

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

30 PDHs)

#### **Course Title**

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

#### **Course Date/Venue**

December 16-20, 2024/ Midtown Board Room, Hampton Inn Houston Downtown by Hilton, London, United Kingdom



# Course Reference

ME0027

#### **Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs

#### **Course Description**







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 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.

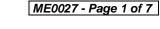




















#### **Course Objectives**

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 involved with pump operation, maintenance technical staff 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\$ 8,800 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day...

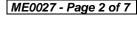




















#### **Course Certificate(s)**

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.

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.

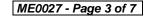


















#### Course Instructor(s)

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 Rotating Equipment Reliability Optimization, 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: Monday 16<sup>th</sup> of December 2024

Duy 1.	Monday to of December 2024
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
	Centrifugal Pumps
0045 1100	Centrifugal Pump Theory • Operating Characteristics • Centrifugal Pump
0945 – 1100	Operation • Cavitations and NPSH • Elements of Minimum Continuous Safe
	Flow (MCSF) • How to Calculate MCSF • Types of Centrifugal Pumps
	Centrifugal Pump Specification and Selection
1100 – 1200	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: Tuesday 17th of December 2024

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	Pump and System Hydraulics
0730 - 0930	Elements of Required Head • Calculation of System-Head Curves • Pump
	Performance Curves • Affinity Law
0930 - 0945	Break
	Pump and System Hydraulics (cont'd)
0945 - 1100	Specific Speed Concept • Rating Curves • Limitation of Suction Conditions •
	Effect of Viscosity on Pump Performance
	Pump and System Hydraulics (cont'd)
1100 – 1200	Operation at Off-Design Conditions • Internal Recirculation in Impeller •
	Pumps and Energy Conservation
1200 – 1215	Break
	Pump Construction
	Basic Configurations and Classification • Hydraulic Components (Impellers,
1215 – 1420	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: Wednesday 18<sup>th</sup> of December 2024

	Pump Construction (cont'd)
0730 - 0930	Emergency Stop Valves • Reheat Emergency Stop Valves • Intercept Valves •
	Feedwater Heating • Open or Direct-Contact Feedwater Heaters • Closed-Type

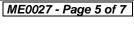




















	Feedwater Heater with Drains Cascaded Backwards • Efficiency & Heat Rate of
	Power Plants
0930 - 0945	Break
0945 – 1100	Pump Construction (cont'd)
	Supercritical Plants • Maintenance of Steam Power Plants • Co-Generation •
	Types of Co-Generation • Topping & Bottoming Cycles • Arrangements of Co-
	Generation 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

Thursday 19th of December 2024 Day 4:

Day 4.	Thursday 15 of December 2024
	Mechanical Seal Failure Analysis and Troubleshooting
0730 - 0930	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
	Couplings and Alignment
1215 - 1330	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

Friday 20th of December 2024 Day 5:

Day J.	Triday 20 Or December 2024
	Centrifugal Pump Maintenance and Repair (cont'd)
0730 – 0930	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

















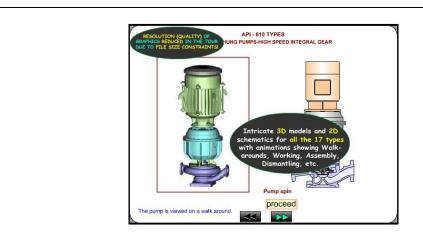




1100 – 1200	Pump Reliability (cont'd)  Addressing Pump Vibrations - Mechanical & Hydraulic • Fifty Upgrading
1200 – 1215	Opportunities for Centrifugal Pumps Break
1200 1210	Reliability Programs
1215 – 1345	Building Availability Data • Availability and Reliability Goals • How to Analyze Pump Costs • How 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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