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COURSE OVERVIEW FE0080

Piping Vibration Analysis & Practical Engineering Solutions

Course Title

Piping Vibration Analysis & Practical Engineering Solutions

Course Date/Venue

July 19-23, 2026/Tactic Meeting Room, Aloft Dharan Hotel, Al Khobar, KSA

3.0 CEUs (30 PDHs) AWARD

H-STK© INCLUDED

Course Reference

FE0080

Course Duration/Credits

Five days/3.0 CEUs/30 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.

This course is designed to provide participants with a detailed and up-to-date overview of Piping Vibration Analysis and Practical Engineering Solutions. It covers the piping vibration engineering, basic vibration and dynamic characteristics of piping systems; the sources of piping vibration, piping system components and their influence including vibration standards and guidelines; the vibration measurement principles and vibration instrumentation; the vibration data collection techniques, frequency analysis and fast fourier transform (FFT) applications; and the diagnostic techniques for piping vibration and flow-induced vibration mechanisms.

During this interactive course, participants will learn the pulsation and acoustic resonance in process piping systems and fluid-structure interaction (FSI); the analytical methods for pulsation and vibration, mitigation of flow-induced vibration and pipe support design for vibration control; the structural modifications and reinforcement, vibration isolation techniques and dynamic stress evaluation; the design against resonance and advanced vibration analysis techniques; and the troubleshooting methodology, vibration assessment of critical piping systems and fitness-for-service and integrity assessment.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on piping vibration analysis and practical engineering solutions
- Discuss piping vibration engineering, basic vibration and dynamic characteristics of piping systems
- Identify the sources of piping vibration, piping system components and their influence including vibration standards and guidelines
- Explain vibration measurement principles and recognize vibration instrumentation
- Carryout vibration data collection techniques, frequency analysis and fast fourier transform (FFT) applications
- Employ diagnostic techniques for piping vibration and discuss flow-induced vibration mechanisms
- Recognize pulsation and acoustic resonance in process piping systems and fluid-structure interaction (FSI)
- Illustrate analytical methods for pulsation and vibration, mitigation of flow-induced vibration and pipe support design for vibration control
- Apply structural modifications and reinforcement, vibration isolation techniques and dynamic stress evaluation
- Describe design against resonance and carryout advanced vibration analysis techniques
- Employ troubleshooting methodology, vibration assessment of critical piping systems and fitness-for-service and integrity assessment

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 a wide understanding and deeper appreciation of piping vibration analysis and practical engineering solutions for engineers who are responsible for operating existing piping systems. However, designers of new piping systems will also find the broad coverage of potential vibration problems a time saving briefing on the variety of vibration problems that can occur in piping systems.

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

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.

Accommodation

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

Course Instructor

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 **Piping Vibration** Analysis & Practical Engineering Solutions, **Vibration** Fundamentals & Definition **Pressure Vessel** Design, Fabrication & Testing, **Pressure Vessel & Piping Systems**, **External Pressure** Design & Considerations, **ASME Boiler & Pressure Vessels Code**, **Pipe Stress Analysis**, **Tanks & Vessels Insulation**, **Pipeline & Piping Insulation**, **Insulation** Testing & Quality Assurance, **Insulation** Maintenance & Repair, **Insulation** Retrofitting, **Pumps**, **Pump** Selection & Installation, **Centrifugal Pumps & Troubleshooting**, **Reciprocating & Centrifugal Compressors**, **Screw Compressor**, **Compressor** Control & Protection, **Heat Exchanger & Boiler Insulation**, **Impulse Tube** Installation & Inspection, **Parker Compression Fittings**, **Pipes & Fittings**, **PSV Inspection**, **Boiler** Operation, Maintenance & 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**, **Engine** Construction & Maintenance, **HP Fuel Pumps & Maintenance**, **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**, **Gas & Steam Turbines**, **Turbine** Operations, **Gas Turbine** Technology, **Valves**, **Process Control Valves**, **Bearings & Lubrication**, 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. Further, he is also well-versed in MS project & AutoCAD, EPC Power Plant, Power Generation, Combined Cycle Powerplant, Leadership & Mentoring, Project Management, Strategic Planning/Analysis, Construction Management, Team Formation, Relationship Building, Communication, Reporting and Six Sigma. 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**, **Field Engineer**, **Thermal Insulation Engineer**, **Mechanical Engineer**, **Preventive Maintenance Engineer**, **Senior Thermal Insulation Technician**, **Researcher**, **Instructor/Trainer**, **Telecom Consultant** and **Consultant** from various companies such as the Podaras Engineering Studies, Metka and Diadikasia, S.A., **Hellenic Petroleum Oil Refinery** and COSMOTE.

Mr. Rovas has a **Master's** degree 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.

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.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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: ***Sunday, 19th of July 2026***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Piping Vibration Engineering*** *Importance of Vibration Control in Piping Systems • Common Vibration-Related Failures and Incidents • Economic and Safety Impacts of Vibration Problems • Overview of Industry Standards and Best Practices*
0930 – 0945	*Break*
0945 – 1030	***Basic Vibration Theory*** *Definitions of Frequency, Amplitude and Phase • Free and Forced Vibration Concepts • Damping Mechanisms and Vibration Attenuation • Resonance and Natural Frequency Fundamentals*
1030 – 1130	***Dynamic Characteristics of Piping Systems*** *Mass, Stiffness, and Damping Relationships • Single-Degree and Multi-Degree of Freedom Systems • Modal Behavior of Piping Structures • Dynamic Response to Operating Loads*
1130 – 1215	***Sources of Piping Vibration*** *Flow-Induced Vibration Mechanisms • Mechanical Excitation from Rotating Equipment • Pulsation-Induced Vibration in Piping Networks • External and Environmental Vibration Sources*
1215 – 1230	*Break*
1230 – 1330	***Piping System Components & Their Influence*** *Pipes, Fittings and Supports • Valves and Control Elements • Expansion Joints and Flexible Connections • Equipment Nozzles and Interface Points*

1330 – 1420	***Basics of Vibration Standards & Guidelines*** *ASME Piping Vibration Considerations • Energy Institute Vibration Guidelines • API Vibration Requirements • Vibration Acceptance Criteria and Limits*
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: ***Monday, 20th of July 2026***

0730 – 0830	***Vibration Measurement Principles*** *Vibration Parameters and Units • Time-Domain and Frequency-Domain Analysis • Displacement, Velocity and Acceleration Measurements • Signal Processing Fundamentals*
0830 – 0930	***Vibration Instrumentation*** *Accelerometers and Velocity Sensors • Data Acquisition Systems • Portable Vibration Analyzers • Wireless Monitoring Technologies*
0930 – 0945	*Break*
0945 – 1100	***Vibration Data Collection Techniques*** *Sensor Selection and Placement • Measurement Planning and Routes • Operating Condition Considerations • Data Quality Assurance Practices*
1100 – 1215	***Frequency Analysis & FFT Applications*** *Fast Fourier Transform (FFT) Principles • Spectrum Interpretation Techniques • Identification of Dominant Frequencies • Harmonic and Subharmonic Analysis*
1215 – 1230	*Break*
1230 – 1330	***Diagnostic Techniques for Piping Vibration*** *Root Cause Identification Methodology • Pattern Recognition in Vibration Signatures • Distinguishing Mechanical and Flow-Related Issues • Trending and Condition Monitoring*
1330 – 1420	***Field Case Studies in Vibration Measurement*** *Compressor Piping Vibration Investigations • Pump System Vibration Assessments • Steam and Gas Pipeline Examples • Lessons Learned from Field Applications*
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: ***Tuesday, 21st of July 2026***

0730 – 0830	***Flow-Induced Vibration Mechanisms*** *Turbulence-Induced Vibration • Vortex Shedding Phenomena • Acoustic-Induced Vibration • Flow Instability Effects*
0830 – 0930	***Pulsation in Process Piping Systems*** *Pulsation Generation Mechanisms • Reciprocating Compressor Pulsation • Reciprocating Pump Pulsation • Pressure Wave Propagation*
0930 – 0945	*Break*

0945 – 1100	***Acoustic Resonance in Piping Systems*** *Acoustic Natural Frequencies • Standing Wave Formation • Resonance Amplification Mechanisms • Acoustic Fatigue Risks*
1100 – 1215	***Fluid-Structure Interaction (FSI)*** *Coupling Between Fluid and Structure • Dynamic Pressure Fluctuations • Structural Response Characteristics • FSI Modeling Approaches*
1215 – 1230	*Break*
1230 – 1330	***Analytical Methods for Pulsation & Vibration*** *Acoustic Modeling Fundamentals • Pulsation Analysis Procedures • Dynamic Simulation Techniques • Validation of Analytical Models*
1330 – 1420	***Mitigation of Flow-Induced Vibration*** *Flow Modification Techniques • Pulsation Suppression Devices • Acoustic Damping Solutions • Design Improvements and Optimization*
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: ***Wednesday, 22nd of July 2026***

0730 – 0830	***Pipe Support Design for Vibration Control*** *Support Stiffness Considerations • Guide and Anchor Design Principles • Spring and Dynamic Supports • Support Spacing Optimization*
0830 – 0930	***Structural Modifications & Reinforcement*** *Stiffening Techniques • Bracing and Restraint Systems • Structural Reinforcement Methods • Temporary Versus Permanent Solutions*
0930 – 0945	*Break*
0945 – 1100	***Vibration Isolation Techniques*** *Flexible Connectors and Expansion Joints • Isolation Mounts and Dampers • Equipment-Piping Decoupling Methods • Isolation System Performance Evaluation*
1100 – 1215	***Dynamic Stress Evaluation*** *Stress Due to Vibration Loading • Fatigue Assessment Methods • Stress Concentration Effects • Allowable Dynamic Stress Limits*
1215 – 1230	*Break*
1230 – 1330	***Design Against Resonance*** *Natural Frequency Separation Criteria • Frequency Tuning Techniques • Design Modifications to Avoid Resonance • Verification of Resonance Avoidance*
1330 – 1420	***Engineering Solutions Workshop*** *Selection of Corrective Actions • Cost-Benefit Evaluation of Solutions • Risk-Based Decision Making • Implementation Planning Strategies*
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:	***Thursday, 23rd of July 2026***
0730 – 0830	***Advanced Vibration Analysis Techniques*** *Modal Analysis Applications • Operational Deflection Shape (ODS) Analysis • Experimental Modal Testing • Advanced Signal Processing Methods*
0830 – 0930	***Troubleshooting Methodology*** *Systematic Vibration Investigation Process • Problem Prioritization Techniques • Root Cause Verification Methods • Troubleshooting Documentation Practices*
0930 – 0945	*Break*
0945 – 1100	***Vibration Assessment of Critical Piping Systems*** *High-Energy Piping Systems • Offshore and LNG Facilities • Refinery and Petrochemical Applications • Power Plant Piping Networks*
1100 – 1215	***Fitness-for-Service & Integrity Assessment*** *Fatigue Life Estimation • Remaining Life Assessment Methods • Risk-Based Inspection Integration • Integrity Management Strategies*
1215 – 1230	*Break*
1230 – 1300	***Comprehensive Industrial Case Studies*** *Reciprocating Compressor Piping Failures • Flow-Induced Vibration in Gas Pipelines • Steam Line Vibration Challenges • Successful Mitigation Project Examples*
1300 – 1345	***Course Workshop & Best Practices*** *End-to-End Vibration Assessment Exercise • Development of Mitigation Strategies • Review of Industry Best Practices • Key Takeaways and Implementation Roadmap*
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*

Course Outcome

Upon completion of this course, participants will be able to:

- Understand vibration mechanisms affecting piping systems.
- Measure, monitor and interpret vibration data effectively.
- Diagnose root causes of piping vibration problems.
- Perform basic vibration and pulsation assessments.
- Develop practical and cost-effective engineering solutions.
- Apply industry standards and best practices for vibration control.
- Improve piping reliability, safety and operational performance.

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

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