COURSE OVERVIEW ME0562-4D
Pump Selection, Installation, Performance & Control

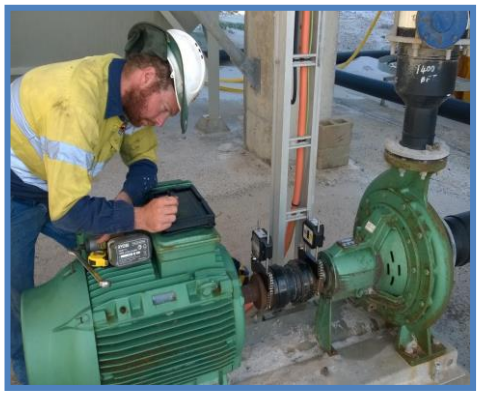
Course Title
Pump Selection, Installation, Performance & Control

Course Date/Venue
November 11-14, 2024/Oryx Meeting Room, Double Tree by Hilton Al Saad, Doha, Qatar

Course Reference
ME0562-4D

Course Duration/Credits
Four days/2.4 CEUs/24 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 simulator.

This course is designed to provide delegates with a detailed and up-to-date overview on the proper selection, installation, performance and control of pumps. It covers pump construction covering centrifugal pump, pump curves, characteristics, most common end-suction and in-line pump types, impeller and casing types, single-stage and multistage pumps, long coupled and close-coupled pumps as well as various types of pumps and mechanical shaft seals including its components, functions and factors affecting the seal performance.

The course will enable the participants to describe motors, liquids and materials and employ proper installation of pumps as well as analyze pump performance, system characteristics and pumps connected in series and parallel. Participants will be able to adjust pump performance and describe speed controlled pump solutions for constant pressure and temperature control, constant differential pressure in a circulating system and flow compensated differential pressure control.

Further, the advantages of speed control and pumps with integral frequency converter as well as its basic function, characteristics, components and special conditions will be discussed and lifecycle costs equation and calculation will be illustrated during the course.

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, installation, performance and control of various types of industrial pumps
- Recognize pump construction covering centrifugal pump, pump curves, characteristics, most common end-suction and in-line pump types, impeller and casing types, single-stage and multistage pumps as well as long coupled and close-coupled pumps
- Identify the various types of pumps and mechanical shaft seals including its components, functions and factors affecting the seal performance
- Describe motors, liquids and materials as well as employ proper installation of pumps
- Analyze pump performance, system characteristics and pumps connected in series and parallel
- Adjust pump performance and describe speed controlled pump solutions for constant pressure and temperature control, constant differential pressure in a circulating system and flow compensated differential pressure control
- Explain the advantages of speed control and pumps with integral frequency converter
- Enumerate the basic function, characteristics, components and special conditions of frequency converter
- Illustrate life cycle costs equation and calculation

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 covers systematic techniques and methodologies in the selection, installation, performance and control of pumps for 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, water utilities, wastewater etc. The course is also highly valuable to senior maintenance technical staff who are involved with pumps, their operation and their maintenance.

Course Fee

US$ 5,000 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.

  Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 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 Mechanical & Maintenance 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 **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**, **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**), **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.

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: ***Monday, 11th of November 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Pump Construction*** *The Centrifugal Pump ● Pump Curves ● Characteristics of the Centrifugal Pump ● Most Common End-Suction & In-Line Pump Types ● Impeller Types (Axial Forces) • Casing Types (Radial Forces) ● Single-Stage Pumps ● Multistage Pumps ● Long-Coupled and Close-Coupled Pumps*
0930 – 0945	*Break*
0945 – 1100	***Types of Pumps*** *Standard Pumps ● Split-Case Pumps ● Hermetically Sealed Pumps ● Sanitary Pumps ● Wastewater Pumps ● Immersible Pumps ● Borehole Pumps ● Positive Displacement Pumps*
1100 – 1230	***Mechanical Shaft Seals*** *The Mechanical Shaft Seal's Components & Function ● Balanced & Unbalanced Shaft Seals ● Types of Mechanical Shaft Seals ● Seal Face Material Combinations ● Factors Affecting the Seal Performance*
1230 – 1245	*Break*
1230 – 1420	***Motors*** *Standards ● Motor Start-Up ● Voltage Supply ● Frequency Converter ● Motor Protection*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: ***Tuesday, 12th of November 2024***

0730 – 0930	***Liquids*** *Viscous Liquids ● Non-Newtonian Liquids ● The Impact of Viscous Liquids on the Performance of a Centrifugal Pump ● Selecting the Right Pump for a Liquid with Antifreeze ● Calculation Example ● Computer Aided Pump Selection for Dense and Viscous Liquids*
0930 – 0945	*Break*
0945 – 1100	***Materials*** *What is Corrosion? ● Types of Corrosion ● Material & Metal Alloys ● Ceramics ● Plastics ● Rubber ● Coatings*

1100 – 1230	***Pump Installation*** *New Installation ● Existing Installation-Replacement ● Pipe Flow for Single-Pump Installation ● Limitation of Noise & Vibrations ● Sound Level (L)*
1230 – 1245	*Break*
1245 – 1420	***Pump Performance*** *Hydraulic Terms ● Electrical Terms ● Liquid Properties*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3: Wednesday, 13th of November 2024

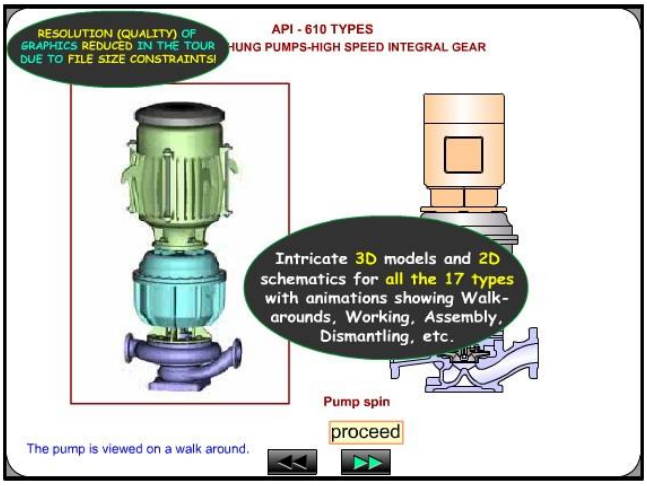
0730 – 0930	***System Characteristics*** *Single Resistances ● Closed and Open Systems*
0930 – 0945	*Break*
0945 – 1030	***Pumps Connected in Series & Parallel*** *Pumps in Parallel ● Pumps Connected in Series*
1030 – 1100	***Adjusting Pump Performance*** *Throttle Control ● Bypass Control ● Modifying Impeller Diameter ● Speed Control ● Comparison of Adjustment Methods • Overall Efficiency of the Pump System ● Example: Relative Power Consumption when the Flow is Reduced by 20%*
1100 – 1230	***Speed-Controlled Pump Solutions*** *Constant Pressure Control ● Constant Temperature Control • Constant Differential Pressure in a Circulating System ● Flow-Compensated Differential Pressure Control*
1230 – 1245	*Break*
1245 – 1420	***Advantages of Speed Control***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4: Thursday, 14th of November 2024

0730 – 0930	***Advantages of Pumps with Integral Frequency Converter*** *Performance Curves of Speed-Controlled Pumps ● Speed-Controlled Pumps in Different Systems*
0930 – 0945	*Break*
0945 – 1100	***Frequency Converter*** *Basic Function & Characteristics ● Components of the Frequency Converter ● Special Conditions Regarding Frequency Converters*
1100 – 1230	***Life Cycle Cost Equation*** *Initial Costs & Purchase Price (Cic) ● Installation & Commissioning Costs (Cin) ● Energy Costs (Ce) ● Operating Costs(Co) ● Environmental Costs (Cenv)* • ***Life Cycle Cost Equation (cont'd)*** *Maintenance & Repair Costs (Cm) ● Downtime Costs, Loss of Production (Cs) ● Decommissioning & Disposal Costs (co)*
1230 – 1245	*Break*
1245 – 1345	***Life Cycle Costs Calculation-An Example***
1345 - 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (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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