COURSE OVERVIEW RE0640(SE2)-4D
Condition Based Monitoring & Maintenance

Course Title
Condition Based Monitoring & Maintenance

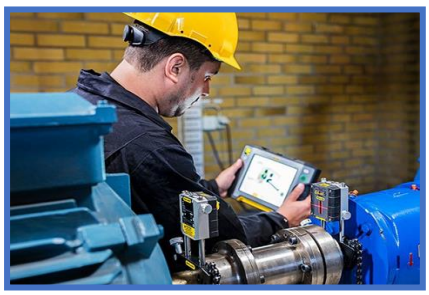
Course Reference
RE0640(SE2)-4D

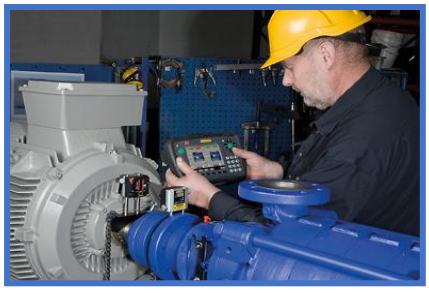
Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	February 05-08, 2024	Boardroom, Warwick Hotel Doha, Doha, Qatar
2	May 06-09, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA
3	August 05-08, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	November 04-07, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Description





This practical and highly-interactive course includes practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Modern process industries are seeking to maximize the value of their existing assets by leveraging new technologies to optimize operations and maintenance activities. One of the most successful maintenance strategies is a conditioned-based approach which utilizes data collected from periodic inspections, testing and predictive maintenance technologies to determine the optimum maintenance requirements.

Contrary to the traditional time-based maintenance approach, Condition Based Maintenance (CBM) is a process, which utilizes monitoring and diagnostic data to drive the maintenance decision process. Condition Based Monitoring (CBM) of power plants can help reduce downtime, increase the safety of plant operations and provide an accurate indicator of impending faults. This can lead to better planned maintenance shutdowns, the avoidance of unplanned shutdowns and a reduction in cost.

Condition Based Monitoring (CBM) primarily involves the continuous analysis of operational equipment and the identification of problems before component breakage or machine failure. CBM has mostly been associated with the analysis of rotating and reciprocating equipment.

Almost any equipment, be it electrical, hydraulic, mechanical, or thermal, generates characteristic signals or 'signature' during optimal performance. A change in this signal, even if marginal, could be an early warning regarding potential equipment failure. The practice of condition-based monitoring and maintenance can be an invaluable tool in improving maintenance efficiency, safety and equipment use. With the proper skills and equipment, plant maintenance technicians not only detect problems before they result in a major machine malfunction or breakdown, but they also perform root cause failure analysis to prevent problems from recurring. Highly trained condition monitoring technicians can have a significant impact on a plant's bottom line profitability.

This course is designed to provide an insight into Condition Based Monitoring (CBM). It will cover the various methods of maintenance and it will give the participant an introduction to the techniques utilized in Condition Based Monitoring such as Noise & Vibration Measurement, Infrared Thermography, Oil Debris Analysis, Laser Alignment and Balancing. Following this course participants will understand the place of condition monitoring in the maintenance process and will appreciate the implications for maintenance cost saving and improved machine reliability. They will be able to assess plant for the most appropriate monitoring parameter, will learn of the various specialist instruments and methods, be able to plan a monitoring programme and set up measurement rounds. The course will introduce participants to the dynamic behaviour of machines and discuss appropriate fault detection and diagnostic criteria and schemes for various applications. It will address the more popular techniques which employ dynamic data analysis, including vibration and acoustic emission signals for the recognition of early life failures in machines. Emphasis will be placed on the practical application of tools to identify a wide range of mechanical, electrical and lubrication flaws in machinery and an objective approach to the optimum choice of analysis procedure.

Course Objectives

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

- Apply and gain knowledge on condition-based monitoring and maintenance
- Interpret the role of condition monitoring in the maintenance process
- Assessing the plant for the most appropriate monitoring parameter
- Present the various techniques and equipment
- Plan a monitoring programme and set up measurement rounds
- Solve maintenance problems using the Root Cause Analysis (RCA) technique
- Discuss of the various maintenance techniques such as breakdown maintenance, preventive maintenance, predictive maintenance and Reliability Centered Maintenance

- Employ condition monitoring techniques and implement a CBM Program
- Discuss monitored parameters and parameter symptom limits
- Employ proper techniques on thermal monitoring, lubricant monitoring, vibration monitoring and recognize the vibration symptoms and the relationship with machine faults
- Present the Fault Detection Process and the ISO requirements

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 a deeper appreciation and wider understanding of vibration analysis and condition monitoring for engineers and other technical staff whose responsibilities require them to be proficient in the set-up and use of condition monitoring systems. This further includes maintenance supervisors, predictive maintenance co-ordinators, reliability engineers, shop supervisors, advanced mechanics, inspectors and millwrights.

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.

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: -

- 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.

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. Manuel Dalas MSc, BSc, is a **Senior Mechanical & Maintenance Engineer** with over **20 years** of industrial experience in **Oil**, **Gas**, **Refinery**, **Petrochemical**, **Power** and **Nuclear** industries. His wide expertise includes **Material Cataloguing**, **Maintenance Planning & Scheduling**, Reliability Centered Maintenance (**RCM**), **Reliability Maintenance**, **Condition Based Maintenance & Condition Monitoring**, **Asset & Risk** Management, **Vibration Condition Monitoring & Diagnostics** of Machines, **Vibration & Predictive** Maintenance, Reliability Improvement & Vibration Analysis for Rotating Machinery, Effective Maintenance **Shutdown & Turnaround** Management, **Engineering Codes & Standards**, **Rotating Equipment** Maintenance, **Mechanical** Troubleshooting, **Static Mechanical Equipment** Maintenance, **Machinery** Failure Analysis, **Machinery Diagnostics & Root Cause Failure** Analysis, **Plant Reliability & Maintenance** Strategies, **Boiler** Operation & Water Treatment, **Pumps** Maintenance & Troubleshooting, **Fans**, **Blowers & Compressors**, **Process Control Valves**, Piping Systems & Process Equipment, **Gas Turbines & Compressors** Troubleshooting, Advanced **Valve** Technology, **Pressure Vessel** Design & Analysis, **Steam & Gas Turbine**, **High Pressure Boiler** Operation, **FRP Pipe** Maintenance & Repair, **Centrifugal & Positive Displacement Pump** Technology Troubleshooting & Maintenance, **Rotating Machinery** Best Practices, **PD Compressor & Gas Engine** Operation & Troubleshooting, **Hydraulic Tools & Fitting**, **Mass & Material Balance**, **Water Distribution & Pump Station**, **Tank Farm & Tank Termin**al Safety & Integrity Management, **Process Piping** Design, Construction & **Mechanical Integrity**, **Stack & Noise** Monitoring, **HVAC & Refrigeration** Systems, BPV Code, Section VIII, Division 2, **Facility Planning & Energy** Management, Hoist - Remote & Basic **Rigging & Slinging**, **Mobile Equipment** Operation & Inspection, **Heat Exchanger**, **Safety Relief Valve**, **PRV & POPRV/PORV**, **Bearing & Lubrication**, **Voith Coupling** Overhaul, **Pump & Valve** Technology, **Lubrication** Inspection, **Process Plant** Optimization, Rehabilitation, Revamping & Debottlenecking, Engineering Problem Solving and **Process Plant** Performance & Efficiency. Currently, he is the **Technical Consultant** of the **Association of Local Authorities of Greater Thessaloniki** where he is in charge of the mechanical engineering services for piping, pressure vessels fabrications and ironwork.

During his career life, Mr. Dalas has gained his practical and field experience through his various significant positions and dedication as the **Technical Manager**, **Project Engineer**, **Safety Engineer**, **Deputy Officer**, **Instructor**, **Construction Manager**, **Construction Engineer**, **Consultant Engineer** and **Mechanical Engineer** for numerous multi-billion companies including the **Biological Recycling Unit** and the **Department of Supplies** of **Greece**, **Alpha Bank Group**, **EMKE S.A**, **ASTE LLC** and **Polytechnic College of Evosmos**.

Mr. Dalas has a **Master's** degree in **Energy System** from the **International Hellenic University, School of Science & Technology** and a **Bachelor's** degree in **Mechanical Engineering** from the **Mechanical Engineering Technical University of Greece** along with a **Diploma** in **Management & Production Engineering** from the **Technical University of Crete**. Further, he is a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), a **Certified Project Manager Professional** (**PMI-PMP**), a **Certified Instructor/Trainer**, a **Certified Energy Auditor** for **Buildings**, **Heating & Climate Systems**, a **Member** of the **Hellenic Valuation Institute** and the **Association of Greek Valuers** and a **Licensed Expert Valuer Consultant** of the **Ministry of Development and Competitiveness**. He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

Course Fee

Doha	**US$ 5,500** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Al Khobar	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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	***PRE-TEST***
0830 – 0930	***Introduction to CBM*** *Problem Solving Process – Root Cause Analysis • RCA Techniques • Maintain • Breakdown Maintenance • Fixed Time/Regular Preventive • Design-Out Maintenance • Condition Based Maintenance*
0930 – 0945	*Break*
0945 – 1100	***Condition Monitoring*** *Paper Based Systems • Hard Wired Sensors • Portable Data Collectors • Integrated CBM • Systematic Application of CM*
1100 – 1215	***Implementing a CBM Program*** *Machine Life Cycles • Warning and Alarm Levels • Monitoring Frequency • System Set-Up*
1215 – 1230	*Break*
1230 – 1420	***Implementing a CBM Program (cont'd)*** *Monitored Parameters • Frequency of Monitoring • Location of Measurement Points*
1420 – 1430	***Recap*** *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	***Monitored Parameters*** *Tactile, Visual and Actual Monitoring • Thermal Monitoring • Lubricant Monitoring • Leak Detection • Corrosion monitoring • Performance Monitoring • Vibration Monitoring • Interpretation of Data According to Data Type*
0930 – 0945	*Break*
0945 – 1100	***Parameter Symptom Limits*** *The Role of Symptom Limits • The Bases for Symptom Limit Setting • The Accuracy of Conventionally Set Symptom Limits • Statistical Process Control Ideas • Achievable Improvements in Accuracy • Adaptive Variations*
1100 – 1215	***Thermal Monitoring*** *Ways of Monitoring Temperature • Sensitivities and Symptom Masking*
1215 – 1230	*Break*
1230 – 1420	***Thermal Monitoring (cont'd)*** *Fault Detection Capability*
1420 – 1430	***Recap*** *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	***Lubricant Monitoring*** *Sources of Wear Debris • The Distinction Between Amount, Size, Shape and Chemical Breakdown • The Condition of The Lubricant Itself*
0930 – 0945	*Break*
0945 – 1100	***Lubricant Monitoring (cont'd)*** *Monitoring and Analysis Techniques • Spectrographic, Spectrometric and Ferrographic Measurements*
1100 – 1215	***Vibration Monitoring*** *Components of a Signal • Vibration Transducers • Overall and Spectral Vibration*
1215 – 1230	*Break*
1230 – 1420	***Vibration Monitoring (cont'd)*** *Monitoring Point Location and Transducer Mounting • Common Fault Symptoms*
1420 – 1430	***Recap*** *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*

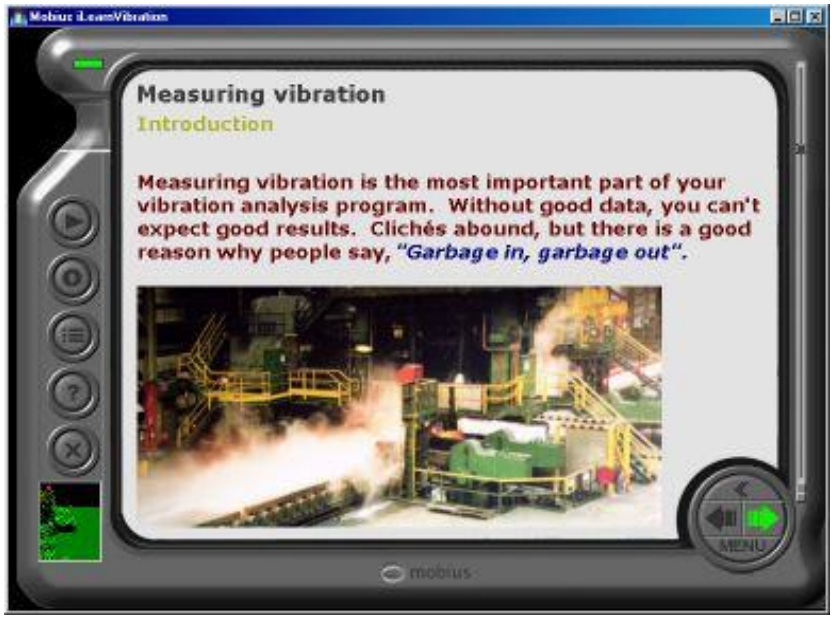
Day 4

0730 – 0930	***Vibration Symptoms*** *Machine Faults and The Frequency Range of Symptoms • Shaft-Related Faults-Looseness, Misalignment and Imbalance*
0930 – 0945	*Break*
0945 – 1100	***Vibration Symptoms (cont'd)*** *Gearbox Faults – Localised Faults and Distributed Faults • Rolling Element Bearing Faults – Impact Excited Resonance*

1100 – 1215	***Fault Detection*** *Vibration Level Classification • ISO Standards • Peak and rms Levels • Dynamic Range*
1215 – 1230	*Break*
1230 – 1345	***Fault Detection (cont'd)*** *Use Of FFT Analysers • Constant Percentage Bandwidth Spectra*
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 our state-of-the-art simulator "iLearnVibration".



iLearnVibration

Course Coordinator

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