

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

**Course Title**

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

**Course Reference**

ME0027

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs

**Course Date/Venue**



Session(s)	Date	Venue
1	October 27-31, 2024	Horus Meeting Room, Holiday Inn & Suites Maadi, Cairo, Egypt
2	December 22-26, 2024	
3	February 23-27, 2025	

**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

### **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 Participants Pack (Folder, Manual, Hand-outs, etc.), 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. Saleh Aich** is a **Senior Mechanical & Maintenance Engineer** with over **20 years** of extensive experience within the **Oil & Gas, Petrochemical** and **Refining** industries. His expertise widely covers in the areas of **Centrifugal Pump Selection, Construction, Operation, Maintenance, Repair & Troubleshooting, Combustion** Techniques, **Combustion** System Performance, **Pump** Operation & Maintenance, **Compressor** Maintenance & Troubleshooting, **Gas Turbine** Control & Protection Systems, **Valve** Troubleshooting & Maintenance, **Vibration** Analysis, **Oil** Analysis, **Dry Gas Seals**, Packing & Mechanical **Seals**, **Seal** Support Systems, **Mechanical Seal** Failure Analysis & Troubleshooting, **Seal** Maintenance & Repair, **Bearing** Care & Maintenance, **Couplings & Alignment, Alignment Methods**, Troubleshooting **Piping & Pipe Support** Systems, **Heat Exchangers** Maintenance & Inspection, **Pressure Vessel** Design, Fabrication & Testing, **Burners, Blowers**, Piston & Plunger **Gearboxes**, Fin-Fans, Separators, Expansion Drums, Filters, Molecule Sieve, Tanks, Fittings, Root Cause Failure Analysis (**RCFA**), Computerized Maintenance Management System (**CMMS**), **Maintenance** Management, **Planning & Scheduling** Work Management, **Parts & Inventory** Management, **Turnaround & Shutdowns, Condition Monitoring**, Regeneration Unit, NGL & Condensate, **Furnace** Operation & Troubleshooting, Performance Measure & Indicators, Total Productive Maintenance (**TPM**), **Preventive & Predictive** Maintenance Analysis, **Rotating & Static Equipment, Machinery & Equipment** Failure Analysis, **Gas & Steam** Turbines, **Boilers, Coolers, Diesel & Gas Engines, Heaters, Separators, Storage Tanks**, H<sub>2</sub>S and ISO 9001:2008 Internal Quality Management System.

During his career life, Mr. Saleh has gained his practical and field experience through his various significant positions and dedication as the **Maintenance Instructor, Mechanical Supervisor, Maintenance Engineer, Mechanical Engineer, Contract Engineer, Planning Engineer** and **Senior Instructor/Lecturer** for various multi-national companies such as the ADNOC Gas Processing (**GASCO**), **ConocoPhillips** and Syrian Gas Company.

Mr. Saleh has a **Bachelor's** degree in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer** and has acquired various certifications and has further delivered numerous training, courses, workshops, seminars and conferences worldwide.





**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 – 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**

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**

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**

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

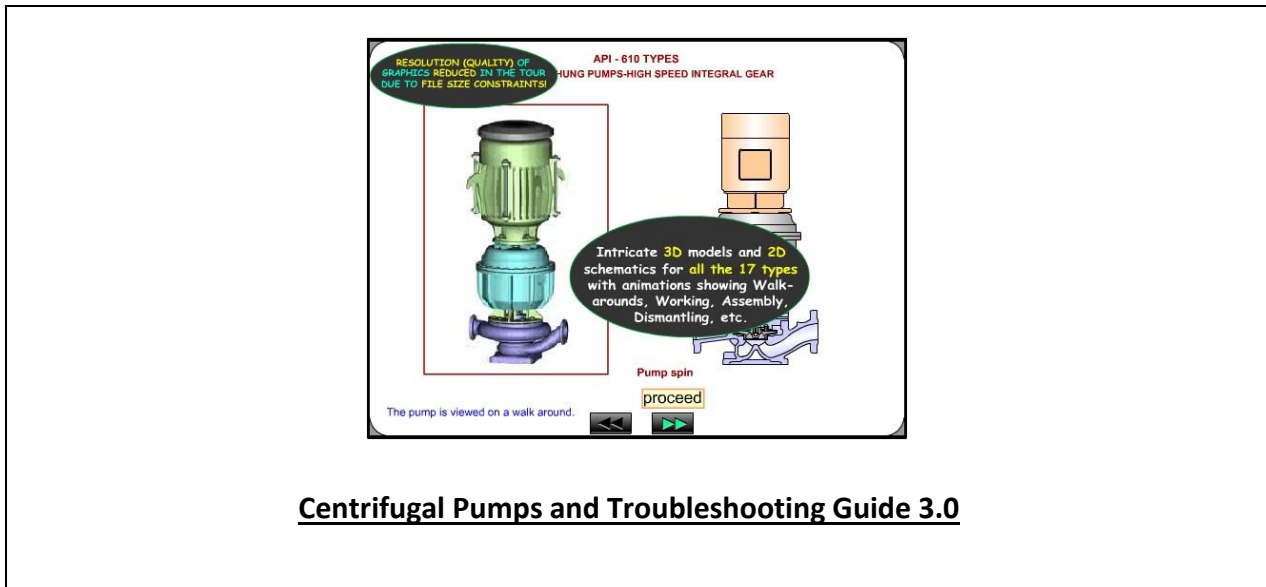


**Day 5**

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

**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”.



**Course Coordinator**

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