COURSE OVERVIEW RE0613-4D
Preventing Maintenance & Condition Monitoring

Course Title
Preventing Maintenance & Condition Monitoring

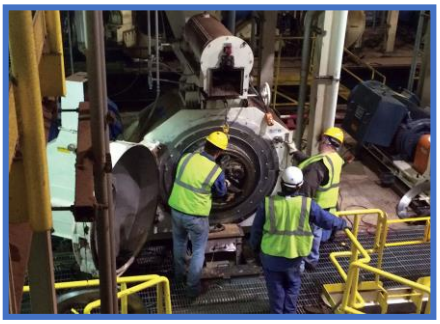
Course Reference
RE0613-4D

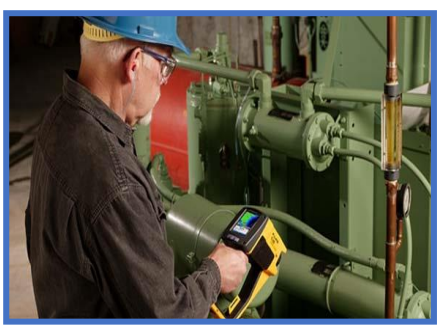
Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	February 05-08, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, KSA
2	May 06-09, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
3	August 19-22, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
4	October 07-10, 2024	Boardroom, Warwick Hotel Doha, Doha, Qatar

Course Description





This practical and highly-interactive course includes practical sessions and exercises. Theory learnt will be applied using the iLearn Vibration simulator.

Preventive maintenance and condition monitoring techniques provide data that define required servicing and inspection periods so that maintenance departments can determine in advance when equipment must be shutdown for overhaul. Statistics are proving that these programs, when properly implemented, can minimize equipment and system breakdowns, resulting in a major reduction in total maintenance and operating costs.

This course covers all facets of preventive maintenance and condition monitoring. It is designed to benefit every level of maintenance personnel, providing the most up-to-date facts and techniques on the maintenance technology that is revolutionizing the way our industry operates. It examines the importance of preventive maintenance in a "World Class Maintenance" environment.

The course is designed to provide an insight into condition monitoring (CM). It will cover the various methods of maintenance and it will give the participant an introduction to the techniques utilized in condition monitoring such as noise & vibration measurement, infrared thermography, oil debris analysis, laser alignment and balancing, vibration and engine analysers, borescope inspection and lube oil sampling.

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 an in-depth knowledge on preventive maintenance and condition monitoring
- Perform preventive maintenance and monitor condition using vibration and engine analyzers, boroscope inspection and lube oil sampling
- Recognize the world-class aspects of maintenance today through the various types of maintenance including maintenance strategy, business model, maintenance organization, R&M policy and productive maintenance
- Carryout machinery diagnostic testing including inspection, test plan development, data acquisition, processing and interpretation, conclusions, recommendations and corrective action plan
- Discuss the principles of risk-based inspection, root cause analysis and reliability centered maintenance
- Review and improve preventive maintenance for lubrication including its storage, handling and oil analysis methodology
- Acquire knowledge on time-based and dynamic-based preventive maintenance
- Recognize the various types of condition-based monitoring predictive maintenance
- Implement condition monitoring program and explain monitored parameters and parameter symptom limits
- Employ proper thermal monitoring, vibration monitoring and engine analyzers
- Determine vibration symptoms and fault detection as well as recognize specialized equipment support

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 preventive maintenance and condition monitoring for mechanical maintenance technicians.

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

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.
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.

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:

Dr. Tony Dimitry, PhD, MSc, BSc, is a **Senior Mechanical Maintenance Engineer** with over **30 years** of industrial experience. His expertise covers **Maintenance** Management (**Preventive**, **Predictive**, **Breakdown**), **Reliability** Management, **Maintenance Auditing & Benchmarking**, **Condition-Based** Monitoring, **Rotating Equipment**, **Rotating Equipment** Maintenance & Failure Analysis, **Shutdowns & Turnarounds** Management, Machinery Diagnostics & Root Cause Failure Analysis (**RCFA**), Total Plant Reliability Centered Maintenance (**RCM**), **Maintenance & Reliability** Best Practices, Principles & Practice of **Predictive** Maintenance, **Preventive & Predictive** Maintenance, **Vibration & Conditional** Monitoring, **Process Plant** Shutdown, Turnaround & Troubleshooting, **Machinery Failure** Analysis, **Mechanical Vibration** Measurement, Monitoring, Analysis & Balancing, **RCFA & Diagnostics**, Lowering Life Cycle Cost of Equipment, Performance Calculation for **Rotating Engines**, Planning & Managing **Plant Turnaround**, **Failure Analysis** Methodologies, Electromechanical Maintenance, **Vibration** Analysis, **Heat Exchanger**, **Gas Turbine**, **Siemens Steam Turbine** Maintenance, **Electromechanical** Maintenance, **Machinery Alignment**, **Lubrication** Technology, **Blower & Fan**, **Shaft Repair**, **Bearings**, **Safety Relief Valves**, **Pipelines**, **Piping Vibration** Analysis, **Pressure Vessels**, **Dry Gas Seal**, **Process Equipment**, **Diesel Engine & Crane** Maintenance, **Tanks & Tank Farms**, **Pneumatic** System, **Static Equipment**, **Failure Analysis**, **FMEA**, **Corrosion**, **Metallurgy**, Planning, Scheduling, Cost Control, Preventive and Predictive Maintenance. Currently, he is the **Maintenance Manager** of the PPC Incorporation wherein he is responsible for the maintenance and upgrade of all plant components, monitoring the thermal stresses and the remaining life of steam pipes, turbine casing, mills, fans and pumps. He is in-charge of the metallurgical failure analysis and the usage of fracture mechanics for determining crack propagation in impellers of turbines, assessing all alterations and developments for upgrading the plant.

During his career life, Dr. Dimitry was a **Senior Engineer** in **Chloride Silent** (**UK**) wherein he was responsible for the mechanical, thermal and electrical modelling of battery problems for electric vehicles and satellites as well as an **Operations Engineer** of the **National Nuclear Corporation** (**UK**) wherein he was responsible for the optimization of the plant. Prior to this, he was a **Professor** at the **Technical University of Crete** and an Assistant **Professor** of the **University of Manchester** (**UK**).

Dr. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **University of Manchester**, **UK**. Further, he is an active member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**). He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

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	***Maintenance Excellence & World Class Maintenance*** *Framework for Maintenance Excellence ● Overall Philosophy ● Maintenance Principles ● Work Environment ● Equipment ● Information Systems ● Elements for Effective Maintenance ● Establishing the Environment for Improvement ● Types of Maintenance ● Maintenance Strategy Development ● Productive Maintenance ● Maintenance Methods Compared ● What Type of Maintenance is Your Plant Doing?*
0930 – 0945	*Break*
0945 – 1030	***Failure Analysis Methodologies for Mechanical Engineers*** *Understand the Nature of Failures ● Types of Equipment Failures ● Failure Classifications & Failure Patterns ● Why Equipment Fails ● Failure Analysis & Root Cause ● How Does Most of Your Equipment Fail?*
1030 – 1130	***Machinery Diagnostic Testing*** *Diagnostic Objectives ● Mechanical Inspection ● Test Plan Development ● Data Acquisition and Processing ● Data Interpretation ● Conclusions and Recommendations ● Corrective Action Plan*
1130 - 1230	***Principles of RBI (Risk Based Inspection)*** *RBI & API 580/581 ● Basic Concepts ● Planning the RBI Assessment ● Data & Information Collection for RBI Assessment ● Identifying Deterioration Mechanisms & Failure Modes ● Assembling Probability of Failure ● Assessing Consequences of Failure ● Risk Determination, Assessment & Management ● Risk Management with Inspection Activities ● Other Risk Mitigation Activities ● Reassessment & Updating RBI Assessments ● Roles, Responsibilities, Training & Qualifications ● RBI Documentation & Record Keeping*
1230 – 1245	*Break*
1245 – 1420	***Principles of RCA (Root Cause Analysis)*** *The Three Levels of Root Cause – Physical, Human & Latent Causes ● General Principles of RCA ● Steps for Root Cause Failure Analysis – Reporting an Incident or Problem ● Scoping ● Appoint the RCA Team ● Defining the Problem ● Collection of Data • Data Analysis ●Total Productive Maintenance ● Program Development Master Plan ● A Chart for Autonomous Maintenance ● Training Skill Development Matrix ● Big Losses ● Overall Equipment Effectiveness (OEE) ● Total Effective Equipment Performance • Direct Benefits of TPM ● Indirect Benefits of TPM ● Difficulties Faced in TPM Implementation ●The Cost of Implementing TP ● Conclusion*
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 – 0830	***Principles of RCM (Reliability Centered Maintenance)*** *What is RCM ● What you Should Expect from RCM ● Who Should Do RCM? ● Which Maintenance is the Most Effective? ● Ways of Measuring Maintenance Effectiveness ● Selecting Maintenance Significant Items (MSI'S) for RCM Analysis; a Structured Decision Process ● Risk Quantification and the Risk Matrix ● Reliability & Maintainability ● The Failure Process–RCM Theory ● Maintenance Tasks ● RCM–The Analytical Decision Logic ● Modification Control ● Maintenance Implementation Strategies ● RCM Audits and Assessments*
0830 - 0930	***Preventive Maintenance-Lubrication*** *Cost of Poor Lubrication ● Fundamentals-Oil & Grease ● Storage & Handling Methods ● Oil Analysis ● Organization ● Comparative Viscosity ● Classifications*
0930 – 0945	*Break*
0945 – 1100	***Preventive Maintenance (Time-Based/Dynamic-Based)*** *General Philosophy ● Upside ● Downside ● CLAIR Activities*
1100 - 1230	***Predictive Maintenance & Condition Monitoring*** *Types of Condition Based Monitoring ● Vibration Monitoring ● Pump Monitoring Frequency ● Infrared Thermography ● Physical Effects Monitoring ● Lube Oil Analysis ● What Kinds of Monitoring are Being Used Today? ● Has the Monitoring Program Been Effective? ● Is the Monitoring Schedule Being Adhered to?*
1230 – 1245	*Break*
1245 – 1420	***Condition Monitoring*** *Paper Based Systems ● Hard Wired Sensors ● Portable Data Collectors ● Integrated CBM • Systematic Application of Condition Monitoring*
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 – 0830	***Implementing a Condition Monitoring Program*** *Machine Life Cycles • Warning & Alarm Levels • Monitoring Frequency • System Set-Up • Monitored Parameters • Frequency of Monitoring • Location of Measurement Points*
0830 - 0930	***Monitored Parameters*** *Tactile, Visual & Actual Monitoring ● Thermal Monitoring ● Lubricant Monitoring ● Leak Detection ● Corrosion Monitoring ● Performance Monitoring ● Vibration Monitoring ● Interpretation of Data According to Data Type*
0930 – 0945	*Break*

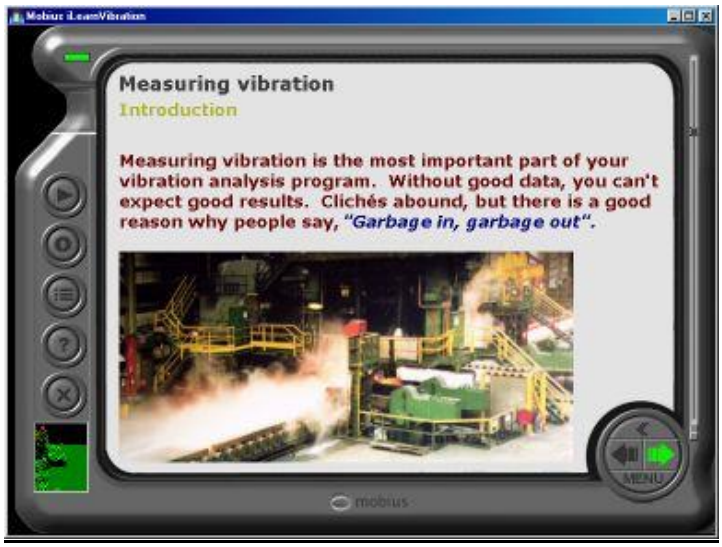
0945 – 1100	***Parameter Symptom Limits*** *The Role of Symptom Limits ● The Bases for Symptom Limit Setting ● The Accuracy of Conventionally Set Symptom Limits ● Statistical Process Control Ideas ● Achievable Improvements in Accuracy ● Adaptive Variations*
1100 - 1230	***Thermal Monitoring*** *Ways of Monitoring Temperature • Sensitivities and Symptom Masking • Fault Detection Capability*
1230 – 1245	*Break*
1245 – 1420	***Lubricant Monitoring & Lube Oil Sampling*** *Lube Oil Sampling ● Sources of Wear Debris ●The Distinction Between Amount, Size, Shape and Chemical Breakdown ● The Condition of the Lubricant Itself ● Monitoring & Analysis Techniques ● Spectrographic, Spectrometric and Ferrographic Measurements*
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 Monitoring & Engine Analyzers*** *Components of a Signal ● Vibration Transducers ● Overall and Spectral Vibration ● Monitoring Point Location and Transducer Mounting ● Common Fault Symptoms ● Engine Analyzers*
0930 – 0945	*Break*
0945 – 1100	***Vibration Symptoms*** *Machine Faults and The Frequency Range of Symptoms ● Shaft-Related Faults-Looseness, Misalignment and Imbalance ● Gearbox Faults – Localised Faults and Distributed Faults ● Rolling Element Bearing Faults – Impact Excited Resonance*
1100 – 1230	***Fault Detection*** *Vibration Level Classification ● ISO Standards ● Peak and RMS Levels ● Dynamic Range ● Use of FFT Analysers ● Constant Percentage Bandwidth Spectra*
1230 – 1245	*Break*
1245 – 1345	***Boroscope Inspection*** *Boroscope Monitoring ● Inspection Tools ● Frequency ● Results*
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 state-of-the-art simulator "iLearnVibration".



iLearnVibration Simulator

Course Coordinator

Kamel Ghanem, Tel: +971 2 30 91 714, Email: kamel@haward.org