



**COURSE OVERVIEW RE0761**

**Rotating Equipment Selection, Operation, Troubleshooting & Effective Predictive Maintenance**

**Course Title**

Rotating Equipment Selection, Operation, Troubleshooting & Effective Predictive Maintenance

**Course Date/Venue**

Session 1: January 19-13, 2025/Boardroom 2, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE  
Session 2: October 05-09, 2025/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA



**Course Reference**

RE0761

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs



**Course Description**



***This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.***

This course is designed to cover the selection, operation, maintenance, inspection and troubleshooting of the various types of plant rotating equipment such as compressors, pumps, motors, turbines, turbo-expanders, gears and transmission equipment. The course will feature a unique blend of practical application experience and basic analysis methods. Its aim is to convey a thorough understanding of machinery operating principles, equipment troubleshooting and effective predictive maintenance.



The course will cover the principal machines represented at a large number of plants. There will be a thorough examination of basic operating concepts, application ranges, selection criteria, maintenance, inspection, troubleshooting and vulnerabilities of certain types of equipment. The course will also cover the equipment failure patterns, bearings, lubrication, shafting, couplings, belts/chain drives and gears.



Upon the successful completion of this course, participants will have gained an understanding of the 12 principal types of machinery used in industry. They will understand the differences between electric motors, design peculiarities, advantages and disadvantages of different types of gears, operating principles of gas turbines and reciprocating gas engines.





The course will convey an understanding of impulse vs. reaction turbines, insights into application ranges, limitations, maintenance and operability constraints for different kinds of pumps, compressors and dynamic gas machinery such as turbo-machinery as opposed to displacement machinery.

The course will discuss the root cause failure analysis (RCFA) and its various approaches and processes, the proper procedure for troubleshooting faults and carrying out the corrective actions including the various troubleshooting and testing tools and instruments. Predictive maintenance will be discussed in details including vibration analysis, oil particle and wear debris analysis, thermography and ultrasonics performance evaluation.

The course includes a comprehensive e-book entitled “*Engineers’ Guide to Rotating Equipment: The Pocket Reference*”, published by Wiley, which will be given to the participants to help them appreciate the principles presented in the course.

### **Course Objectives**

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

- Select, operate and troubleshoot rotating equipment and implement an effective predictive maintenance program
- Identify the various plant rotating equipments and their components, how equipment works and define the maintenance educational component (MEC) term
- Discuss electric motors, gears & transmission equipment, gas turbines & engines, steam turbines and expanders
- Select and use centrifugal pumps, positive displacement and vacuum pumps, turbo-compressors, fans, blowers and displacement compressors
- Apply the principles of equipment failure patterns and review the common reasons for equipment failure
- Troubleshoot, repair and maintain the major components of rotating equipment including bearings, lubrication, shafting, shaft couplings, V-belts, positive-drive belts, chain drives, gears, gearing and housing
- Use the concept of root cause failure analysis (RCFA) including the various types and approaches used in rotating equipments
- Troubleshoot all possible faults and failures of the rotating equipment and identify the various approaches to be considered in applying corrective actions
- Employ the various predictive maintenance techniques and strategies used for rotating equipment
- Determine the various types of conditioning monitoring techniques and recognize their importance in troubleshooting plant rotating equipment and their major role in predictive maintenance



**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 provides an overview of all significant aspects and considerations of mechanical and rotating equipment at industrial plants, utilities, production oil/gas field, or manufacturing facilities for those who are involved in the selection, operation, maintenance, inspection and troubleshooting of rotating equipment and carrying out effective predictive maintenance. General maintenance personnel and engineers will find this course extremely useful as well as for those who are coming from a wide variety of industries, skill-levels, company sizes and job titles.

**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\$ 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.

**Accommodation**

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






**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:



**Mr. Karl Thanasis, PEng, MSc, MBA, BSc, is Senior Mechanical & Maintenance Engineer with over 45 years of extensive industrial experience within the Power & Water Utilities and other Energy Sectors. His wide expertise includes District Cooling Plant, District Cooling Plant Operations, HVAC Basics, HVAC&R, KOTZA, Refrigeration, Modern HVAC & Refrigeration Systems Design, Utilization, Operation & Effective Maintenance, Control Valve & Actuators, Fire Safe Valves, Piping & Pipeline, Maintenance, Repair, Shutdown, Turnaround & Outages, Maintenance & Reliability Management, Mechanical Maintenance Planning, Scheduling & Work Control, Advanced Techniques in Maintenance Management, Predictive & Preventive Maintenance, Maintenance & Operation Cost Reduction Techniques, Reliability Centered Maintenance (RCM), Machinery Failure Analysis, Rotating Equipment Reliability Optimization & Continuous Improvement, Material Cataloguing, Mechanical & Rotating Equipment Troubleshooting & Maintenance, Root Cause Analysis & Reliability Improvement, Condition Monitoring, Root Cause Failure Analysis (RCFA), Steam Generation, Steam Turbines, Power Generator Plants, Gas Turbines, Combined Cycle Plants, Boilers, Process Fired Heaters, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, Heat Exchangers, Heat Transfer, Coolers, Power Plant Performance, Efficiency & Optimization, Storage Tank Design & Fabrication, Thermal Power Plant Management, Boiler & Steam System Management, Pump Operation & Maintenance, Chiller & Chiller Plant Design & Installation, Pressure Vessel, Safety Relief Valve Sizing & Selection, Valve Disassembling & Repair, Pressure Relief Devices (PSV), Hydraulic & Pneumatic Maintenance, Advanced Valve Technology, Pressure Vessel Design & Fabrication, Pumps, Turbo-Generator, Turbine Shaft Alignment, Lubrication, Mechanical Seals, Packing, Blowers, Bearing Installation, Couplings, Clutches and Gears. Further, he is also versed in Wastewater Treatment Technology, Networking System, Water Network Design, Industrial Water Treatment in Refineries & Petrochemical Plants, Piping System, Water Movement, Water Filtering, Mud Pumping, Sludge Treatment and Drying, Aerobic Process of Water Treatment that includes Aeration, Sedimentation and Chlorination Tanks. His strong background also includes Design and Sizing of all Waste Water Treatment Plant Associated Equipment such as Sludge Pumps, Filters, Metering Pumps, Aerators and Sludge Decanters.**

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager, Plant Manager, Area Manager - Equipment Construction, Construction Superintendent, Project Engineer and Design Engineer.** His duties covered **Plant Preliminary Design, Plant Operation, Write-up of Capital Proposal, Investment Approval, Bid Evaluation, Technical Contract Write-up, Construction and Sub-contractor Follow up, Lab Analysis, Sludge Drying and Management of Sludge Odor and Removal.** He has worked in various companies worldwide in the **USA, Germany, England and Greece.**

Mr. Thanasis is a **Registered Professional Engineer** in the **USA and Greece** and has a **Master's and Bachelor's degree in Mechanical Engineering with Honours** from the **Purdue University and SIU in USA** respectively as well as an **MBA** from the **University of Phoenix in USA.** Further, he is a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management (ILM)** a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, seminars, workshops 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	<b>PRE-TEST</b>
0830 – 0930	<b>Introduction</b> Overview of Rotating Equipment • What is Common to All Types of Equipment? • Understanding How Equipment Works • The Maintenance Educational Component (MEC)
0930 – 0945	Break
0945 – 1100	<b>Electric Motors</b> Design • Controls • Wiring Systems • Standard Motors • Special Designs • Major Components • The Motor as Part of a System • Adjustable Frequency Motors
1100 – 1230	<b>Gears &amp; Transmission Equipment</b> Types of Gears • Applications Constraints • Maintenance
1230 – 1245	Break
1245 – 1330	<b>Gas Turbines &amp; Engines</b> Simple Cycle • Heat Recovery Cycles • Type Selection • Maintenance • Two & Four Cycle Gas Engines • Gas Engine Compressor Auxiliary Systems
1330 – 1420	<b>Steam Turbines &amp; Expanders</b> Impulse Turbines • Reaction Turbines • Application Ranges • Turbine Configurations • Applications Constraints • Maintenance • Turbo-expander Construction Features • Applications • Operation
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

**Day 2**

0730 – 0930	<b>Centrifugal Pumps</b> Configurations & Styles • Application Ranges & Constraints • Construction Features & Options • Pump Auxiliaries • Wear Components • Canned Motor & Magnetic Drive Pumps • High Speed/Low Flow Pumps • Servicing & Condition Monitoring
0930 – 0945	Break
0945 – 1100	<b>Positive Displacement &amp; Vacuum Pumps</b> Reciprocating Steam & Power Pumps • Diaphragm Pumps • Plunger Pumps • Gear Screw & Progressive Cavity Pumps • Peristaltic Pumps • Conventional & Special Vacuum Pumps • Liquid Jet & Liquid Ring Pumps • Combination & Staged Vacuum Pumps
1100 – 1230	<b>Turbo-compressors</b> Types, Styles & Configurations of Centrifugal & Axial Compressors • Construction Features • Mode of Operation • Compressor Auxiliaries & Support Systems • Condition Monitoring • Application Criteria • Performance Capabilities & Limitations • Maintenance





1230 – 1245	Break
1245 – 1420	<b>Fans &amp; Blowers</b> Types & Configurations • Performance & System Effects • Performance Correction • Capacity Control Options
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

**Day 3**

0730 – 0930	<b>Displacement Compressors</b> Classification • Reciprocating Compressors vs. Rotary Screw Compressors • Application Ranges & Limitations • Compression Processes • Construction Features & Components • Capacity Control
0930 – 0945	Break
0945 – 1100	<b>Equipment Failure Patterns</b> Distinguishing between Repairable & Non-Repairable Equipment • Types of Equipment Failure • Review Why Equipment Fails • Areas of the Bath-Tub Curve • Actual Equipment Failure Patterns • Actions to Minimize Failure Effect • Discussions • How does Most of Your Equipment Fail?
1100 – 1230	<b>Bearings &amp; Lubrication</b> Anti Friction • Plain • Importance of Lubrication • Types of Lubrication • What Needs to be Lubricated • How & When to Lubricate
1230 – 1245	Break
1245 – 1420	<b>Shafting &amp; Shaft Couplings</b> Types of Shafts • Types of Couplings • Uses & Applications
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

**Day 4**

0730 – 0930	<b>V-Belts, Positive-Drive Belts &amp; Chain Drives</b> Component Overview • Uses for Equipment • Failure Modes
0930 – 0945	Break
0945 – 1100	<b>Gears, Gearing &amp; Housing</b> Gear Types & Mechanisms • Removing the Mysteries • Repair & Maintenance of Gears • Types of Housing
1100 – 1230	<b>Root Cause Failure Analysis (RCFA)</b> Structured Problem Solving & RCFA • Cause Analysis • Two-Track Approach • Failure Types • The Three Levels of Cause • Collecting Failure Data • Parts & Position • The Analysis Process
1230 – 1245	Break
1245 – 1330	<b>Root Cause Failure Analysis(RCFA) (cont'd)</b> Describing the Process • Data Analysis I • Data Analysis II • Data Analysis III • Another Way • Human Root Causes • Solutions • Stewardship of RCFA Results
1330 – 1420	<b>Troubleshooting Faults &amp; Corrective Action</b> Vibration Analysis • Fast Fault Finding • Acoustical Troubleshooting • Infra-red Inspection
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

**Day 5**

0730 – 0930	<b>Troubleshooting Faults &amp; Corrective Action (cont'd)</b> Oil Analysis • Motors • Megger Testing • Pumps, Blowers & Fans • Other Rotating Equipment
0930 – 0945	Break
0945 – 1100	<b>Predictive Maintenance Overview</b> Classification of Plant Machinery • Maintenance Strategies as Adopted to Each Class of Machinery • Identification of Critical Machinery & Adoption of CBM • Principles of Predictive Maintenance • Detection & Diagnosis
1100 – 1230	<b>Predictive Maintenance Techniques</b> Vibration Analysis • Oil particle & Wear Debris Analysis • Thermography • Ultrasonics • Performance Evaluation
1230 – 1245	Break
1245 – 1345	<b>Predictive Maintenance: Condition-Based Monitoring</b> Types of Condition-Based Monitoring • Vibration Monitoring • Pump Monitoring Frequency • Temperature Based Monitoring • Infrared Monitoring • Lube Oil Analysis • Discussion • Analytical- Base Tools • Data Analysis • Weibul Analysis • Discussions • What Kind of Analysis is Done?
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

**Practical Sessions**

This practical and highly-interactive course includes real-life case studies and exercises:

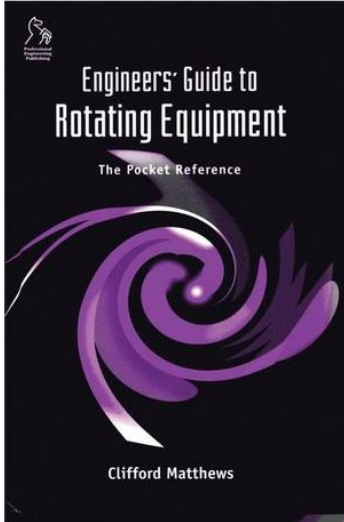






**Book(s)**

As part of the course kit, the following e-book will be given to all participants:



**Title** : Engineers' Guide to Rotating Equipment: The Pocket Reference  
**ISBN** : 9781860583445  
**Author** : Clifford Matthews  
**Publisher** : Wiley

**Course Coordinator**

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