COURSE OVERVIEW ME0027
Centrifugal Pumps

Course Title
Centrifugal Pumps

Course date/venue
October 05-09, 2025/Meeting Plus TBA, City Centre Rotana, Doha, Qatar

3.0 CEUs (30 PDHs) AWARD

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
- Learn how to select centrifugal pumps based on system head, flow rate and fluid characteristics.
- Understand internal pump components, materials of construction and impeller design features
- Apply proper installation and alignment procedures to ensure optimal performance and reliability
- Troubleshoot issues such as seal leakage, bearing failures and impeller damage using structured methods
- Conduct performance testing and implement repair practices that meet OEM and industry standards
- 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 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.

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

Haward's 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**. 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.

- 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 Fee

US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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 **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, **Centrifugal & Reciprocating Compressor**, **Screw Compressor** Troubleshooting, **Heat Exchanger** Overhaul & Testing, **Pipe Stress** Analysis, **Control Valves & Actuators**, **Vent & Relief System**, **Centrifugal & Reciprocating Pump** Installation & Repair, **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.

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, 05th of October 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Pump Types and Terminology*** *Pumps • Pump Terminology • Nomenclature and Definitions • Pump Types*
0930 – 0945	*Break*
0945 – 1100	***Centrifugal Pumps*** *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	***Centrifugal Pump Specification and Selection*** *Selecting a Pump Vendor • Industry Standards • API vs. ANSI Standards • Driver Size Selection*
1200 – 1215	*Break*
1215 – 1420	***Centrifugal Pump Specification and Selection (cont'd)*** *Variable Speed Drive Selection • Pump Design Audit/Review*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: ***Monday, 06th of October 2025***

0730 – 0930	***Pump and System Hydraulics*** *Elements of Required Head • Calculation of System-Head Curves • Pump Performance Curves • Affinity Law*
0930 – 0945	*Break*
0945 – 1100	***Pump and System Hydraulics (cont'd)*** *Specific Speed Concept • Rating Curves • Limitation of Suction Conditions • Effect of Viscosity on Pump Performance*
1100 – 1200	***Pump and System Hydraulics (cont'd)*** *Operation at Off-Design Conditions • Internal Recirculation in Impeller • Pumps and Energy Conservation*

1200 – 1215	*Break*
1215 – 1420	***Pump Construction*** *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	***Recap***
1430	*Lunch & End of Day Two*

Day 3: ***Tuesday, 07th of October 2025***

0730 – 0930	***Pump Construction (cont'd)*** *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	***Break***
0945 – 1100	***Pump Construction (cont'd)*** *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	***Packing and Mechanical Seals*** *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	*Break*
1215 – 1420	***Mechanical Seal Systems*** *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	***Recap***
1430	*Lunch & End of Day Three*

Day 4: ***Wednesday, 08th of October 2025***

0730 – 0930	***Mechanical Seal Failure Analysis and Troubleshooting*** *Failure Analysis • Mechanical Seal Troubleshooting • Determining Leakage Rates • Ascertaining Seal Stability • Troubleshooting Hydraulic Instability*
0930 – 0945	*Break*
0945 – 1100	***Mechanical Seal Maintenance and Repair*** *Bellows Seal Repair • Cartridge Seal Installation and Management • Seal Face Care • Seal Consolidation and Standardization Programs*
1100 – 1200	***Bearing Care and Maintenance*** *Basic Concepts of Bearings • Bearing Classifications • Bearing Care and Maintenance • Lubrication Management*
1200 – 1215	*Break*
1215 – 1330	***Couplings and Alignment*** *Purpose of Couplings • Types of Couplings • Alignment Methods • Foundation and Grouting Guidelines • Inlet Piping Configuration and Piping Installation Guidelines*

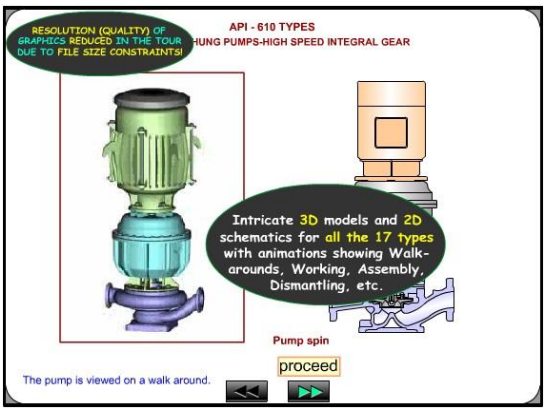
1330 – 1420	***Centrifugal Pump Maintenance and Repair*** *Parts of Centrifugal Pumps • Bearing Basics • Balancing Criteria • Installation and Startup*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5: ***Thursday, 09th of October 2025***

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