

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

**Course Title**

Operation, Maintenance & Troubleshooting of Pumps & Compressors

**Course Date/Venue**

December 16-20, 2024/Oxford Street Suites, Thistle Marble Arch, London, United Kingdom

**Course Reference**

ME0615

**Course Duration/Credits**

Five days/3.0 CEUs/30 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 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 Fee

**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.

### 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. Eric Matthews** is a **Senior Mechanical Maintenance Engineer** with over **35 years** of industrial experience. His expertise includes **Pumps & Compressors** Operation, Maintenance & Troubleshooting, **Centrifugal Compressor & Steam Turbine** Design, Performance, Operation, Maintenance & Troubleshooting, **Maintenance & Reliability Management**, **Process Plant Shutdown, Turnaround & Troubleshooting**, **Machinery Root Cause Failure Analysis (RCFA)**, **Preventive & Predictive Maintenance** and **Condition Based Monitoring**. He is also a well verse in **Construction Safety (STOP)**, **Process Safety Management (PSM)**, **Risk Management**, **Risk Assessment**, **ISO 14001 (2004) Lead Auditor**, **OSHA**, **SHEQ**, **Industrial Hygiene**, **Confined Space Entry**, **Fall Protection**, **Work Permit & First Aid**, **Forklift Operations**, **Accident & Incident Prevention**, **Site Inspection**, **HSE Leadership**, **Safety Attitude** and **Industrial Plant Safety** as well as Pneumatic, Control Systems and Logic Boards. Moreover, his experience includes Quality Management System (**QMS**), Change Management, Project Management, Contract Management, Business Management, Time Management, Performance Management, Supervisory & Management Skills, Coaching & Mentoring and Strategic Decision Making. He is currently the **Managing Director** of **Ken Matthews & Associates Training Consultancy**. Further, he is a **Registered** and **Certified Trainer, Assessor, Moderator, Verifier** and **Program Designer & Developer** as well as an **Authorized Accreditation Advisor**.

During Mr. Matthews' career life, he has shared his knowledge and practical expertise through the continuous and numerous trainings internationally. He started his profession from various challenging positions such as the **Tool Maker**, **Mechanical Technician**, **Sea Going Engineer**, **Safety Officer**, **Senior Lecturer/Professor**, **College Mentorship Programme Head**, **Mechanical Engineering Curriculum Designer**, **Learning Material Developer**, **Trainer & Assessor**.

Mr. Matthews has **Bachelor** degree in **Industrial Psychology** with **Honours**. Further, he is an active member of the British Institute of Works Managers and Personnel Practitioners, a **Certified Trainer/Assessor** by the **British City & Guilds** and by the **British Institute of Leadership & Management (ILM)** and a **Certified Instructor** by **Haward Technology Train-the-Trainer Program**.

### Accommodation

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

### 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, 16<sup>th</sup> of December 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction</b> Overview of Rotating Equipment • Understanding How Equipment Works
0930 – 0945	Break
0945 – 1100	<b>Pump Types and Terminology</b> Pump Basics • Pump Terminology • Nomenclature & Definitions
1100 – 1215	<b>Centrifugal Pumps Overview</b> Centrifugal Pump Theory • Operating Characteristics • Centrifugal • Pump Operation • Cavitation & NPSH
1215 – 1230	Break
1230 – 1330	<b>Centrifugal Pumps Overview (cont'd)</b> Minimum Continuous Safe Flow (MCSF) • Types of Centrifugal Pumps • Troubleshooting & Preventive Maintenance for Pumps
1330 – 1420	<b>Compressor Types and Terminology</b> Centrifugal • Axial • Reciprocating • Helical Screw • Ranges of Application & Limitations
1420 – 1430	<b>Recap</b> 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 One

#### **Day 2: Tuesday, 17<sup>th</sup> of December 2024**

0730 – 0930	<b>Centrifugal Compressors Overview</b> 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	<b>Equipment Failure Patterns</b> Materials Selection • Types of Corrosion • Bath-Tub Curve • Actual Equipment Failure Patterns • Actions to Minimize Failure Effect



1100 – 1215	<b>Basic Approaches to Machinery Troubleshooting</b> <i>Examples from Recent Failure Incidents Attributed to Design Defects • Processing &amp; Manufacturing Deficiencies</i>
1215 – 1230	<i>Break</i>
1230 – 1245	<b>Case Studies</b>
1245 – 1400	<b>Troubleshooting Faults and Applying Corrective Action</b> <i>Equipment Performance Monitoring • Vibration Analysis • Fast Fault Finding</i>
1400 – 1415	<b>Vibration Analysis DVD's</b>
1415 – 1420	<b>Case Studies</b>
1420 – 1430	<b>Recap</b> <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today &amp; Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch &amp; End of Day Two</i>

**Day 3: Wednesday, 18<sup>th</sup> of December 2024**

0730 – 0930	<b>Troubleshooting Faults and Applying Corrective Action (cont'd)</b> <i>Acoustical Troubleshooting • Infra-red Inspection • Oil Analysis</i>
0930 – 0945	<i>Break</i>
0945 – 1100	<b>Introduction to Dry Gas Seals</b> <i>Principle of Operation • Materials of Construction • Manufacturing &amp; Verification Testing</i>
1100 – 1215	<b>Packing and Mechanical Seals</b> <i>Compression Packing • Molded (Automatic) Packing • Basic Principles of Mechanical Seals • Face Materials • Secondary Seal Materials • Single Mechanical Seals • Single Mechanical Seal • Flushing Plans</i>
1215 – 1230	<i>Break</i>
1230 – 1300	<b>Flowserve DVD</b>
1300 – 1330	<b>Case Studies</b>
1330 – 1400	<b>Seal Support Systems</b> <i>Dual Sealing Systems &amp; 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</i>
1400 – 1420	<b>Dry Gas Seal for Centrifugal Gas Compressors</b>
1420 – 1430	<b>Recap</b> <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today &amp; Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch &amp; End of Day Three</i>

**Day 4: Thursday, 19<sup>th</sup> of December 2024**

0730 – 0930	<b>Mechanical Seal Failure Analysis and Troubleshooting</b> <i>Failure Analysis • Mechanical Seal Troubleshooting • Determining Leakage Rates • Ascertaining Seal Stability</i>
0930 – 0945	<i>Break</i>
0945-1100	<b>Mechanical Seal Maintenance and Repair</b> <i>Bellows Seal Repair • Cartridge Seal Installation &amp; Management • Seal Face Care</i>



1100 – 1215	<b>Bearing Care and Maintenance</b> Basic Bearing Concepts • Bearing Classifications • Bearing Care & Maintenance • Lubrication Management Break
1215 – 1230	Break
1230 – 1400	<b>Couplings and Alignment</b> Purpose of Couplings • Types of Couplings • Alignment Methods • Foundation & Grouting Guidelines
1400 – 1415	<b>Flowserve DVD</b>
1415 – 1420	<b>Case Studies</b>
1420 – 1430	<b>Recap</b> 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

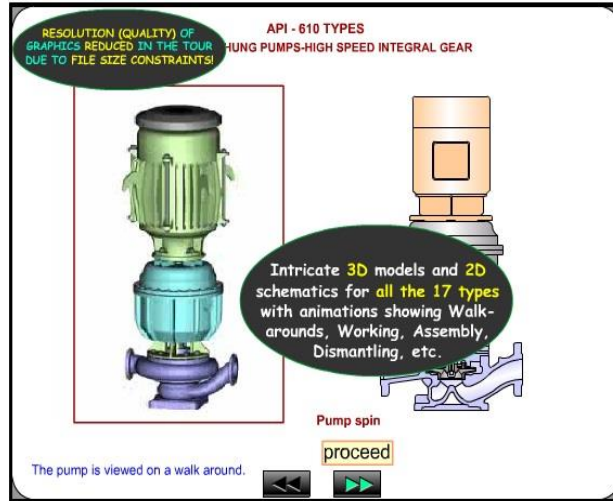
**Day 5: Friday, 20<sup>th</sup> of December 2024**

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

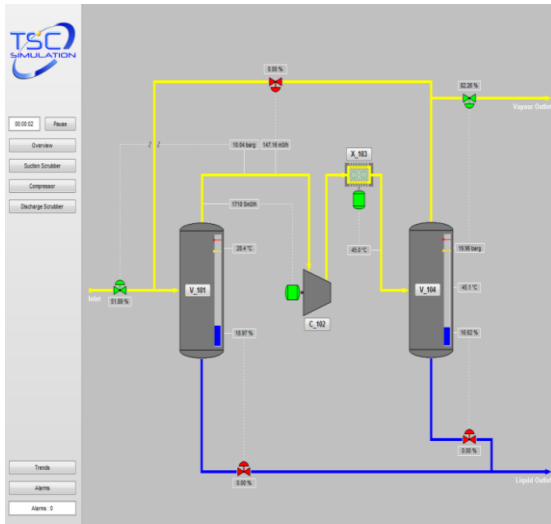


**Simulator (Hands-on Practical Sessions)**

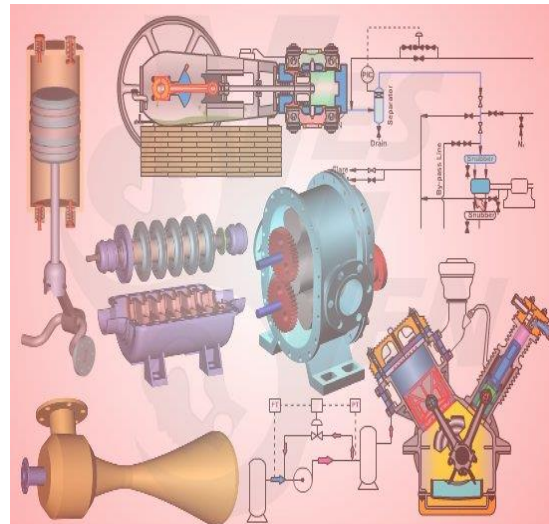
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor” and “CBT on Compressors”.



**Centrifugal Pumps and Troubleshooting Guide 3.0**



**SIM 3300 Centrifugal Compressor Simulator**



**CBT on Compressors**

**Course Coordinator**

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