

COURSE OVERVIEW RE0030-4D
Rotating Equipment Reliability Optimization

Course Title

Rotating Equipment Reliability Optimization

Course Date/Venue

October 14-17, 2024/Club B Meeting Room,
 Ramada Plaza by Wyndham Istanbul City
 Center, Istanbul, Turkey

Course Reference

RE0030-4D

Course Duration/Credits

Four days/2.4 CEUs/24 PDHs



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.

The problem of reliability allocation and optimization of Rotating Equipment has been widely investigated by world-class process companies during the last decade. Instead of concentrating exclusively on redundancy allocation as per the old fashion maintenance, the minimum required reliability for each component of the equipment are now estimated in order to achieve the equipment reliability goal with minimum cost. Thereafter, the engineer can decide whether this minimum required component reliability will be achieved via fault avoidance or redundancy. This new philosophy allocates reliability to a component according to the cost of increasing its reliability.

Continuous improvement of plant reliability by optimizing predictive maintenance for rotating equipment is one of the most important challenges plants face today. To know how to effectively prevent equipment failures, conduct a successful root cause failure analysis and improve condition monitoring for pumps, turbines and compressors are continuing challenges for engineers. Proper analysis and solving of chronic problems at the source saves time and money.

This course is designed to explain the effective method of component condition monitoring for use as both a predictive maintenance and root cause analysis tool. It also details the major failure causes, the world-class proven root cause analysis procedure with exercises and case histories, installation, pre-commissioning planning, functional testing and commissioning, preventive maintenance strategies and more.

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

The course will concentrate on the problems and solutions surrounding equipment failures, diagnostics and effective methods to prevent them. This results in more efficient plant maintenance, increased operational efficiency, lower operating costs and improved plant availability. Upon the successful completion of this course, each participant will be able to: -

- Apply an in-depth knowledge on rotating equipment reliability optimization and recognize the concept of organizing for world class operations particularly the characteristics and steps used toward pacesetter performance
- Review equipment failure patterns and maintenance affect on reliability and discern how maintenance influences equipment performance
- Optimize equipment maintenance and replacement decisions through CCM and PDM
- Recognize the principle of predictive maintenance, employ the various predictive maintenance and component condition monitoring techniques and determine its importance in rotating equipment reliability optimization and continuous improvement
- Carryout the concept of optimizing reliability particularly condition monitoring and predictive maintenance and identify its components and importance
- Illustrate root cause failure analysis (RCFA) by identifying its step by step process
- Perform site reliability assessment in order to identify targets for improvement and prepare site reliability optimization plan
- Discuss in detail rotating reliability assurance and carryout machinery installation as per the guidelines
- Identify pipe stress and soft foot effects on component failures, the effects of misalignment on reliability and conversion to metric system

Who Should Attend

This course covers systematic techniques and methodologies on equipment reliability and optimization and continuous improvement for managers, section heads and planners as well as maintenance, reliability, machinery, plant, PMV and operations engineers and other technical staff.

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\$ 5,000 per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), 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 **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.

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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. Rod Larmour (UK), PEng, MSc, BSc, is a **Senior Mechanical Engineer** with over **40 years** of **Onshore & Offshore** practical experience within the **Power, Petrochemical, Oil & Gas** industries. His expertise greatly covers the application of **Rotating Machinery, Mechanical Alignment, Stress Analysis, Thermodynamics, Fluid Mechanics, Heat & Mass Transfer Engineering, Air Conditioning & Refrigeration Technology, Cooling Towers, Gas & Steam Turbines, Centrifugal Compressor & Pumps** and the **design, failure investigation, and maintenance of Atmospheric Storage Tanks & Tank Farms and Bolted Flanges & Joints.**

Currently, Mr. Larmour is working with Transnet overseeing the performance and safety of several **fuel pipelines** including **pumping stations** and **inland tank farms** locally. He also takes lead in the **planning** of detailed design of a **fuel gas supply system** from a site to the **proposed new power station**, the **management** of an **EPC booster gas compressor station** including an **overland piping**, and **spearheads** the **commercial & contractual management** within the **Ilitha Process Group.**

Throughout Mr. Larmour's lengthy career, he has worked with **several international companies** like **Mobil, Mossgas, Stewarts & Lloyds** and **Ilitha** with prime positions such as **Operations Manager, Principal Project Manager, Senior Mechanical Engineer, Offshore Projects Manager, Design Manager, Quality Assurance Manager** and **Project Engineer.**

Mr. Larmour's experience was not only confined to the industry alone. He was also able to largely contribute his expertise and impart his knowledge in the academe. He has engaged himself with **researches** and **lectures** in for several **universities** and **companies** and has held numerous **training courses** on **Thermomechanics & Fluid mechanics, Engineering Design, Refrigeration & Air Conditioning** and **Heat Transfer.**

Mr. Larmour is **Registered Professional Engineer** and has **Master & Bachelor** degrees in **Mechanical Engineering** and has a **Diploma in Nuclear Science.**

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, 14th of October 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Reliability Overview Introduction • The End User's Objectives • Reliability Terms & Definitions • Optimizing Reliability
0930 – 0945	Break
0945 – 1100	The Major Causes of Machinery Failure Rotating Equipment does not Fail Randomly • The Major Causes of Machinery Failure – Failure Classifications • Summary



1100 – 1230	How to Prevent Machinery Failures Introduction • Component Function Awareness – ‘What should it Do?’ • Component Condition Monitoring – ‘What is it Doing?’ • Preventive (PM) and Predictive Maintenance (PDM) • Troubleshooting • Reliability, Everyone’s Responsibility
1230 – 1245	Break
1245 – 1420	Optimizing Equipment Maintenance & Replacement Decisions Through CCM & PDM (Component Condition Monitoring & Predictive Maintenance) The Major Machinery Components • Component Condition Monitoring • Predictive Maintenance (PDM) Techniques
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2: Tuesday, 15th of October 2024

0730 – 0930	Effective Predictive Maintenance (Including Root Cause Analysis Techniques) Introduction • Troubleshooting Procedure Overview • Initial Fact Finding • Thorough Knowledge of Equipment, Component and System Functions • Defining Abnormal Conditions • Listing All Possible Causes • Eliminating Causes Not Related to the Problem • State Root Causes of the Problem • Develop an Action Plan to Eliminate Root Cause
0930 – 0945	Break
0945 – 1100	Root Cause Analysis Example Problem Introduction • Example Case History • Answers and Comments for the Example Case History
1100 – 1230	Root Cause Analysis Techniques (Improving Component Function Knowledge Base) Introduction • Component Function • Component Failure Causes • Component Condition Monitoring • Examples of Knowledge Base Enhancement
1230 – 1245	Break
1245 – 1420	Site Reliability Assessment Site Reliability Audit Form • Reduction of Data • Identifying Targets for Improvement • Forms and Worksheets
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3: Wednesday, 16th of October 2024

0730 – 0930	Preparing a Site Reliability Optimization Plan Introduction • Identifying Opportunities for Optimization • Determine the Root Cause of Each Identified Opportunity
0930 – 0945	Break
0945 – 1100	Preparing a Site Reliability Optimization Plan (cont’d) Establish Steps to Prevent Re-Occurrence of Problems • Setting Up an Effective Multi Disciplined Site Reliability Initiative • Obtain and Maintain Management Support • How to Maintain Continuous Improvement of the Established Program
1100 – 1230	Rotating Equipment Reliability Assurance Introduction • The Pre-FEED Phase • The Specification and ITB Phase • Pre-Bid Activity and Degree of Audits • Bid Evaluations • Pre-Award



	Meeting • The Coordination Meeting • Design and Manufacturing Audits • Document Review • Testing Phase
1230 – 1245	Break
1245 – 1420	Machinery Installation Guidelines Introduction • Site Procedures • Foundations • Piping • Shaft Alignment • Couplings • Cleaning of Equipment and Associated Pipe • Final Inspection and Start-Up Checks • First Start, Run In and Initial Operation
1420 – 1430	Recap
1430	Lunch & End of Day Three

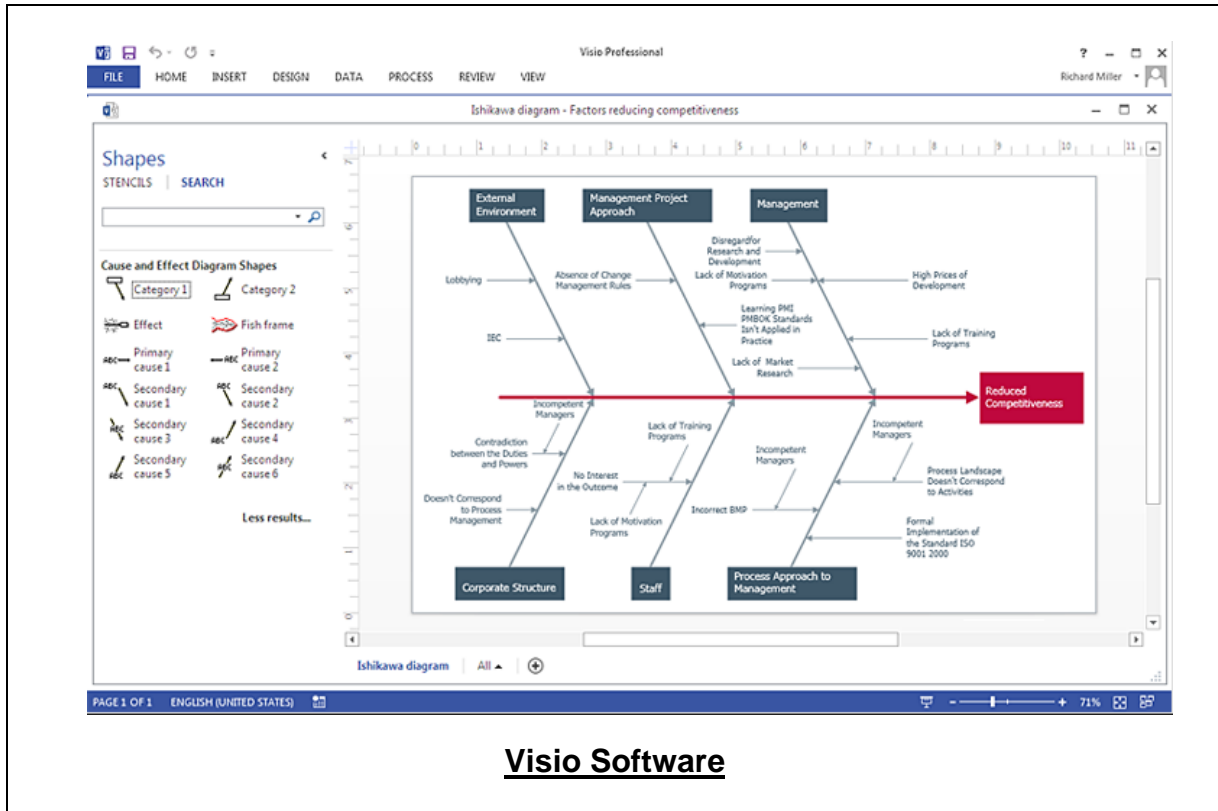
Day 4: Thursday, 17th of October 2024

0730 – 0930	Pipe Stress & Soft Foot Effects on Component Failure Introduction • How Pipe Stress and Soft Foot Can Cause Component Failure • The Root Causes of Excessive Pipe Stress and Soft Foot • Condition Monitoring Indications of Excessive Pipe Stress and Soft Foot
0930 – 0945	Break
0945 – 1100	Pipe Stress & Soft Foot Effects on Component Failure (cont'd) Confirming Excessive Pipe Stress and/or Foundation Forces (Soft Foot) • Correcting Excessive Pipe Stress and Foundation Forces on Equipment • Implementation of the Action Plan
1100 – 1230	The Effects of Misalignment on Reliability Introduction • Why Misalignment Reduces Rotating Equipment Reliability
1230 – 1245	Break
1245 – 1345	The Effects of Misalignment on Reliability (cont'd) How Misalignment Effects Can Be Detected • Alignment Methods and Guidelines
1345 – 1400	Course Conclusion
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 simulators “Visio Software”, “Mindview Software” and “iLearnVibration.





The screenshot displays the Mindview Software interface. At the top, a 'Map View' window shows a complex mind map with nodes for 'Assessment', 'Planning', 'Measurement', and 'Monitoring'. Below this, a 'Word' window is open, showing a document titled 'PROBLEM SOLVING' with a table of contents and a 'Planning' section. The 'Mind map' label is positioned to the right of the Word window.

Mindview Software

The screenshot shows the IQRAS software interface. On the left, a tree view displays system components like 'Airplane: Airplane', 'Engine System', 'Fuel System', 'Propeller', 'Wings System', 'Avionics', and 'Wheels'. The main window displays a fault tree diagram with nodes for 'ESD', 'COBRA', 'SUPTER', and 'HARD'. A 'IQRAS Results View' window is open, showing a graph of 'CDF' vs 'Parameter' and a 'STATISTIC VALUE' table.

STATISTIC	VALUE
Mean	0.3501
1st	0.163
5th	0.2352
10th	0.2544
50th	0.3513
90th	0.4439
95th	0.469
99th	0.5157





iLearnVibration Simulator

Book(s)

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

	<p>Title : Engineers' Guide to Rotating Equipment: The Pocket Reference ISBN : 9781860583445 Author : Clifford Matthews Publisher : Wiley</p>
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Course Coordinator

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