COURSE OVERVIEW FE0593

Piping System and Specification (E-Learning Module)

Course Title

Piping System and Specification
(E-Learning Module)

Course Reference

FE0593

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 E-learning course is designed to provide participants with a detailed and up-to-date overview of piping system and specification. It covers the ASME B31.3 process piping, piping development process and ASME piping system standards; the severe cyclic conditions, metallic pipe and fitting selection; the bases for selection and flange P-T ratings; the reliability, robustness, fire resistance, blow-out resistance, tendencies to leak, corrosion resistance, corrosion under insulation and material toughness; and the piping component standards, listed components and some unlisted components.

During this course, participants will learn the fluid service requirements, pipe fluid service requirements, threaded joint fluid service requirements and solder; the brazed joint fluid service requirements and requirements miter bend fluid service; the important gasket characteristics and bolting fluid service requirements; the pipe and fitting selection, impact test methods and acceptance; the specific material consideration, aluminum and aluminum alloys; the pressure design of components, fittings, pipe bends, reducers, fabricated branch connections, flanges and blanks; and the code requirements, listed valves and P-T ratings.

Course Objectives

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

- Apply and gain a comprehensive knowledge on piping system and specification
- Discuss ASME B31.3 process piping, piping development process and ASME piping system standards
- Recognize severe cyclic conditions and employ metallic pipe and fitting selection
- Identify the bases for selection and review flange P-T ratings
- Discuss reliability, robustness, fire resistance, blow-out resistance, tendencies to leak, corrosion resistance, corrosion under insulation and material toughness
- Describe piping component standards and recognize listed components and some unlisted components
- Identify fluid service requirements, pipe fluid service requirements, threaded joint fluid service requirements and solder, brazed joint fluid service requirements and requirements miter bend fluid service
- Illustrate important gasket characteristics and identify bolting fluid service requirements
- Employ pipe and fitting selection as well as apply impact test methods and acceptance
- Discuss specific material consideration as well as differentiate aluminium and aluminium alloys
- Describe pressure design of components, fittings, pipe bends, reducers, fabricated branch connections, flanges and blanks
- Identify code requirements, listed valves and P-T ratings

Who Should Attend

This course provides an overview of all significant aspects and considerations of piping systems and specification for those who are involved in the inspection, repair, alteration and re-rating of in-service piping systems. Other engineers, managers, mechanical design draftsmen or technical staff who are dealing with piping systems will definitely benefit from this course.

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 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: -

- 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.

- 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 Fee
As per proposal

Course Contents

- ASME B31.3 Process Piping
- Scope of B31 .3 Course
- Introduction
- Definitions: (300.2)
- More Definitions
- Piping Development Process
- Piping System Standards
- ASME Piping System Standards
- Other Piping System Standards
- B31.3 Publication
- B31.3 Interpretations
- B31.3 Scope
- B31.3 Scope- Exclusions: (300.1.3)
- B31.3 Scope- Intent of the Code [300(c)]
- B31.3 Scope- Responsibilities [300(b)]
- Organization of the Code- “Base Code” Chapters:
- B31.3 Fluid Service Definitions
- Fluid Service
- Category D
- Category M
- High Pressure
- B31.3 Definitions
- Severe Cyclic Conditions
- Flammable
- Metallic Pipe & Fitting Selection
- The material in this section is addressed by B31.3 in:
- Bases for Selection
- Pressure Class
- Flange P-T Ratings— Gray Iron (psi)- (Class Rated in accordance with ASME B16.1)

- Flange P-T Ratings— Gray Iron (bar)- (Class Rated in accordance with ASME B16.1)
- Flange P-T Ratings — Carbon Steel (psi)- (Class Rated in accordance with ASME B16.5)
- Flange P-T Ratings — Carbon Steel (bar)- (Class Rated in accordance with ASME B16.5)
- Flange P-T Ratings — Carbon Steel (bar)- (PN Rated in accordance with EN 1092-1)
- Flange P-T Ratings — Carbon Steel (bar)- (K Rated in accordance with JIS B2220)
- Cl 300 Flange Ratings — Several Materials (psi)
- (Class Rated in accordance with ASME B16.5, B16.24 and B31.3)
- Reliability
- Robustness
- Fire Resistance
- Blow-out Resistance
- Tendencies to Leak
- Corrosion Resistance
- Corrosion Under Insulation
- Material Toughness
- Example of Brittle Fracture
- Example of Ductile Deformation
- Cost
- Piping Component Standards
- Some Listed Components – ASME
- Some Listed Components – Other
- Listed Components
- Some Unlisted Components
- Unlisted Components [302.2.3, 326.2.1]
- Fluid Service Requirements
- Fluid Service Requirements- Safeguarding examples
- Piping Components
- Pipe
- Pipe – Seamless
- Pipe – ERW
- Weld Joint Quality Factor Ej

- Pipe Fluid Service Requirements
- Fittings
- Fittings: Threaded
- Threaded Joint Fluid Service Requirements
- Fittings: Socket Welding
- Fittings: Buttwelding
- Fittings: OD Tubing
- Fittings: Water Tube
- Solder & Brazed Joint Fluid Service Requirements
- Fittings: Grooved
- Fittings: Compression for Pipe
- Fittings: Hygienic
- Fittings: Hygienic Clamp
- Fittings: Hygienic Buttweld
- Fittings for Severe Cyclic Conditions
- Requirements Miter Bend Fluid Service
- Branches
- Fabricated Branches
- Branches - Branch Connection Fittings
- Flanges (ASME B16.5)
- Flanges (ASME B16.5)- Other types of flanges - Slip-on
- Slip-on Flange Fluid Service Requirements
- Flanges (ASME B16.5)- Other types of flanges - Lapped joint
- Joints Similar to Lapped Joint
- Flanges Facings (ASME B16.5)- Raised — normal choice
- Flat
- Gaskets
- Important Gasket Characteristics
- Gaskets— Rubber
- Gaskets — Reinforced Rubber
- Gaskets – Fluoropolymer
- Gaskets - Flexible Graphite
- Gaskets - Spiral Wound
- Gaskets – Kammprofile

- Gaskets - Ring Joint
- Bolting
- 1st and 2nd degree burns
- Bolting Fluid Service Requirements
- Flanged Joints
- Pipe & Fitting Selection
- Case Study #1
- Quiz #1
- Materials
- The Material in This Section is Addressed by B31.3 in:
- Strength of Materials
- Bases for Design Stresses
- Bases for Design Stresses- Most Materials
- ASTM A106 Grade B Carbon Steel (US Customary Units)
- ASTM A106 Grade B Carbon Steel (Metric Units)
- ASTM A312 Gr TP316 Stainless Steel (US Customary Units)
- ASTM A312 Gr TP316 Stainless Steel (Metric Units)
- Additional Notes
- Bolting
- Gray Iron
- Malleable Iron
- Gray Iron
- B31.3 Material Requirements
- Listed and unlisted materials
- Temperature limits
- Table 323.2.2- requirements for low temperature toughness test
- Carbon steel lower temperature units
- Figure 323.2.2A
- Figure 323.2.2B
- Impact test methods and acceptance
- Acceptance criteria
- Fluid Service Requirements (323.4.2)
- Ductile iron
- Other cast iron

- Gray iron
- Malleable iron
- High silicon iron
- Aluminium casting
- Lead, tin & their alloys
- Clad Materials
- Deterioration
- Deterioration in service
- General Consideration
- Specific Material Consideration
- High alloy Steel
- Aluminium and aluminium alloys
- Pressure design
- The Material in This Section is Addressed by B31.3 in:
- Design Pressure & Temperature
- Weld joint quality factor E
- Weld joint strength factor
- Pressure design of components
- Straight Pipe
- Coefficient Y
- Straight Pipe Wall Thickness
- Pipe Wall Thickness
- Fittings
- Fittings – listed fitting example
- Pipe Bends
- Reducers
- Fabricated Branch Connections
- Flanges and blanks
- Bolt loads – section VIII, Div. 1
- Gasket factors
- Other components
- Straight Pipe – External Pressure
- Pipe Material Specification Workshop
- Case Study

- Quiz #2
- Valve Selection
- The Material in This Section is Addressed by B31.3 in:
- Code Requirements
- Listed Valves
- Gate Valve
- Gate Valve Stems
- Gate Valve Stem Pull Test
- Gate Valve Trim
- Gate Valve Discs
- Extended Body Gate Valve
- Knife Gate Valves
- Gate Valve Attributes
- Globe Valve
- Needle Instrument Valve
- Globe Valve Attributes
- Check Valve
- Dual-Plate Wafer Check Valves
- Check Valve Attributes
- Types vs. P-T Ratings
- Types vs. Manufacturers
- Butterfly Valve - Low Pressure
- Butterfly Valve - High Pressure
- Ball Valve
- Ball Valve Attributes
- Plug Valve Attributes
- Pinch Valve
- Pinch Valve Attributes
- Diaphragm Valve
- Diaphragm Valve Attributes
- Flexibility Analysis
- The material in this section is addressed by B31.3 in:
- What are we trying to achieve?
- Sustained Loads

- Sustained Loads – Weight
- Sustained Design Criteria
- For Occasional loads such as wind and earthquake
- Displacement Loads
- Displacement Design Criteria
- Allowable Stress Range Workshop
- Reaction Design Criteria
- Design Criteria Summary
- Flexibility Analysis Example
- Proposed System
- Sustained Load Analysis
- Displacement Load Analysis
- Flexibility Analysis
- Case Study
- Quiz #3
- Layout and Support
- The material in this section is addressed by B31.3 in
- Design
- General Considerations
- Support Spacing
- Usually based on simplifying assumptions
- Assuming simply supported ends
- Assuming Fixed ends
- For Cantilevered Piping
- For Propped End Cantilevered Piping
- Sagging Due to Creep (100,000 hrs)
- Support Locations
- Guide
- Spring Hangers
- Special Purpose Supports
- Support Element Selection
- The Sustained Load Analysis
- The Sustained Load Analysis- Acceptance criteria
- Fixing Problems

- Weight and Pressure Loads
- Wind and Earthquake Loads
- Reactions
- General consideration
- Fabricated equipment
- Calculation method
- Reaction limits
- Nozzle flexibility
- Rotating equipment
- Calculation methods
- Temperature range examples
- Reaction limits
- Supports
- Support flexibility
- Flanged joints
- Cold spring
- Case study #4
- Quiz #4
- Designing with Expansion Joints
- Types of Expansion Joints
- Pressure Thrust
- Installation of Expansion Joints
- Bellows Movement
- Universal Expansion Joint
- Hinged expansion joint
- Gimbal expansion joint
- Pressure balanced Expansion join
- Bellows expansion joint types
- Metal bellows expansion joints
- Bellow shapes (EJMA)
- Metal Bellows Failure Modes
- Flixborough Disaster
- Metal bellows fatigue
- Special design

- Designer responsibilities
- Metal bellows design conditions
- Piping design for metal bellows
- Installation and testing
- Manufacturer responsibilities
- Other consideration
- Problems to avoid
- Fabrication and installation
- Fabrication, assembly and erection
- Welder qualification
- Bazer qualification
- Welding processes – fusion weld
- Welding Processes — Electric Arc
- Shielded Metal Arc Welding
- Gas Metal Arc Welding
- Flux Cored Arc Welding
- Gas Tungsten Arc Welding
- Welding Processes
- Weld Preparation
- Typical Welds
- Untypical Welds
- Typical Welds
- Preheating
- Heat Treatment
- Bending and Forming
- Typical Owner Added Requirements
- Installation- Code Requirements
- Installation-Typical Owner Added Requirements
- Flange Joints
- Case Study #5
- Quiz #5
- Inspection, Examination & Testing
- Typical Weld Imperfections
- Examination Methods

- Examination Methods- Visual
- Examination Methods- Positive Material Identification
- Examination Methods- Liquid Dye Penetrant
- Examination Methods- Magnetic Particle
- Examination Methods- Radiography
- Examination Methods- Ultrasonic
- Examination Methods- Radiography- In-Process
- Examination Methods- Radiography- Progressive Sampling for Examination
- Examination Requirements - VT
- Acceptance Criteria for Welds
- Testing
- Leak test methods-Hydrostatic
- Leak test methods- Pneumatic
- Leak test methods- Initial Service
- Leak test methods- Sensitive
- Leak test methods- Alternative
- Leak test required
- Other leak test provision
- System
- Instrument piping
- Pressure relieving Systems
- Pressure containment or relief
- Case Study #6
- Quiz #6
- Nonmetallic Piping
- Nonmetallic Piping and Piping Lined with Nonmetals
- Stress Tables and Allowable Pressure Tables for Nonmetals
- General
- Thermoplastic- Characteristics
- Thermoplastic- Allowable Stress
- Allowable Stress- US Customary Units
- Allowable Stress- Metric Units
- Pressure Design — Three Methods
- Pressure Design — Straight Pipe

- Pressure Design — Other components with specific Code formulas
- Flexibility Analysis – Purpose
- Flexibility Analysis — Support
- Flexibility Analysis — Flexibility & Reactions
- Thermoplastic- Fabrication
- Thermoplastic- Bonders
- Thermoplastic- BPS and Bonder Qualification Tests
- Examination Required — Normal Fluid Service
- Examination Required — Category D Fluid Service
- Reinforced Thermosetting Resins [RTR]
- Filament wound
- Reinforced thermosetting resins
- Reinforced thermosetting resins- Centrifugally Cast
- Reinforced Thermosetting Resins- Reinforced plastic mortar pipe
- Reinforced Thermosetting Resins- Vendor recommended temperature limits
- Reinforced Thermosetting Resins- Characteristics
- Allowable Stress — Filament Wound and Centrifugally Cast
- Allowable Stress — Contact Molded
- Pressure Design — Same as for thermoplastic pipe
- Flexibility Analysis
- Flexibility Analysis — Support
- Flexibility Analysis — Flexibility & Reactions
- Fabrication
- Reinforced Concrete
- Vitrified Clay
- Borosilicate Glass
- Piping Lined with Nonmetals
- Typical Fittings
- Untypical Fittings
- Common Thermoplastic Liners
- B31.3 recommended temperature limits for liners:
- Limitations
- Thermoplastic Piping
- Category M Fluid Service

- Piping for Category M Fluid Service
- Design Requirements
- Metallic
- Nonmetallic
- Examination Requirements – VT
- Metallic Leak Test Requirements
- Nonmetallic Examination and Testing Requirements
- Typical Owner Added Requirements
- Case Study #7
- Quiz #7
- High Pressure Piping
- Allowable Stresses for High Pressure Piping
- Materials
- Impact Test Requirements
- Materials
- Pressure Design – Straight Pipe
- Pressure Design- External Pressure
- Pressure Design- Fatigue Analysis
- Limitations- Not permitted
- Limitations- Joints not permitted
- Flexibility analysis
- Fabrication
- Examination requirements
- Testing
- Overpressure protection
- Case study #8
- Quiz #8
- In-Service Piping
- API 570 Piping Inspection Code
- Responsibilities
- Responsibilities- Repair Organization
- Responsibilities-Inspector
- What to inspect
- External Inspection Checklist

- Types of inspection
- Inspection practices
- Frequency and extent of inspection
- Class 1 - Greatest hazard (safety or environmental) should a leak occur
- Class 2 - Includes services that are not Class 1 or Class 3
- Class 3
- Inspection Intervals
- Extent of CUI Inspections
- Extent of Small-Bore Piping Inspection
- Remaining Life Calculation
- 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
- ASME B31.3 Code Interpretations
- Case Study #10
- Quiz #10