1100	<b>Reciprocating Compressors (cont'd)</b> Influence of Process Conditions on Compressor Performance: Suction or Discharge Pressure, Suction Temperature, Gas Composition
1100 – 1230	<b>Reciprocating Compressors (cont'd)</b> Case of multi Stage Compressor • Flow Control, Specific Safety Devices
1230 – 1245	Break
1245 – 1420	<b>Reciprocating Compressors (cont'd)</b> Start-up Philosophy
1420 - 1430	<b>Recap</b>
1430	Lunch & End of Day Four

**Day 5: Thursday 26<sup>th</sup> of December 2024**

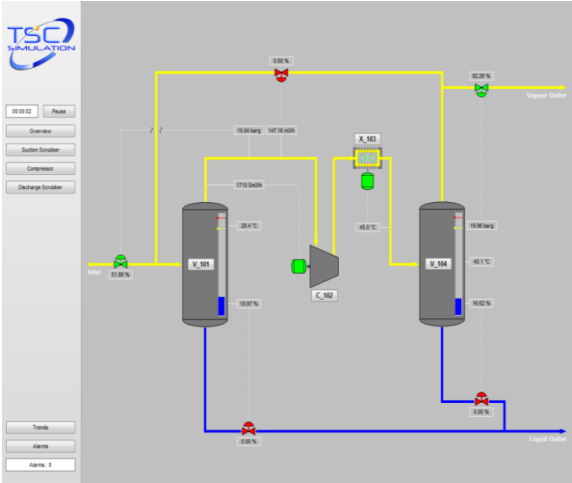
0730 – 0930	<b>Centrifugal Compressors</b> Description of a Multi-Stage Centrifugal Compressor • Technology of Main Components & Ancillaries • Pressure Increase Process for a Compressor Stage
0930 - 0945	Break
0945 – 1100	<b>Centrifugal Compressors (cont'd)</b> Overview of Operating Window: Low & High Speed Limits, Stonewall, Surge, Typical Anti Surge Protection Systems • Flow Regulation: Control Valve, Speed Variation, Inlet Guide Vanes
1100 – 1230	<b>Centrifugal Compressors (cont'd)</b> Specific Precautions for Start-Up • Detailed Operation Procedures, Safety Practices, Troubleshooting
1230 – 1245	Break
1245 – 1345	<b>Centrifugal Compressors (cont'd)</b> Daily Routine Check • Do's & Don'ts for Each Specific Equipment
1345 - 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 - 1430	Presentation of Course Certificates
1430	Lunch & End of Course

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

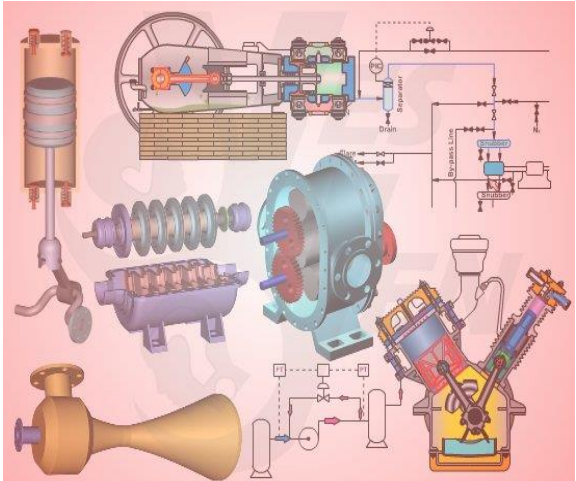
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor Simulator” & “CBT on Compressors” Simulators.



**Centrifugal Pumps and Troubleshooting Guide 3.0**



**SIM 3300 Centrifugal Compressor Simulator**



**CBT on Compressors**

**Course Coordinator**

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