COURSE OVERVIEW ME1151
Failure Analysis of Pump Mechanical Seals

Course Title
Failure Analysis of Pump Mechanical Seals

Course Reference
ME1151

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

Course Date/Venue

Session(s)	Date	Venue
1	June 22-26, 2025	Safir Meeting Room, Divan Istanbul, Turkey
2	August 25-29, 2025	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
3	October 26-30, 2025	Crowne Meeting Room, Crowne Plaza Al Khobar, KSA
4	December 14-18, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai UAE

Course Description

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

This course is designed to provide participants with a detailed and up-to-date overview of Failure Analysis of Pump Mechanical Seals. It covers the importance of seals in pump operation and the types of mechanical seals; the components of pump mechanical seals, basic pump seal failure mechanisms and seal selection criteria; the pump seal standards and codes, seal installation and alignment and handling seal components to avoid damage; and the causes and consequences of dry running, preventive measures and monitoring techniques.

Further, the course will also discuss the excessive temperature, seal face wear, contamination and chemical attack; the impact of vibration on mechanical seals, effects of pump misalignment on seal integrity and the importance of proper shaft and bearing alignment; the improper seal face pressure and visual inspection techniques; and documentation of failure symptoms and the use of magnification tools for close inspection.

During this interactive course, participants will learn the microscopic and surface analysis, chemical and material testing, thermal imaging for heat detection and performance data analysis; the failure mode and effect analysis (FMEA), seal maintenance best practices, seal repair procedures and seal replacement guidelines; upgrading pump seal technology and cost analysis of seal failures; the seal failure prevention program and the future trends in pump mechanical seals; and the role of AI and automation in seal monitoring.

Course Objectives

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

- Apply and gain an in-depth knowledge on failure analysis of pump mechanical seals
- Discuss the importance of seals in pump operation and the types of mechanical seals
- Identify the components of pump mechanical seals, basic pump seal failure mechanisms and seal selection criteria
- Employ pump seal standards and codes and apply seal installation and alignment and handling seal components to avoid damage
- Recognize the causes and consequences of dry running and apply preventive measures and monitoring techniques
- Determine excessive temperature, seal face wear, contamination and chemical attack
- Discuss the impact of vibration on mechanical seals, effects of pump misalignment on seal integrity and the importance of proper shaft and bearing alignment
- Identify improper seal face pressure and apply visual inspection techniques, documentation of failure symptoms and the use of magnification tools for close inspection
- Carryout microscopic and surface analysis, chemical and material testing, thermal imaging for heat detection and performance data analysis
- Employ failure mode and effect analysis (FMEA), seal maintenance best practices, seal repair procedures and seal replacement guidelines
- Upgrade pump seal technology, apply cost analysis of seal failures and create a seal failure prevention program
- Discuss the future trends in pump mechanical seals and the role of AI and automation in seal monitoring

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 failure analysis of pump mechanical seals for mechanical engineers, maintenance and reliability engineers, rotating equipment engineers, plant engineers and technicians, operations and production personnel, failure analysis specialists, condition monitoring and vibration analysts, seal and pump vendors or OEM representatives, asset integrity and reliability managers.

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

Haward's Certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

- 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.

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 Engineer** with over **30 years** of industrial experience. His expertise covers **Pumps, Compressors, Turbines & Troubleshooting**, **Centrifugal Pumps**, Maintenance of **Gas Compressors**, **Compressor & Steam Turbine**, **Pressure Safety Relief Valve** Repair & Recalibration, **PSV/PRV** Troubleshooting, **PRV** Testing & Repair, **Valve** Testing & Inspection, **Valve** Sealing, **Valve** Calibration, **Process Equipment**, **Vibration Analysis**, **Heat Exchanger**, **Siemens Steam Turbine Maintenance**, **Electromechanical Maintenance**, **Machinery Alignment**, **Lubrication Technology**, **Compressors**, **HVAC & Refrigeration Systems**, **Piping System**, **Blower & Fan**, **Shaft Repair**, **Control Valve & Actuator**, **Safety Relief Valves**, **Pipelines**, **Piping Vibration Analysis**, **Pressure Vessels**, **Dry Gas Seal**, **Process Equipment**, **Diesel Engine & Crane Maintenance**, **Maintenance Management** (**Preventive**, **Predictive**, **Breakdown**), **Reliability Management**, **Condition-Based Monitoring**, **Rotating Equipment**, **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 **Victory University of Manchester** and the **University of Newcastle**, **UK** respectively. Further, he is a **Certified Instructor/Trainer,** a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an associate member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**). He has further delivered various trainings, seminars, courses, workshops and conferences internationally.

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 Fee

Istanbul	**US$ 6,000** 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$ 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.
Al Khobar	**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.
Dubai	**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.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop 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	***Understanding Pump Seals*** *Definition and Role of Mechanical Seals • Importance of Seals in Pump Operation • Types of Mechanical Seals (e.g., Single, Double, Cartridge) • Applications in Various Industries*
0930 – 0945	*Break*

0945 – 1030	***Components of Pump Mechanical Seals*** *Primary Sealing Elements (Faces, Springs) • Secondary Sealing Elements (O-Rings, Gaskets) • Seal Housing and Its Function • Auxiliary Components (Flush Systems, Pressure Relief Valves)*
1030 – 1130	***Basic Pump Seal Failure Mechanisms*** *Wear and Abrasion • Corrosion and Chemical Degradation • Thermal Distortion • Improper Lubrication*
1130 – 1215	***Seal Selection Criteria*** *Pump Operating Conditions (Pressure, Temperature) • Fluid Characteristics (Viscosity, Corrosiveness) • Environmental Factors (Dust, Vibration) • Material Selection (Metallic, Ceramic, Carbon)*
1215 – 1230	*Break*
1230 – 1330	***Pump Seal Standards & Codes*** *ANSI/ASME Seal Standards • API and ISO Standards for Mechanical Seals • Industry-Specific Standards (e.g., FDA, GMP) • Importance of Compliance for Safety and Efficiency*
1330 – 1420	***Seal Installation & Alignment*** *Best Practices for Proper Installation • Tools and Equipment for Seal Alignment • Handling Seal Components to Avoid Damage • Impact of Improper Installation on Seal Performance*
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	***Dry Running & Lack of Lubrication*** *Causes and Consequences of Dry Running • Role of the Seal's Lubricating Fluid • Preventive Measures and Monitoring Techniques • Seal Failure Due to Insufficient Lubrication*
0830 - 0930	***Excessive Temperature*** *Thermal Expansion and Its Effect on Seals • Temperature Limits for Various Materials • Cooling Methods to Prevent Overheating • Effects of Hot and Cold Shock on Seals*
0930 – 0945	*Break*
0945 – 1100	***Seal Face Wear*** *Causes of Face Wear (Abrasion, Thermal Stress) • Wear Rate and Its Impact on Seal Longevity • Detecting Early Signs of Wear • Preventive Measures to Reduce Wear*
1100 – 1215	***Contamination & Chemical Attack*** *Types of Contaminants (Dust, Particles, Chemical Agents) • Effects of Chemical Attack on Seal Materials • Preventing Contamination (Cleaning Procedures, Filtration) • Seal Materials Resistant to Chemical Degradation*
1215 – 1230	*Break*
1230 – 1330	***Vibration & Misalignment*** *Impact of Vibration on Mechanical Seals • Effects of Pump Misalignment on Seal Integrity • Identifying and Addressing Vibration Sources • Importance of Proper Shaft and Bearing Alignment*

1330 – 1420	***Improper Seal Face Pressure*** *Importance of Correct Face Pressure in Sealing Performance • Consequences of High or Low Face Pressure • Calculating Optimal Face Pressure • Adjusting Face Pressure During Operation*
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	***Visual Inspection & Diagnosis*** *Techniques for Visual Inspection of Seals • Common Failure Signs Visible During Inspection • Documentation of Failure Symptoms • Use of Magnification Tools for Close Inspection*
0830 – 0930	***Microscopic & Surface Analysis*** *Using a Microscope to Examine Seal Faces • Analyzing Wear Patterns (Scratching, Pitting, Grooving) • Techniques for Measuring Surface Roughness • Role of Scanning Electron Microscopy (SEM)*
0930 – 0945	*Break*
0945 – 1100	***Chemical & Material Testing*** *Identifying Chemical Degradation Through Material Testing • Techniques for Analyzing Seal Material Integrity • Conducting Hardness Tests to Assess Seal Wear • Interpreting Results from Chemical Exposure Tests*
1100 – 1215	***Thermal Imaging for Heat Detection*** *Using Thermal Cameras to Detect Overheating • Identifying Hot Spots on Seals • Correlating Heat Patterns with Seal Failure • Role of Thermal Imaging in Predictive Maintenance*
1215 – 1230	*Break*
1230 – 1330	***Performance Data Analysis*** *Analyzing Pressure and Temperature Data • Trends in Seal Failure from Historical Data • Using Data Loggers to Track Seal Performance Over Time • Calculating Seal Wear Rates and Predicting Failure*
1330 – 1420	***Failure Mode & Effect Analysis (FMEA)*** *Applying FMEA to Mechanical Seal Design • Identifying Potential Failure Modes • Assessing the Severity and Likelihood of Failures • Implementing Corrective Actions Based on FMEA Results*
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 – 0830	***Seal Maintenance Best Practices*** *Routine Inspection and Maintenance Intervals • Importance of Regular Lubrication and Cleaning • Preventing Contamination and Wear • Establishing a Maintenance Schedule*
0830 – 0930	***Seal Repair Procedures*** *Repairing Minor Seal Damage (Re-Lapping, Resurfacing) • When to Repair Versus Replace Seals • Tools and Equipment for Seal Repair • Steps to Ensure Repair Effectiveness*

0930 – 0945	*Break*
0945 – 1100	***Seal Replacement Guidelines*** *Criteria for Deciding When to Replace Seals • Steps for Proper Seal Replacement • Tools and Techniques for Easy Seal Replacement • Impact of Improper Seal Replacement on Pump Performance*
1100 – 1215	***Upgrading Pump Seal Technology*** *Latest Advancements in Mechanical Seal Technology • Benefits of Using High-Performance Seals • Seal Upgrades for Extreme Operating Conditions • Comparing Traditional versus Modern Sealing Technologies*
1215 – 1230	*Break*
1230 – 1330	***Cost Analysis of Seal Failures*** *Estimating the Cost of Seal Failure (Downtime, Maintenance, Energy) • Understanding the Long-Term Financial Impact of Seal Failures • Developing a Cost-Effective Seal Maintenance Strategy • ROI on Using High-Quality Seals*
1330 – 1420	***Creating a Seal Failure Prevention Program*** *Developing a Proactive Seal Maintenance Program • Establishing Monitoring and Diagnostic Systems • Training Staff to Identify Early Failure Signs • Implementing a Continuous Improvement Process for Seal Reliability*
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 Four*

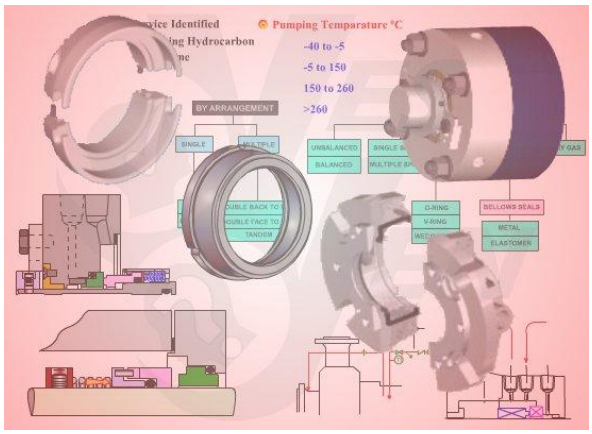
Day 5

0730 – 0830	***Case Study: Pump Seal Failure in a Chemical Plant*** *Overview of a Real-World Failure Case • Analyzing the Root Causes of the Failure • Lessons Learned from the Case Study • Implementing Corrective Measures in the Plant*
0830 – 0930	***Case Study: Seal Failure in an Offshore Oil Rig*** *Specific Challenges Faced in Offshore Environments • Impact of Environmental Factors on Seal Performance • Solutions Implemented to Prevent Recurrence • Comparing Offshore and Onshore Seal Failure Cases*
0930 – 0945	*Break*
0945 – 1100	***Workshop: Hands-On Seal Failure Diagnosis*** *Practical Session on Inspecting Mechanical Seals • Identifying Common Failure Modes in Seals • Group Discussion on Failure Analysis Techniques • Sharing Personal Experiences from Industry*
1100 – 1215	***Group Discussion: Seal Failures in Various Industries*** *How Seal Failures Differ in Diverse Industries (Oil, Chemical, Food Processing) • Comparing Pump Seal Performance in Critical Applications • Strategies for Minimizing Seal Failures in Various Sectors • Best Practices for Enhancing Seal Reliability Across Industries*

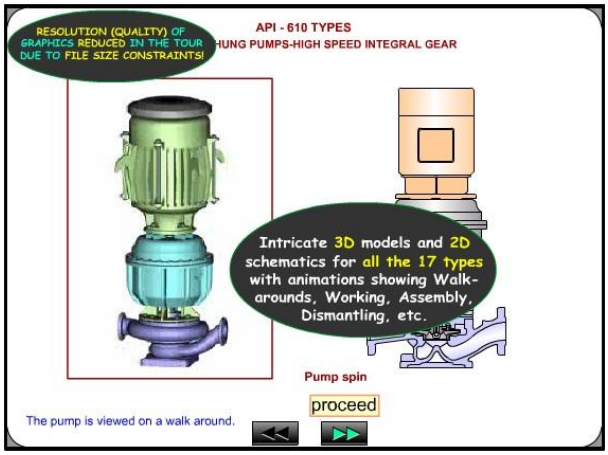
1215 – 1230	*Break*
1230 – 1345	***Future Trends in Pump Mechanical Seals*** *Innovations in Seal Materials and Designs • The Role of AI and Automation in Seal Monitoring • How Industry 4.0 Is Influencing Seal Technologies • Predictive Analytics for Seal Life Expectancy*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t 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 session 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 "Mechanical Seals CBT" and "Centrifugal Pumps and Troubleshooting Guide 3.0".



Mechanical Seals CBT Simulator



Centrifugal Pumps and Troubleshooting Guide 3.0

Course Coordinator

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