



COURSE OVERVIEW FE0157

Piping (E-Learning Module)

Course Title

Piping (E-Learning Module)

Course Reference

FE0157

Course Format & Compatibility

SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration

30 online contact hours
(3.0 CEUs/30 PDHs)



Course Description



This course is designed to provide participants with a detailed and up-to-date overview of piping. It covers the procedure of piping maintenance and inspection; the codes and standards including the historical perspective and ASME B31; the six fundamental areas, system design, detailed design, fabrication, construction, operations, integrity assessment and repairs; the ASME boiler and pressure vessel codes, API codes and standards, ASTM standards, NACE recommended practice and other standards; the material addressed by ASME B31.3; and the strength of materials, creep, toughness, basis for design stresses, carbon steel lower temperature limits, impact test methods and acceptance, fluid service requirements and deterioration in service.

Further, the course will also discuss the metallic pipe and fitting selection, pressure – temperature rating, fire resistance, corrosion resistance and material toughness; the material cost, material selection of piping, elevated temperature fluid service, pipe components and other listed components; the seamless and ERW of pipes, weld joint quality factor, fittings, solder and brazed joint fluid service requirements and branches; the branches, flanges, gaskets, bolting, bolting fluid service requirements and flanged joints; the valve selection; and the pipe line valves, bolted bonnet gate valve, gate valve stems, gate valve trim and gate valve discs.



Moreover, the course will cover the extended body gate valve, knife gate valves, gate valve, globe valve, check valve, butterfly valve, ball valve, plug valve and diaphragm valve; the flange joints, flange standards, assembly of pipe flanges, gasket installation, bolt specifications and leakage diagnostics; the layout and support, general considerations, support spacing, sagging due to creep, support locations and simple support; the spring hangers, special purpose supports, support element selection, sustained load analysis and fixing problems; the inspection, examination and testing, ultrasonic examination, visual inspection, required leak test, hydrostatic test of piping with vessels, pneumatic leak test and other leak test provisions; the external inspection checklist, inspection practices, remaining life calculation, assessment of inspection findings, repairs and alterations, temporary repairs, fabrication and examination and leak testing; and the remaining strength of corroded pipelines, acceptable applications, analysis level, flaw interaction and safety factors.

During this course, participants will learn the proper repairs of pressure equipment, piping systems and pipelines; the grinding and defect repair using composite reinforcement sleeves; the clock spring repair, weld deposition repair, temper bead technique weld deposition repairs, welding procedure qualification and grind out and weld deposition; the mechanical clamps, leak clamp, hot tapping, in-service welding, welding in-service, patches and half soles; the weld overlay and illustrate flush patch (window repair), post-weld heat treatment, heat treatments, internal wrap, lining and coating; the pigging and cleaning of pipelines, pigging during pipeline construction, pig launching and receiving and selective pipe replacement; the mechanical sleeve repair, composite sleeve repair, pipeline re-coating, extensive pipe replacements and maintenance strategies; the reactive approach, proactive approach, predictive planning, preventive maintenance, predictive maintenance and pro-active strategy; the proactive systems, facility safety basis, production loss, maintenance cost, risk of failure and regulatory requirements; and the corrective maintenance, preventive or predictive maintenance and reliability.

Course Objectives

The course should serve the following overall learning objectives:-

- Apply and gain a comprehensive knowledge on piping
- Study piping reference standards and material specification
- Take knowledge about different type and shape of fittings, support and hangers
- Understand the piping failure mode and corrosion protection
- Identify the procedure of piping maintenance and inspection
- Discuss the codes and standards including the historical perspective and ASME B31
- Identify the six fundamental areas and illustrate system design, detailed design, fabrication, construction, operations, integrity assessment and repairs
- Review the ASME boiler and pressure vessel codes, API codes and standards, ASTM standards, NACE recommended practice and other standards

- Recognize the material addressed by ASME B31.3 and determine the strength of materials, creep, toughness, basis for design stresses, carbon steel lower temperature limits, impact test methods and acceptance, fluid service requirements and deterioration in service
- Carryout metallic pipe and fitting selection, pressure – temperature rating, fire resistance, corrosion resistance and material toughness
- Identify material cost, material selection of piping, elevated temperature fluid service, pipe components and other listed components
- Describe seamless and ERW of pipes, weld joint quality factor, fittings, solder and brazed joint fluid service requirements and branches
- Identify branches, flanges, gaskets, bolting, bolting fluid service requirements and flanged joints
- Employ valve selection and identify the pipe line valves, bolted bonnet gate valve, gate valve stems, gate valve trim and gate valve discs
- Recognize extended body gate valve, knife gate valves, gate valve, globe valve, check valve, butterfly valve, ball valve, plug valve and diaphragm valve
- Discuss flange joints, flange standards, assembly of pipe flanges, gasket installation, bolt specifications and leakage diagnostics
- Determine layout and support, general considerations, support spacing, sagging due to creep, support locations and simple support
- Identify spring hangers, special purpose supports, support element selection, sustained load analysis and fixing problems
- Employ inspection, examination and testing, ultrasonic examination, visual inspection, required leak test, hydrostatic test of piping with vessels, pneumatic leak test and other leak test provisions
- Inspect, repair, alterate and rerate in-service in accordance with API 570
- Carryout external inspection checklist, inspection practices, remaining life calculation, assessment of inspection findings, repairs and alterations, temporary repairs, fabrication and examination and leak testing
- Determine the remaining strength of corroded pipelines, acceptable applications, analysis level, flaw interaction and safety factors
- Apply proper repairs of pressure equipment, piping systems and pipelines as well as grinding and defect repair using composite reinforcement sleeves
- Employ clock spring repair, weld deposition repair, temper bead technique weld deposition repairs, welding procedure qualification and grind out and weld deposition
- Identify mechanical clamps, leak clamp, hot tapping, in-service welding, welding in-service, patches and half soles
- Discuss weld overlay and illustrate flush patch (window repair), post-weld heat treatment, heat treatments, internal wrap, lining and coating

- Perform pigging and cleaning of pipelines, pigging during pipeline construction, pig launching and receiving and selective pipe replacement
- Employ mechanical sleeve repair, composite sleeve repair, pipeline re-coating, extensive pipe replacements and maintenance strategies
- Illustrate reactive approach, proactive approach, predictive planning, preventive maintenance, predictive maintenance and pro-active strategy
- Recognize proactive systems, facility safety basis, production loss, maintenance cost, risk of failure and regulatory requirements
- Apply corrective maintenance, preventive or predictive maintenance and reliability

Who Should Attend

This course provides an overview of all significant aspects and considerations of piping for those who are involved in the design, analysis, fabrication, installation, maintenance or ownership of piping systems. Engineers, senior draftsmen, maintenance, quality assurance, and manufacturing personnel who work in the chemical, petroleum, utility, plastic processing, pulp and paper, and manufacturing, fields will find it a time-saving means to broaden and update their knowledge of piping. Those who must comply with code requirements will benefit from the practical approach presented in this course in obtaining satisfactory and economical piping systems.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Fee

As per proposal


Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.



Certificate Accreditations


Certificates are accredited by the following international accreditation organizations: -

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USA International Association for Continuing Education and Training (IACET)

Haward Technology is an Authorized Training Provider by the International Association 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 1-2013 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 1-2013 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 Association 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.

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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 Contents

- Overview of Codes and Standards
- Development of Codes and Standards
- Historical Perspective
- ASME B31 Pressure Piping Code

- B31.3 Process Piping
- ASME B31.3
- ASME B31.3 Process
- B31.4 & B31.8 Transmission Pipeline
- ASME B31.4 Liquids
- ASME B31.8 Gas
- B31.4 and B31.8 Introduction
- Six Fundamental Areas
- System Design (Process Design, P&ID)
- System Design
- Materials
- Detailed Design
- Fabrication and Construction
- Operations
- Integrity Assessment and Repairs
- Pipelines Incidents 2004-2009
- Third-Party Damage
- Pipelines Leaks 2004-2009
- Pipelines Failures 2004-2009
- Pipeline-Related Standards
- Regulation 49 CFR
- ASME Boiler & Pressure Vessel Codes
- API Codes and Standards
- API Codes and Standards: 500
- API Codes and Standards: 600
- API Codes and Standards: 5
- API Codes and Standards: 1100
- ASME B16 Dimensional and Pressure Rating Standards
- 12,000 ASTM Standards
- NACE Recommended Practice
- NACE Publications
- Other Standards
- Case Study #1

- Quiz #1
- Materials
- Introduction
- Limits of B31.3
- Materials
- Material Addressed by ASME B31.3
- Strength of Materials
- Creep
- Toughness
- Bases for Design Stresses
- ASTM A106 Grade B Carbon Steel (Metric Units)
- 323.1 Materials and Specifications
- B31.3 Material Requirements
- Listed and Unlisted Materials
- Carbon Steel Lower Temperature Limits
- Impact Test Methods and Acceptance
- Fluid Service Requirements (323.4.2)
- Deterioration in Service
- Case Study #2
- Quiz #2
- Metallic Pipe & Fitting Selection
- Bases for Material Selection
- Pressure - Temperature Rating
- Flange P-T Ratings— Gray Iron (psi) (Class Rated in accordance with ASME B16.1)
- Flange P-T Ratings — Carbon Steel (psi) (Class Rated in accordance with ASME B16.5)
- Fire Resistance
- Corrosion Resistance
- Material Toughness
- Example of Brittle Fracture
- Material Cost
- Material Selection of Piping
- Pipe for Category D Fluid Service

- Pipe for Severe Cyclic Conditions
- Elevated Temperature Fluid Service
- Pipe Components – ASME
- Other Listed Components
- Pipe – Seamless
- Pipe – ERW
- Weld Joint Quality Factor Ej
- Fittings
- Fittings: Threaded
- Fittings: Socket Welding
- Fittings: Buttwelding
- Solder & Brazed Joint Fluid Service Requirements
- Branches
- Branches - Branch Connection Fittings
- Flanges (ASME B16.5)
- Gaskets (ASME B16.20)
- Gaskets - Rubber
- Gaskets - Reinforced Rubber
- Gaskets - Flexible Graphite
- Gaskets - Spiral Wound
- Gaskets – Ring Joint
- Bolting
- Bolting Fluid Service Requirements
- Flanged Joints
- Case Study #3
- Quiz #3
- Valve Selection
- Pipe Line Valves (API-6D)
- Bolted Bonnet Gate Valve (API 600)
- Type of Gate Valve Bonnet
- Type of Gate Valve Stems
- Gate Valve Stem Pull Test
- Type of Gate Valve Trim

- Type of Gate Valve Discs
- Extended Body Gate Valve (API 606)
- Knife Gate Valves (MSS-SP-81)
- Gate Valve Attributes
- Globe Valve
- Globe Valve Attributes
- Check Valve
- Dual-Plate Wafer Check Valves (API-594)
- Check Valve Attributes
- Types vs. P-T Ratings
- Types vs. Attributes
- Butterfly Valve - Low Pressure
- Butterfly Valve - High Pressure
- Ball Valve
- Ball Valve Attributes
- Plug Valve
- Plug Valve Attributes
- Diaphragm Valve
- Diaphragm Valve Attributes
- Case Study #4
- Quiz #4
- Flanged Joints
- Flange Standards
- Flange Types 1 - Welding Neck
- Flange Types 2 - Threaded
- Flange Types 3 - Slip On
- Flange Types 4 - Socket Welded
- Flange Types 5 - Lap Joint
- Assembly of Pipe Flanges
- Gasket Installation
- Bolt Specifications
- Leakage Diagnostics
- Case Study #5

- Quiz #5
- Layout and Support
- The Material in This Section is Addressed by B31.3 in
- General Considerations
- Support Spacing
- Sagging Due to Creep (100,000 hrs)
- Support Locations
- Simple Support
- Guide
- Spring Hangers
- Special Purpose Supports
- Support Element Selection
- The Sustained Load Analysis
- Fixing Problems
- Course Recap
- Quiz #6
- ASME B31.3 Chapter VI Inspection, Examination and Testing
- Inspection, Examination & Testing
- Inspection
- Examination
- 341.3 Examination Requirements
- 341.3.2 Acceptance Criteria.
- 344.6 Ultrasonic Examination
- Examination Methods
- Visual Inspection Tools
- 341.4.1 Examination — Normal Fluid Service
- 341.4.3 Examination — Severe Cyclic Conditions
- Examination Requirements – VT
- Examination Requirements – Other
- 345 Testing
- 345.1 Required Leak Test
- Leak Test Methods
- 345.4.3 Hydrostatic Test of Piping with Vessels

- 345.5 Pneumatic Leak Test
- Other Leak Test Provisions
- Exam & Test Workshop
- Case Study #7
- Quiz #7
- Pressure Tests Hydrostatic, Pneumatic, and Combination Tests
- API 570 Pressure Testing Requirements 5.8
- ASME B31.3 Calculation of Test Pressures 345.4
- Pressure Tests
- Initial Service Leak Test
- Case Study #8
- Quiz #8
- In-Service Piping API 570 – Inspection, Repair, Alteration and Rerating of In-Service
- In-Service Piping
- API 570 Piping Inspection Code
- Responsibilities
- What to Inspect
- External Inspection Checklist
- Types of Inspection
- Inspection Practices
- Frequency and Extent of Inspection
- Inspection Intervals
- Extent of CUI Inspections
- Extent of Small-Bore Piping Inspection
- Remaining Life Calculation
- Corrosion Rate Calculations [LT or ST]
- Maximum Allowable Working Pressure
- Required Minimum Thickness
- Assessment of Inspection Findings
- Repairs and Alterations
- Temporary Repairs
- Fabrication and Examination
- Leak Testing

- Rerating
- Case Study #9
- Quiz #9
- ASME B31G Manual for Determining the Remaining Strength of Corroded Pipelines
- Scope
- Acceptable Applications
- Analysis Level
- Level 0 Evaluation
- Level 1 Evaluation
- Level 2 Evaluation
- Level 3 Evaluation
- Flaw Interaction
- Tables of Allowable Length of Corrosion
- Example:1
- Example:2
- Safety Factors and Meaning of Acceptance
- Level 1 Evaluation
- Case Study #10
- Quiz #10
- Repairs of Pressure Equipment, Piping Systems and Pipelines
- Repair Techniques
- Repair Plan
- PRCI Pipeline Repair Manual
- PRCI Repairs
- ASME Post-Construction Code PCC-2
- Pipeline Repair Methods
- Remove and Replace
- Grinding
- Grind-Out and Weld Deposit
- Grind Out of a Defect
- Grinding-Out As-Is
- Grinding
- Full-Encirclement Steel Sleeves

- Welded Sleeve (Petro-Line)
- Type A Sleeve (No Girth Weld)
- Type B Sleeve (With Girth Weld)
- Split Sleeve
- Qualifications: Procedure, Welder
- Welded Leak Box
- Defect Repair Using Composite Reinforcement Sleeves
- Fiberglass Wrap
- Carbon Fiber Wrap
- Clock Spring Repair
- Weld Deposition Repair
- Background
- Temper Bead Technique Weld Deposition Repairs
- Welding Procedure Qualification
- Grind Out and Weld Deposition
- Weld Deposition
- Weld Overlay
- Perimeter and Fill Passes
- Weld Overlay Repair First and Second Pass
- Weld Overlay Repair of Internal Corrosion
- Limitations on the Use of Weld Deposition Repair
- Mechanical Clamps
- Leak Clamp
- Hot Tapping
- Tube Welded to the Weld Build-Up
- In-Service Welding
- MT of Hot Tap
- Welding In-Service
- 1. Prevent Flammable and Explosive Environments
- 2. Prevent Burn-Through
- 3. Prevent H Cracking
- Weld Susceptibility Models
- Patches and Half Soles

- Grinding Out and Weld Deposition
- Grind Out
- Weld Build-Up
- Full-Circumference Weld Overlay
- Flush Patches
- Fillet Welded Patches
- Fillet Welded Patch
- Corroded Pipe Too Thin – Burn-Through
- 2.11 Clad Restoration
- Weld Overlay
- Flush Patch (Window Repair)
- Post-Weld Heat Treatment
- Heat Treatments
- Internal Wrap
- Lining and Coating
- Sleeve for Protruding Weld
- Sleeve on Sleeve
- Leak Repair with Sleeve
- Case Study #11
- Quiz #11
- Pigging and Cleaning of Pipelines
- What is a Pig?
- Pigging for Pipeline Efficiency
- Pigging
- Conventional Pigs
- Special Pigs
- Specialist Pigs
- Pigging During Pipeline Construction
- Pigging During Construction
- Why Clean? (Operator said it was clean)
- Pig Launching & Receiving
- Pig Launcher
- Pig Launcher Operational Sequence

- Pig Receiver
- Conventional
- Pigging
- Cleaning Pigs
- Cleaning of Pipeline
- First Pig
- 2nd Pig
- 3rd Pig
- Change Pig Type – Bi-Di
- 2nd Bi-Di
- 3rd Bi-Di
- D-scaling Pig
- Cleaning
- Smart Pig
- Selective Pipe Replacement
- Mechanical Sleeve Repair
- Composite Sleeve Repair
- Pipeline Re-coating
- Extensive Pipe Replacements
- Case Study #12
- Quiz #12
- Maintenance Strategies
- Maintenance Objective
- Reactive Approach
- Proactive Approach
- Predictive Planning
- Preventive Maintenance
- Predictive Maintenance
- Pro-Active Strategy
- Proactive Systems
- Facility Safety Basis
- Production Loss
- Maintenance Cost



- Risk of Failure
- Regulatory Requirements
- Corrective Maintenance
- Preventive or Predictive Maintenance
- Reliability
- The First Method
- The Advantage
- The Shortcoming
- The Second Method
- Advantage
- Shortcoming
- The Third Method
- Case Study #13
- Quiz #13

