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	July 22-26, 2024	Hampstead Meeting Room, London Marriott Hotel Regents Park, London, United Kingdom
2	September 15-19, 2024	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey
3	November 17-21, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
4	January 19-23, 2025	The Kooh Al Noor Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE

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

London	**US$ 8,800** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**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.
Dubai	**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:-

- 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.

- 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. Mohamed Refaat, MSc, BSc, is a **Senior Maintenance & Reliability Engineer** with almost **30 years** of extensive experience in **Rotating Equipment** and **Machinery** including **Pumps**, **Compressors**, **Turbines**, **Motors**, **Turbo-expanders**, **Gears**, etc. His wide experience also covers **Modern Maintenance & Reliability** Management, **Maintenance Errors**, **Maintenance Audit & Site Inspection**, **Maintenance Management** Best Practices, **Rotating Equipment** Reliability Optimization, Practical **Machinery Vibration**, **Vibration** Techniques, Effective **Reliability Maintenance**, Excellence in **Maintenance & Reliability** Management, **Preventive & Predictive Maintenance**, Machinery Failure Analysis (**RCFA**), **Reliability** Optimization & Continuous Improvement, **Maintenance** Planning, Scheduling & Work Control, **Maintenance Management** Strategy, **Mechanical & Rotating Equipment** Troubleshooting, Preventive Maintenance, Predictive Maintenance, Reliability Centered Maintenance (**RCM**), Condition Based Monitoring (**CBM**), **Centrifugal Compressor & Steam Turbine**, **Centrifugal Pump**, **Pump** Technology, **Gas Turbine** Technology, **Heat Exchanger**, **Turbines & Motors**, **Variable Speed Drives**, **Seals**, **Control Valves**, Advanced **Valve** Technology, **Dry Seal**, **Fired Heaters**, **Air Coolers**, **Crude Desalter**, **Process Vessels & Valves**, **Industrial Equipment & Rotating Machinery**, **Mechanical** Engineering, **Mechanical Equipment & Turbomachinery**, **Piping**, **Pipelines**, **Valves**, **Lubrication Technology**, **Vibration Analysis**, **Power System Hydraulics**, **Security Detection** Systems & Operation, **Process Plant** Equipment, Troubleshooting **Process Operations**, **FMEA** and Troubleshooting of machinery and rotating equipment including turbines, bearings, compressors, pumps etc. He is currently the **Mechanical Maintenance Section Head** of the **Arab Petroleum Pipelines Company** where he is in charge of planning, scheduling & managing the execution of preventive & corrective mechanical maintenance activities for all equipment. He is responsible for executing the scheduled inspections & major overhauls for gas turbines, valves & pumps, carrying out off-line vibration monitoring plans, troubleshooting, fault diagnosing & investigating failures of machinery.

During his career life, Mr. Mohamed was able to modify the gas turbines self-cleansing system to improve its maintainability and extend the air filters' lifetime. He was responsible for defining & updating the equipment codes and parameters for replacing the old **CMMS** with **MAXIMO**. He also worked as the Operations Supervisor wherein he was closely involved with the operation of the crude oil internal **pipeline** system between the tankers and tank farm, operation & control of the booster pumps for pumping crude oil for main pipelines and the development & implementation of the plans & procedures for draining the main terminal internal lines for maintenance purposes. He also held the position of Measurement Engineer where he was responsible for the crude oil custody transfer, performing loss control analysis and operating the crude oil automatic sampler & related equipment. Prior to that, he was the Design Engineer responsible for the design phase of the Truck Mixer Manufacturing Project of the Mechanical Design Department.

Mr. Refaat has **Master** and **Bachelor** degrees in **Mechanical Engineering** and a General Certificate of Education (**GCE**) from the **University of London**, **UK**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and a member of the Engineering Syndicate of Egypt. He 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	***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

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

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

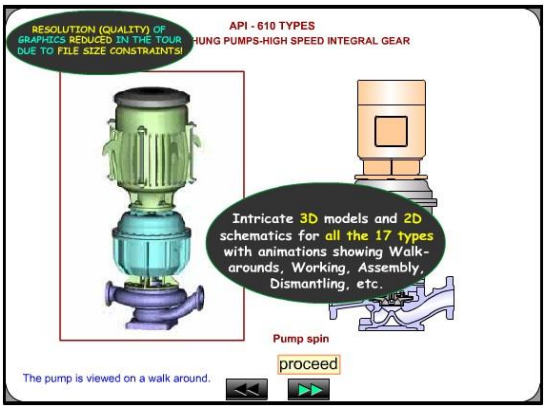
0730 – 0930	***Mechanical Seal Failure Analysis and Troubleshooting*** *Failure Analysis • Mechanical Seal Troubleshooting • Determining Leakage Rates • Ascertaining Seal Stability • Troubleshooting Hydraulic Instability*
0930 – 0945	*Break*
0945 – 1100	***Mechanical Seal Maintenance and Repair*** *Bellows 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

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

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org