COURSE OVERVIEW ME0897
API 670: Machinery Protection Systems

Course Title
API 670: Machinery Protection Systems

Course Date/Venue
Option 1: April 27 – May 01, 2025 or,
Option 2: May 04-08, 2025 or,
Option 3: June 29 – July 03, 2025
Venue: Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
ME0897

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

Course Description

This practical and highly-interactive course includes real-life case studies where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of API 670: Machinery Protection Systems. It covers the purpose and scope of API 670 and the key components and systems in machinery protection; the basic principles of vibration monitoring, types of vibration sensors, signal processing for vibration analysis and common causes of excessive vibration; the importance of temperature monitoring and types of temperature sensors used in protection systems; and the pressure and flow monitoring, displacement and proximity sensing including machinery protection system (MPS) architecture.

Further, the course will also discuss the detailed vibration analysis techniques and transient vibration analysis; integrating vibration data with other monitoring systems; the signal conditioning and data processing for vibration systems using filtering and noise reduction techniques; the signal amplification and conversion methods including data storage and retrieval in vibration monitoring systems; the common machinery types, configurations machinery and challenges in turbomachinery monitoring; the role of hydraulic and pneumatic controls in machinery; monitoring hydraulic oil condition and flowing; troubleshooting pneumatic systems in machinery; the trip systems and design considerations for API 670 compliant systems; and the root cause analysis (RCA) in machinery protection.

During this interactive course, participants will learn the condition-based monitoring (CBM), data analytics in machinery protection and remote monitoring and real-time data management; the failure mode and effects analysis (FMEA) for machinery protection; combining API 670 with other standards; the risk-based maintenance strategies and developing risk profiles for critical assets; setting risk-based maintenance priorities and reviewing RBI best practices in the petroleum sector; the key cybersecurity threats to protection systems and the best practices for securing API 670 systems; the role of firewalls, encryption, and access controls; monitoring system effectiveness and identifying gaps and improvement areas; preparing API 670 audits and developing checklist for compliance assessment; and the documentation and record-keeping requirements and corrective actions for non-compliance findings.

Course Objectives

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

- Apply and gain an in-depth knowledge on machinery protection systems in accordance with the API 670 standard
- Discuss purpose and scope of API 670 and the key components and systems in machinery protection
- Recognize the basic principles of vibration monitoring, types of vibration sensors, signal processing for vibration analysis and common causes of excessive vibration
- Identify the importance of temperature monitoring and types of temperature sensors used in protection systems
- Illustrate pressure and flow monitoring, displacement and proximity sensing including machinery protection system (MPS) architecture
- Carryout detailed vibration analysis techniques and transient vibration analysis as well as integrate vibration data with other monitoring systems
- Apply signal conditioning and data processing for vibration systems using filtering and noise reduction techniques
- Discuss signal amplification and conversion methods including data storage and retrieval in vibration monitoring systems
- Recognize common machinery types and configurations machinery and challenges in turbomachinery monitoring
- Identify the role of hydraulic and pneumatic controls in machinery, monitor hydraulic oil condition and flow and troubleshoot pneumatic systems in machinery
- Implement trip systems, recognize design considerations for API 670 compliant systems and apply root cause analysis (RCA) in machinery protection
- Employ condition-based monitoring (CBM), data analytics in machinery protection, remote monitoring and real-time data management
- Carryout failure mode and effects analysis (FMEA) for machinery protection including setting up condition monitoring programs
- Combine API 670 with other standards and enhance interoperability across equipment

- Apply risk-based maintenance strategies and develop risk profiles for critical assets
- Set risk-based maintenance priorities and review RBI best practices in the petroleum sector
- Identify the key cybersecurity threats to protection systems and best practices for securing API 670 systems
- Define the role of firewalls, encryption, and access controls and ensure data integrity and system resilience
- Monitor system effectiveness and identify gaps and improvement areas
- Prepare API 670 audits, develop checklist for compliance assessment and apply documentation and record-keeping requirements and corrective actions for non-compliance findings

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 machinery protection systems for machine operators, machine maintenance personnel, process engineers, production engineers, controls engineers, electricians, design engineers, corporate safety committee, integrators and for those who are involved with plant safety.

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

Course 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: -

- 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.

- 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.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

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. Dimitry Rovas, CEng, MSc, PMI-PMP, SMRP-CMRP is a **Senior Mechanical & Maintenance Engineer** with extensive industrial experience in **Oil**, **Gas**, **Power** and **Utilities** industries. His expertise includes **Boiler** Inspection & Maintenance, **Boiler** Systems, **Boiler** instrumentation & Controls, **Boiler** Start-up & Shutdown, **Boiler** Operation & Steam System Management, **Boiler** Water Chemistry & Treatment, **Boiler** Efficiency & Waste Heat Recovery, **Boiler** Inspection & Testing, **Boiler** Maintenance, **Boiler** Troubleshooting & Safety, **Boiler** Emissions & Pollution Control, **Combustion** Analysis & Tuning Procedures, **Water Treatment** Technology, Heat Recovery Steam Generating (**HRSG**), **Impulse Tube** Installation & Inspection, **Parker Compression Fittings**, **Pipes & Fittings**, **PSV Inspection**, **Root Cause Failure Analysis**, **Tank** Design & Engineering, **Tank Shell**, **Tanks & Tank Farms**, **Vacuum Tanks**, **Gas Turbine** Operating & Maintenance, **Diesel Engine**, **Engine Cycles**, **Governors & Maintenance**, **Crankshafts** & Maintenance, **Lubrication** System Troubleshooting & Maintenance, **Engines/Drivers**, **Motor** Failure Analysis & Testing, **Motor** Predictive Maintenance, **Engine** Construction & Maintenance, **HP Fuel Pumps & Maintenance**, **Fired Equipment** Maintenance, Combustion **Techniques**, **Process Heaters**, Glass Reinforced Epoxy (**GRE**), Glass Reinforced Pipes (**GRP**), Glass Reinforced Vent (**GRV**), **Mechanical Pipe Fittings**, **Flange Joint Assembly**, Adhesive Bond Lamination, **Butt Jointing**, **Joint & Spool Production**, **Isometric Drawings**, **Flange Assembly** Method, **Fabrication & Jointing**, Jointing & Spool Fabrication, **CAESAR**, **Pipe Stress Analysis**, **Pipe Cuttings**, **Flange Bolt Tightening** Sequence, **Hydro Testing**, **Pump** Technology, Fundamentals of **Pumps**, **Pump** Selection & Installation, **Centrifugal Pumps & Troubleshooting**, **Reciprocating & Centrifugal Compressors**, **Screw Compressor**, **Compressor** Control & Protection, **Gas & Steam Turbines**, **Turbine** Operations, **Gas Turbine** Technology, **Valves**, **Process Control Valves**, **Bearings & Lubrication**, Advanced **Machinery Dynamics**, **Rubber Compounding**, **Elastomers**, **Thermoplastic**, **Industrial Rubber Products**, **Rubber** Manufacturing Systems, **Heat Transfer**, **Vulcanization Methods**, **Process Plant Shutdown & Turnaround**, **Professional Maintenance Planner**, Advanced **Maintenance Management**, **Maintenance Optimization & Best Practices**, **Maintenance Auditing & Benchmarking**, **Material Cataloguing**, **Reliability** Management, **Rotating Equipment**, **Energy Conservation**, **Energy Loss Management** in Electricity Distribution Systems, **Energy Saving**, **Thermal Power Plant** Management, **Thermal Power Plant** Operation & Maintenance, **Heat Transfer**, **Machine Design**, **Fluid Mechanics**, **Heating & Cooling Systems**, **Heat Insulation Systems**, **Heat Exchanger & Cooling Towers**, **Mechanical Erection**, **Heavy Rotating Equipment**, Material Unloading & Storage, Commissioning & Start-Up. He is currently the **Project Manager** wherein he is managing, directing and controlling all activities and functions associated with the domestic heating/cooling facilities projects.

During his life career, Mr. Rovas has gained his practical and field experience through his various significant positions and dedication as the **EPC Project Manager**, **Maintenance Manager**, **Mechanical Engineer**, **Field Engineer**, **Preventive Maintenance Engineer**, **Lead Rotating Equipment Commissioning Engineer**, **Construction Commissioning Engineer**, **Offshore Lead Maintenance Engineer**, **Researcher**, **Instructor/Trainer**, **Telecom Consultant** and **Consultant** from various companies such as the Mytilineos Aluminium Group, Podaras Engineering Studies, Metka and Diadikasia, S.A., **Hellenic Petroleum Oil Refinery** and COSMOTE.

Mr. Rovas has **Master's** degrees in **Energy Production & Management** and **Mechanical Engineering** from the **National Technical University of Athens** (**NTUA**), **Greece**. Further, he is a **Certified Instructor/Trainer**, a **Certified Maintenance and Reliability Professional** (**CMRP**) from the Society of Maintenance & Reliability Professionals (**SMRP**), **Certified Project Management Professional** (**PMI-PMP**), **Certified Six Sigma Black Belt**, **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), **Certified Construction Projects Contractor**, **Certified Energy Auditor** and a **Chartered Engineer**. Moreover, he is an active member of **American Society for Quality**, Project Management Institute (**PMI**), **Body of Certified Energy Auditors** and **Technical Chamber of Greece**. He has further received various recognition and awards and delivered numerous trainings, seminars, courses, workshops and conferences internationally.

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	***Overview of API 670 Standard*** *Purpose and Scope of API 670 • Key Components and Systems in Machinery Protection • Role of API 670 in Reliability and Maintenance • Compliance and Industry Applications*
0930 – 0945	*Break*
0945 – 1030	***Vibration Monitoring*** *Basic Principles of Vibration Monitoring • Types of Vibration Sensors (e.g., Velocity, Acceleration) • Signal Processing for Vibration Analysis • Common Causes of Excessive Vibration*
1030 – 1130	***Temperature Monitoring in Machinery*** *Importance of Temperature Monitoring • Types of Temperature Sensors Used in Protection Systems • Temperature Monitoring for Rotating and Reciprocating Equipment • Interpreting Temperature Data for Fault Diagnosis*
1130 – 1215	***Pressure & Flow Monitoring*** *Role of Pressure and Flow in Machinery Health • Types of Pressure and Flow Sensors • Installation Best Practices for Accurate Measurements • Common Pressure and Flow Anomalies and Their Causes*
1215 – 1230	*Break*
1230 – 1330	***Displacement & Proximity Sensing*** *Understanding Displacement and Proximity Sensors • Types of Proximity Probes and Their Applications • Calibration and Maintenance of Proximity Probes • Application in Machinery Protection and Gap Detection*
1330 – 1420	***Machinery Protection System (MPS) Architecture*** *Key Components of MPS • System Communication Protocols • Role of Redundancy in Protection Systems • Basic Troubleshooting and Maintenance Practices*
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	***Detailed Vibration Analysis Techniques*** *Spectrum Analysis and its Significance • Waveform and Time-Domain Analysis • Understanding Phase Data in Vibration Analysis • Balancing and Alignment Impacts on Vibration*
0830 – 0930	***Transient Vibration Analysis*** *Monitoring and Analyzing Transient Events • Critical Speeds and Resonance Detection • Start-up and Shutdown Vibration Profiles • Case Studies in Transient Vibration Issues*
0930 – 0945	*Break*

0945 – 1100	***Case Studies in Vibration Diagnostics*** *Analysis of Common Faults (e.g., Misalignment, Unbalance) • Examples of Bearing and Gear Vibration Signatures • Interpreting Vibration Patterns for Troubleshooting • Best Practices in Corrective Actions*
1100 – 1215	***Integration of Vibration Data with Other Monitoring Systems*** *Synchronizing Vibration with Temperature Data • Combining Pressure, Flow, and Vibration Insights • Data Integration for Holistic Machinery Health Assessment • Building Predictive Models for Failure Prevention*
1215 – 1230	*Break*
1230 – 1330	***Signal Conditioning & Data Processing for Vibration Systems*** *Importance of Signal Conditioning in Accurate Measurement • Filtering and Noise Reduction Techniques • Signal Amplification and Conversion Methods • Data Storage and Retrieval in Vibration Monitoring Systems*
1330 – 1420	***Hands-On Session: Vibration Monitoring Setup*** *Installation and Calibration of Vibration Sensors • Configuring Alarm and Trip Settings • Data Logging and Trending Practices • Troubleshooting Common Sensor Issues*
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	***Monitoring Turbomachinery*** *Common Machinery Types and Configurations • Challenges in Turbomachinery Monitoring • High-Speed Rotor Dynamics and Bearing Health • Strategies for Protecting Critical Assets*
0830 – 0930	***Hydraulic & Pneumatic Systems in Protection*** *Role of Hydraulic and Pneumatic Controls in Machinery • Monitoring Hydraulic Oil Condition and Flow • Common Hydraulic Failures and Their Impact • Troubleshooting Pneumatic Systems in Machinery*
0930 – 0945	*Break*
0945 – 1100	***Understanding & Implementing Trip Systems*** *Types of Trip Systems and API 670 Requirements • Configuration and Testing of Trip Systems • Practical Considerations for Trip Points and Alarms • Preventive Maintenance of Trip Systems*
1100 – 1215	***Design Considerations for API 670 Compliant Systems*** *Mechanical and Electrical Design Requirements • Sensor Placement for Optimal Protection • Wiring and Grounding Best Practices • Factors Influencing System Reliability*
1215 – 1230	*Break*
1230 – 1330	***Root Cause Analysis (RCA) in Machinery Protection*** *Introduction to RCA Techniques • Tools and Methods for Failure Investigation • Documentation and Reporting for RCA • Implementing Corrective Actions from RCA Findings*

1330 – 1420	***Hands-On Session: Protective Systems Testing & Calibration*** *Functional Testing of API 670 Systems • Calibration Procedures for Sensors and Alarms • Diagnostic Testing and Troubleshooting Exercises • Documentation of Calibration and Test Results*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the T were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

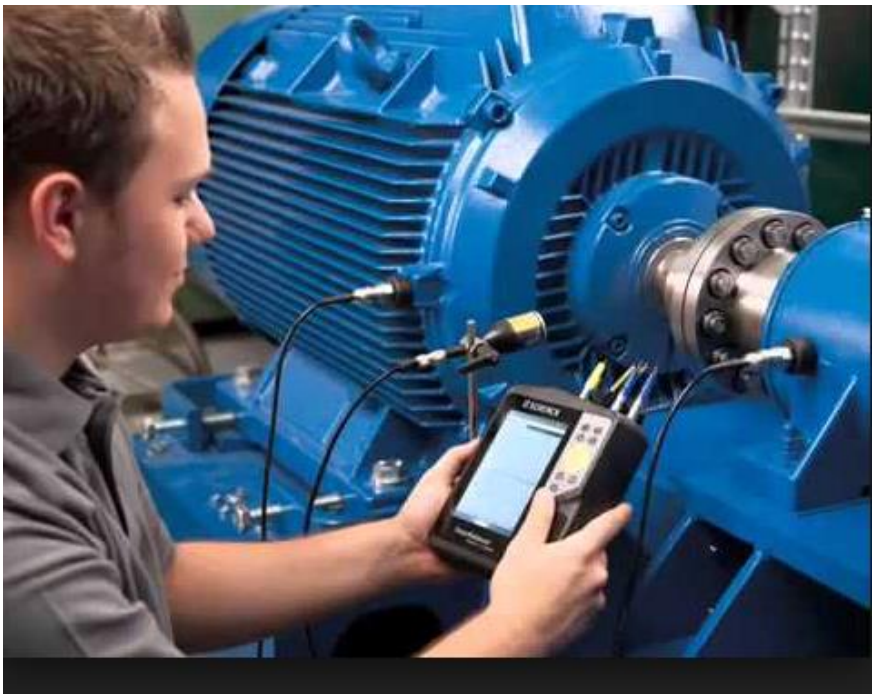
0730 – 0830	***Condition-Based Monitoring (CBM)*** *Principles and Importance of CBM • Benefits Over Reactive Maintenance Approaches • Key Technologies in CBM for Machinery Protection • Integration with Maintenance Planning*
0830 – 0930	***Data Analytics in Machinery Protection*** *Data Collection Techniques and Challenges • Analytical Tools for Data Interpretation • Developing Data-Driven Maintenance Insights • Role of Artificial Intelligence in Data Analysis*
0930 – 0945	*Break*
0945 – 1100	***Remote Monitoring & Real-Time Data Management*** *Basics of Remote Monitoring Systems • Cloud Solutions for Real-Time Data • Alarm and Notification Management • Case Studies in Remote Monitoring Effectiveness*
1100 – 1215	***Failure Mode & Effects Analysis (FMEA) for Machinery Protection*** *Introduction to FMEA Methodology • Identifying Critical Failure Modes in Machinery • Mitigating High-Risk Failure Points • Documenting and Updating FMEA Results*
1215 – 1230	*Break*
1230 – 1330	***Setting Up Condition Monitoring Programs*** *Goals and Objectives of Condition Monitoring • Program Design and Component Selection • Periodic Assessment and Improvement Strategies • Defining KPIs for Program Success*
1330 – 1420	***Hands-On Session: Data Interpretation & Analysis*** *Real-World Case Studies in Data Interpretation • Exercises in Trending and Anomaly Detection • Building Maintenance Recommendations from Data*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the T were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0830	***System Integration: Combining API 670 with Other Standards*** *Overview of Relevant Standards (e.g., ISO, API 618) • API 670 Compliance in Multi-Standard Environments • Integrating Protection Systems with Safety Systems • Enhancing Interoperability Across Equipment*
0830 – 0930	***Risk-Based Maintenance Strategies*** *Overview of Risk-Based Inspection (RBI) Principles • Developing Risk Profiles for Critical Assets • Setting Risk-Based Maintenance Priorities • Reviewing RBI Best Practices in the Petroleum Sector*
0930 – 0945	*Break*
0945 – 1100	***Cybersecurity in Machinery Protection Systems*** *Key Cybersecurity Threats to Protection Systems • Best Practices for Securing API 670 Systems • Role of Firewalls, Encryption and Access Controls • Ensuring Data Integrity and System Resilience*
1100 – 1215	***Program Evaluation & Continuous Improvement*** *Monitoring System Effectiveness • Identifying Gaps and Improvement Areas • Continuous Learning and Knowledge Management • Case Studies in Successful Program Optimization*
1215 – 1230	*Break*
1230 – 1300	***API 670 Audits & Compliance Check*** *Preparing for API 670 Audits • Checklist for Compliance Assessment • Documentation and Record-Keeping Requirements • Corrective Actions for Non-Compliance Findings*
1300 – 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1315 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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