



COURSE OVERVIEW ME0615 Operation, Maintenance & Troubleshooting of Pumps & Compressors

Course Title

Operation, Maintenance & Troubleshooting of Pumps & Compressors

Course Reference

ME0615

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Date/Venue

Session(s)	Date	Venue
1	October 13–17, 2024	Horus Meeting Room, Holiday Inn & Suites Maadi, Cairo, Egypt
2	December 08-12, 2024	
3	February 09-13, 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.

Pumps and compressors are used extensively in the process industries. There are many types with widely varying configurations and applications. They represent a significant part of the capital and operating costs of most plants, and optimizing their selection, operation and maintenance are therefore, of major economic importance.



The course deals with efficiencies, operating characteristics, reliability, maintenance and troubleshooting implications of pumps and compressors.



The course will cover the operating principles of pumps and compressors, specifications, thermodynamics, effects of efficiency on operating costs, energy usage, and effect on plant costs, materials of construction, selection, troubleshooting and maintenance.

The course will also cover plant run-length extension surveys, organizing for successful turnarounds and on-going reliability improvement, and preventive vs. predictive maintenance strategy decisions.



The course will provide the participant with a basic as well as advanced pump and compressor technology knowledge, inventory required to successfully select, apply, operate, troubleshoot and maintain pumps and compressors.

At the end of this course, participants will have gained a thorough understanding of the various types of pumps and compressors available to most industrial users, including sizing and application criteria, maintainability, reliability, vulnerability and troubleshooting issues. Participants will learn simple techniques and short-cut methods of machinery sizing and selection. This replaces tedious hand or other methods of calculation and will serve as a fast way to arrive at sensitivity or influence of parameter changes on equipment performance.

Course Objectives

Upon the successful completion of this course, each participant will be able to: -

- Apply systematic techniques in the operation, maintenance and troubleshooting of pumps and compressors
- Discuss the concepts of pump types and terminology and introduce the theory and operating characteristics of centrifugal pumps
- Identify the common types of compressors and the ranges of application and limitation and have an overview of centrifugal compressors including its type and function
- Recognize the principles of equipment failure patterns including its type and review the common factors of why equipment fails
- Differentiate between the different aspects of machinery corrosion and to make the correct selection of material for a given application
- Determine the basic approaches to machinery troubleshooting and troubleshoot most possible faults and failures of pumps and compressors and discover the various approaches to be considered in applying corrective actions
- Employ the principles of dry gas, packing and mechanical seals and recognize their components and functions
- Develop a good background on seal support systems including its selection strategies and other applications and explain the features of dry gas seal for centrifugal gas compressor
- Analyze and troubleshoot mechanical seal failure and identify the various maintenance & repair methods used
- Discuss the basic concept of bearing care & maintenance, bearing classification and lubrication management
- Identify the various types of couplings and recognize their purpose & function and list-down the different alignment methods used
- Recognize and implement the various preventive and predictive maintenance techniques and strategies used for pumps & compressors

Who Should Attend


This course provides an overview of all significant aspects and considerations of pumps and compressors for those who are involved in the operation, maintenance and troubleshooting of such equipment. This includes rotating equipment and machinery engineers, plant and maintenance engineers and other technical staff involved in turbomachinery management, operation and maintenance. Further, it is suitable for operations, process and process unit contact, mechanical and project engineers.

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.

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:



Dr. Sayed Shaaban, PhD, MSc, BSc, is a **Senior Mechanical Engineer** with over 30 years of integrated **industrial experience** as a consultant and academic experience as a University Professor. His wide expertise includes **Machinery Vibrations Analysis, Maintenance & Reliability Management, Machinery Failure Analysis & Prevention**, Computerized Maintenance Management Systems (**CMMS**), Root Cause Failure Analysis (**RCFA**), **Preventive Maintenance, Predictive Maintenance, Total Productive Maintenance, Industrial Hydraulics, Mechanical Troubleshooting Maintenance, Pumps, Compressors, Bearings, Lubrication and Mechanical Shaft Alignment**. Furthermore, he is also an expert in assets inspection & management, measurements & instrumentations, maintenance planning & scheduling, transportation planning & management, inspection & assessment of laboratory testing equipments, utility trucks, heavy equipment, diesel engines and technical report writing.

During his career life, Dr. Shaaban has gained his practical and field experience through his various significant positions and dedication as the **Head of Automotive and Tractors Engineering Department, Project Manager, Technical Consultant, Team Leader and Material Testing Engineer** for international companies, universities, colleges, institutes and research centers like the British Council, James Watt College of Scotland, Helwan University, Technical Research Center, Al Handasia Manufacturing Co., GIAD Manufacturing Co. and the Egyptian Standards Authority.

Dr. Shaaban has **PhD** degree in **Mechanical Engineering** from the **Ecole Centrale (France)** and has **Master's** and **Bachelor's** degree in **Mechanical Engineering**. Furthermore, he is an **author** of more than **40 technical books** along ten years of his work as a Technical Curricula Specialist in the Middle East and he has published **26 research papers** in local and international scientific journals and conferences.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

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.

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

0730 – 0800	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 – 0930	Introduction <i>Overview of Rotating Equipment • Understanding How Equipment Works</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Pump Types and Terminology <i>Pump Basics • Pump Terminology • Nomenclature & Definitions</i>
1100 – 1215	Centrifugal Pumps Overview <i>Centrifugal Pump Theory • Operating Characteristics • Centrifugal • Pump Operation • Cavitation & NPSH</i>
1215 – 1230	<i>Break</i>
1230 – 1330	Centrifugal Pumps Overview (cont'd) <i>Minimum Continuous Safe Flow (MCSF) • Types of Centrifugal Pumps • Troubleshooting & Preventive Maintenance for Pumps</i>
1330 – 1420	Compressor Types and Terminology <i>Centrifugal • Axial • Reciprocating • Helical Screw • Ranges of Application & Limitations</i>
1420 – 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day One</i>



Day 2

0730 – 0930	Centrifugal Compressors Overview Rotors • Balancing • Rotor Dynamics • Impellers • Casings • Troubleshooting & Preventive Maintenance for Compressors • Bearings • Seals: Labyrinths, Oil Seals & Self-Acting Gas Seals • Couplings • Controls
0930 – 0945	Break
0945 – 1100	Equipment Failure Patterns Materials Selection • Types of Corrosion • Bath-Tub Curve • Actual Equipment Failure Patterns • Actions to Minimize Failure Effect
1100 – 1215	Basic Approaches to Machinery Troubleshooting Examples from Recent Failure Incidents Attributed to Design Defects • Processing & Manufacturing Deficiencies
1215 – 1230	Break
1230 – 1245	Case Studies
1245 – 1400	Troubleshooting Faults and Applying Corrective Action Equipment Performance Monitoring • Vibration Analysis • Fast Fault Finding
1400 – 1415	Vibration Analysis DVD's
1415 – 1420	Case Studies
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3

0730 – 0930	Troubleshooting Faults and Applying Corrective Action (cont'd) Acoustical Troubleshooting • Infra-red Inspection • Oil Analysis
0930 – 0945	Break
0945 – 1100	Introduction to Dry Gas Seals Principle of Operation • Materials of Construction • Manufacturing & Verification Testing
1100 – 1215	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
1215 – 1230	Break
1230 – 1300	Flowserve DVD
1300 – 1330	Case Studies
1330 – 1400	Seal Support Systems Dual Sealing Systems & Flushing Plans • API 682 Reference Guide • Gas Barrier Seal Technology for Pumps • Support Systems for Dry Gas (Self Acting) Compressor Seals • Mechanical Seal Selection Strategies
1400 – 1420	Dry Gas Seal for Centrifugal Gas Compressors
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
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
0930 – 0945	Break
0945-1100	Mechanical Seal Maintenance and Repair Bellows Seal Repair • Cartridge Seal Installation & Management • Seal Face Care
1100 – 1215	Bearing Care and Maintenance Basic Bearing Concepts • Bearing Classifications • Bearing Care & Maintenance • Lubrication Management Break
1215 – 1230	Break
1230 – 1400	Couplings and Alignment Purpose of Couplings • Types of Couplings • Alignment Methods • Foundation & Grouting Guidelines
1400 – 1415	Flowserve DVD
1415 – 1420	Case Studies
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

Day 5

0730 – 0915	Preventive Maintenance-Lubrication Cost of Poor Lubrication • Fundamentals-Oil & Grease • Storage & Handling Methods
0915 – 0930	Flowserve DVD
0930 – 0945	Break
0945 – 1200	Preventive Maintenance-Lubrication (cont'd) Comparative Viscosity • Classifications
1200 – 1215	Lubrication DVD
1215 – 1230	Break
1230 – 1345	Preventive Maintenance General Philosophy • Equipment Sparing Factor & Maintenance Approach
1345 – 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

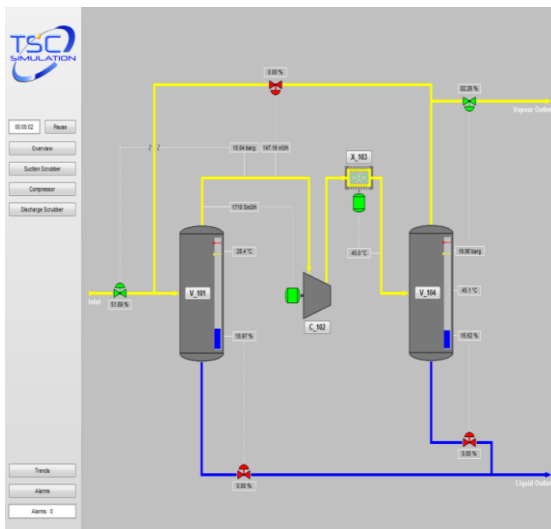


Simulator (Hands-on Practical Sessions)

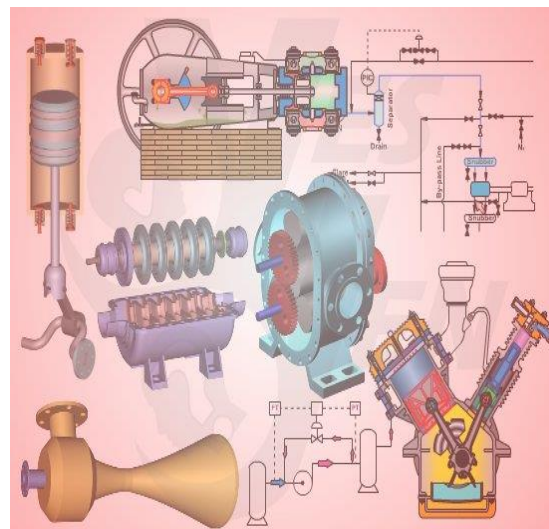
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor” and “CBT on Compressors”.



Centrifugal Pumps and Troubleshooting Guide 3.0



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors

Course Coordinator

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