

**COURSE OVERVIEW ME0027**  
**Centrifugal Pump Selection, Construction, Operation, Maintenance, Repair & Troubleshooting**

**Course Title**

Centrifugal Pump Selection, Construction, Operation, Maintenance, Repair & Troubleshooting

**Course Date/Venue**

January 19-23, 2025/TBA Meeting Room, The Tower Plaza Hotel, Dubai, UAE

**Course Reference**

ME0027

**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 a detailed and up-to-date overview of centrifugal pump selection, construction, operation, maintenance, repair and troubleshooting. It covers the pump types and terminology; the operating characteristics of centrifugal pumps; the centrifugal pump specification and selection; the pump and system hydraulics; the pump construction; the packing and mechanical seals; and the mechanical seal systems.



At the completion of the course, participants will be able to apply proper mechanical seal failure analysis and troubleshooting; mechanical seal maintenance and repair; bearing care and maintenance; couplings and alignment; and centrifugal pump maintenance and repair.

The course will also cover the pump reliability including the systematic approach, predictive/preventive, addressing pump vibrations, building availability data, analyzing pump costs and initiating pump reliability improvement program.

## Course Objectives

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

- Apply and gain an in-depth knowledge on the selection, construction, operation, maintenance, repair and troubleshooting of centrifugal pumps
- Discuss the different types of pumps, terminology, specifications and standards
- Identify the pump and system hydraulics and classify the hydraulic components in pump construction
- Properly maintain bearings and describe the importance of couplings, mechanical seals, alignment and various maintenance and reliability programs to analyze and minimize pump costs and improve its reliability

## 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, 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 centrifugal pump for those who are involved in the selection, construction, operation, maintenance, repair and troubleshooting. Plant and maintenance engineers, process engineers, maintenance personnel, supervisors and reliability specialists working in a wide variety of process plant environments such as petrochemical, plastics, power utilities, oil, gas, refineries, water utilities and wastewater treatment facilities will definitely benefit from the practical approach of this course. Further, the course is highly valuable to senior maintenance technical staff involved with pump operation, maintenance and troubleshooting.

## 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:-

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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.

### 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 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 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: Sunday, 19<sup>th</sup> of January 2025**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Pump Types and Terminology</b> Pumps • Pump Terminology • Nomenclature and Definitions • Pump Types
0930 – 0945	Break
0945 – 1100	<b>Centrifugal Pumps</b> Centrifugal Pump Theory • Operating Characteristics • Centrifugal Pump Operation • Cavitations and NPSH • Elements of Minimum Continuous Safe Flow (MCSF) • How to Calculate MCSF • Types of Centrifugal Pumps
1100 – 1200	<b>Centrifugal Pump Specification and Selection</b> Selecting a Pump Vendor • Industry Standards • API vs. ANSI Standards • Driver Size Selection
1200 – 1215	Break
1215 – 1420	<b>Centrifugal Pump Specification and Selection (cont'd)</b> Variable Speed Drive Selection • Pump Design Audit/Review
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2: Monday, 20<sup>th</sup> of January 2025**

0730 – 0930	<b>Pump and System Hydraulics</b> Elements of Required Head • Calculation of System-Head Curves • Pump Performance Curves • Affinity Law
0930 – 0945	Break
0945 – 1100	<b>Pump and System Hydraulics (cont'd)</b> Specific Speed Concept • Rating Curves • Limitation of Suction Conditions • Effect of Viscosity on Pump Performance
1100 – 1200	<b>Pump and System Hydraulics (cont'd)</b> Operation at Off-Design Conditions • Internal Recirculation in Impeller • Pumps and Energy Conservation
1200 – 1215	Break
1215 – 1420	<b>Pump Construction</b> Basic Configurations and Classification • Hydraulic Components (Impellers, Collectors, Wearing Rings, Axial Thrust Balancing) • Pressure Containment (Casings, Shaft Seals) • Rotor Support (Shafts, Bearings, Bearing Housings) • Turning Gear • Jacking Oil System • Lubrication System • Governing Valves
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two





**Day 3: Tuesday, 21<sup>st</sup> of January 2025**

0730 – 0930	<b>Pump Construction (cont'd)</b> Emergency Stop Valves • Reheat Emergency Stop Valves • Intercept Valves • Feedwater Heating • Open or Direct-Contact Feedwater Heaters • Closed-Type Feedwater Heater with Drains Cascaded Backwards • Efficiency & Heat Rate of Power Plants
0930 – 0945	<b>Break</b>
0945 – 1100	<b>Pump Construction (cont'd)</b> Supercritical Plants • Maintenance of Steam Power Plants • Co-Generation • Types of Co-Generation • Topping & Bottoming Cycles • Arrangements of Co-Generation Plants • Economics of Co-Generation
1100 – 1200	<b>Packing and Mechanical Seals</b> Compression Packing • Molded (Automatic) Packing • Basic Principles of Mechanical Seals • Face Materials • Secondary Seal Materials • Single Mechanical Seals • Single Mechanical Seal Flushing Plans
1200 – 1215	<b>Break</b>
1215 – 1420	<b>Mechanical Seal Systems</b> Dual Sealing Systems & Flushing Plans • API 682 Reference Guide • Gas Barrier Seal Technology • Tough Applications: Slurries, Pulp & Paper, Abrasives, Crystallizing Fluids, High Temperature Fluids, Autoclaves, Mixers & Reactors • Mechanical Seal Selection Strategies
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4: Wednesday, 22<sup>nd</sup> of January 2025**

0730 – 0930	<b>Mechanical Seal Failure Analysis and Troubleshooting</b> Failure Analysis • Mechanical Seal Troubleshooting • Determining Leakage Rates • Ascertaining Seal Stability • Troubleshooting Hydraulic Instability
0930 – 0945	<b>Break</b>
0945 – 1100	<b>Mechanical Seal Maintenance and Repair</b> Bellows Seal Repair • Cartridge Seal Installation and Management • Seal Face Care • Seal Consolidation and Standardization Programs
1100 – 1200	<b>Bearing Care and Maintenance</b> Basic Concepts of Bearings • Bearing Classifications • Bearing Care and Maintenance • Lubrication Management
1200 – 1215	<b>Break</b>
1215 – 1330	<b>Couplings and Alignment</b> Purpose of Couplings • Types of Couplings • Alignment Methods • Foundation and Grouting Guidelines • Inlet Piping Configuration and Piping Installation Guidelines
1330 – 1420	<b>Centrifugal Pump Maintenance and Repair</b> Parts of Centrifugal Pumps • Bearing Basics • Balancing Criteria • Installation and Startup
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

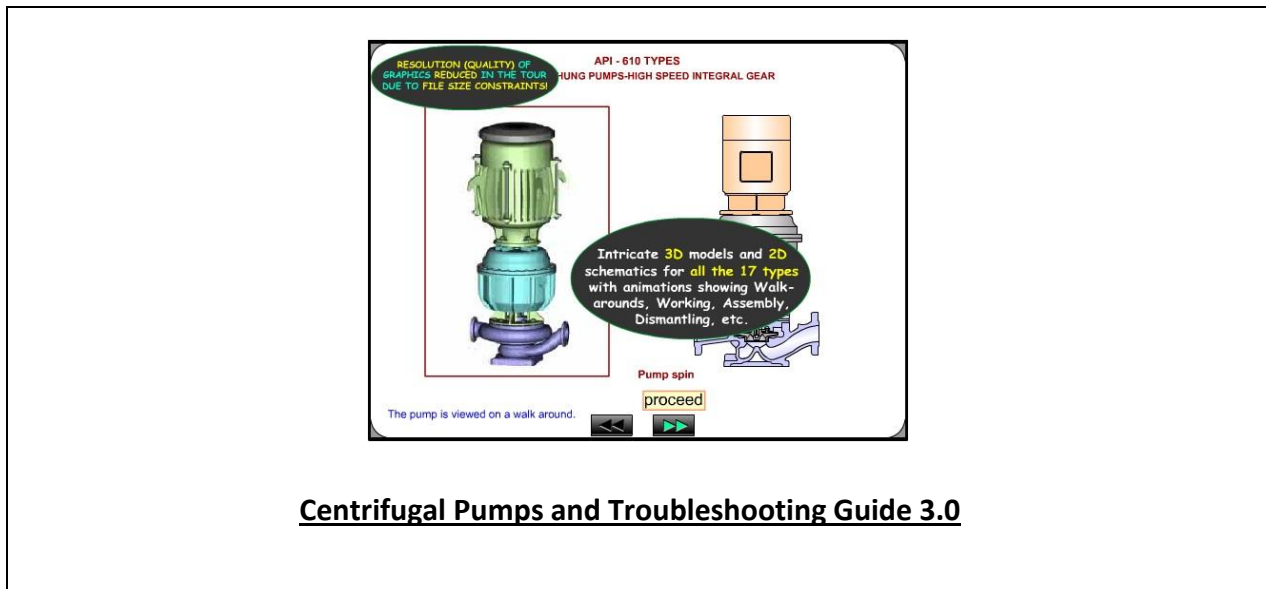


**Day 5: Thursday, 23<sup>rd</sup> of January 2025**

0730 – 0930	<b>Centrifugal Pump Maintenance and Repair (cont'd)</b> Troubleshooting Centrifugal Pumps • Inspecting Centrifugal Pump Components for Wear • Centrifugal Pump Overhaul • Case Studies
0930 – 0945	Break
0945 – 1100	<b>Pump Reliability</b> A Systems Approach to Pump Reliability • Predictive/Preventive
1100 – 1200	<b>Pump Reliability (cont'd)</b> Addressing Pump Vibrations - Mechanical & Hydraulic • Fifty Upgrading Opportunities for Centrifugal Pumps
1200 – 1215	Break
1215 – 1345	<b>Reliability Programs</b> Building Availability Data • Availability and Reliability Goals • How to Analyze Pump Costs • How to Initiate a Pump Reliability Improvement Program
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

**Simulators (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 Simulator “Centrifugal Pumps and Troubleshooting Guide 3.0”.



**Centrifugal Pumps and Troubleshooting Guide 3.0**

**Course Coordinator**

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