COURSE OVERVIEW RE0030
Rotating Equipment Reliability Optimization

Course Title
Rotating Equipment Reliability Optimization

Course Date/Venue
Session 1: February 18-22, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
Session 2: March 03-07, 2024/ Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey

Course Reference
RE0030

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes practical session s 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

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 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.

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 **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.

- 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, 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**. Further, he is a **Certified Instructor/Trainer**.

Course Fee

Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** 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.

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

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?'*
1230 – 1245	*Break*
1245 – 1420	***How to Prevent Machinery Failures (cont'd)*** *Preventive (PM) and Predictive Maintenance (PDM) • Troubleshooting • Reliability, Everyone's Responsibility*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Optimizing Equipment Maintenance & Replacement Decisions Through CCM & PDM (Component Condition Monitoring & Predictive Maintenance)*** *The Major Machinery Components • Component Condition Monitoring • Predictive Maintenance (PDM) Techniques*

0930 – 0945	*Break*
0945 – 1100	***Effective Predictive Maintenance (Including Root Cause Analysis Techniques)*** *Introduction • Troubleshooting Procedure Overview • Initial Fact Finding • Thorough Knowledge of Equipment, Component and System Functions*
1100 – 1230	***Effective Predictive Maintenance (Including Root Cause Analysis Techniques) (cont'd)*** *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*
1230 – 1245	*Break*
1245 – 1420	***Root Cause Analysis Example Problem*** *Introduction • Example Case History • Answers and Comments for the Example Case History*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Root Cause Analysis Techniques (Improving Component Function Knowledge Base)*** *Introduction • Component Function • Component Failure Causes • Component Condition Monitoring • Examples of Knowledge Base Enhancement*
0930 – 0945	*Break*
0945 – 1100	***Site Reliability Assessment*** *Site Reliability Audit Form • Reduction of Data • Identifying Targets for Improvement • Forms and Worksheets*
1100 – 1230	***Preparing a Site Reliability Optimization Plan*** *Introduction • Identifying Opportunities for Optimization • Determine the Root Cause of Each Identified Opportunity*
1230 – 1245	*Break*
1245 – 1420	***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*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Rotating Equipment Reliability Assurance*** *Introduction • The Pre-FEED Phase • The Specification and ITB Phase • Pre-Bid Activity and Degree of Audits • Bid Evaluations*
0930 – 0945	*Break*
0945 – 1100	***Rotating Equipment Reliability Assurance (cont'd)*** *Pre-Award Meeting • The Coordination Meeting • Design and Manufacturing Audits • Document Review • Testing Phase*
1100 – 1230	***Machinery Installation Guidelines*** *Introduction • Site Procedures • Foundations • Piping • Shaft Alignment*

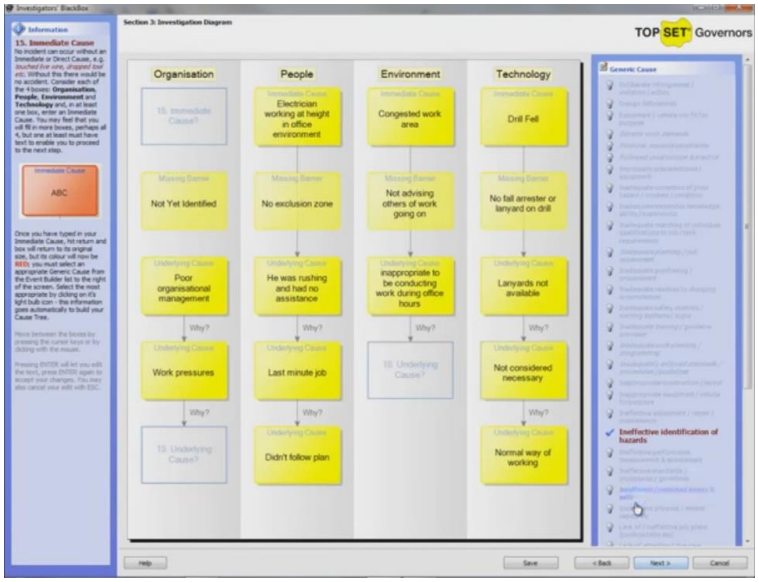
1230 – 1245	*Break*
1245 – 1420	***Machinery Installation Guidelines (cont'd)*** *Couplings • Cleaning of Equipment and Associated Pipe • Final Inspection and Start-Up Checks • First Start, Run In and Initial Operation*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

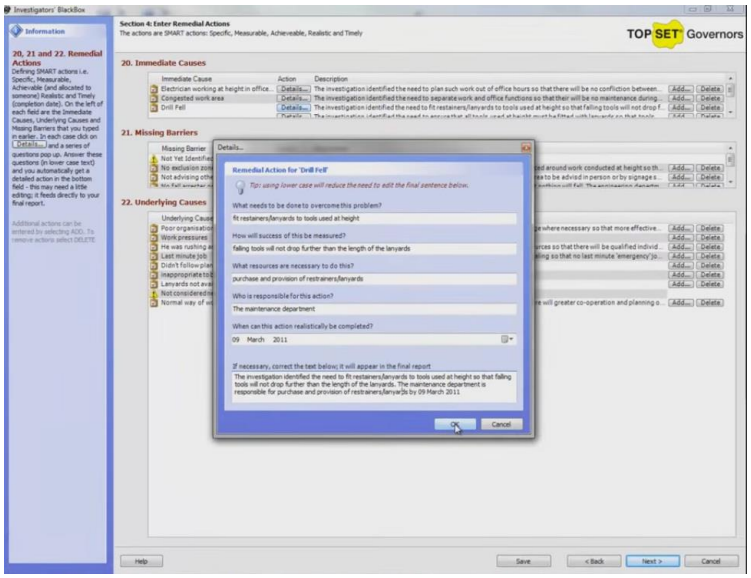
Day 5

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 “BlackBox” and “iLearnVibration” simulators.



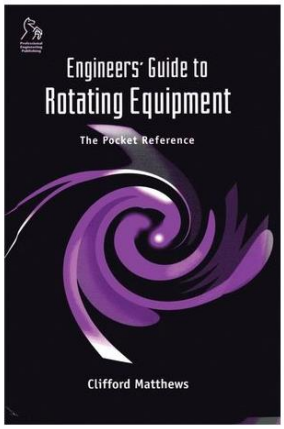


BlackBox Software Tool

iLearnVibration Simulator

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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