

A Live Online Course

# Piping and Pipeline Systems

Presented by Dr. Maurice Stewart

## INTRODUCTION

This Plant Piping and Pipeline Systems course is designed and conducted by Dr. Maurice Stewart.

In this live online training, participants will learn all the essential aspects of piping and pipeline design such as how to:

- Determine pressure drop, wall thickness and optimize line size for gas, liquid and two-phase flow
- Apply international design codes / standards such as **ASME/ANSI B31.3, ASME / ANSI B31.4, ASME ANSI B31.8, ASME Section VIII, Division 1 & 2, ANSI B16.5, API RP 14E, API RP 14C and API RP 14J, API RP 520 Part 1 & 2, API 521, API 526, API 2000, API 1104 and NACE MR-01-75**
- Select the appropriate **ANSI / API** pressure/temperature ratings for pipe flanges, valves, and fittings
- Analyze piping systems so as to determine piping “**spec breaks**”
- Design and analyze new and existing piping systems for expansion, supports, pumping, compression, manifolds, pigging and insulation requirement

- Inspect and test piping and pipeline system
- Specify and design a pipeline pigging system
- Detect, monitor and control pipeline corrosion
- Evaluate a piping system for Stress and Dynamic Loading
- Select the appropriate relief device and set pressure for each application and size the device for the worst-case condition such as blocked discharge, gas blow-by, and fire.

Maurice Stewart is the author of Surface Production Operations: Volume III: Facility Piping and Pipeline Systems. He has a storehouse of knowledge and experience that he passes along to help the participants get a unique multidiscipline approach to combine electrical, mechanical, civil and petroleum methods in solving the problems associated with piping and pipelines.

## **COURSE CONTENT**

### **Fluid Flow Design**

- Types and Functions of Piping Systems
- Fluid Flow, Types and Characteristics
- Flow Conditions
- Special considerations: emulsions, pigging, corrosion protection
- Networks

### **Pressure Drop Calculations**

- Basic Equations and Factors
- Bernoulli's Equation
- Darcy's Equation
- Reynolds Number
- Liquid and Gas Viscosity
- Relative Roughness
- Friction Factor- Equations and Charts
- "Z" Factor Correlation's
  - Basic Pressure Drop Equations

- General and Empirical Hazen-Williams Equations for Liquids
- Isothermal, General, Weymouth and Panhandle Equations for Gases
- Approximate Equations for Small Pressure Drops
- Spitzglass Equation for very low-pressure lines
- Fritzsche's and Babcock Equations for Steam Flow
- AGA, API RP 14E and other Empirical Equations for Two-Phase Flow
- Application of Pressure Drop Equations
- Effects of Elevation on Pipeline Pressure Drop
  - Head Loss in Valves and Fittings
- Resistance and Flow Coefficients
- Equivalent Length Determination

### **Choosing a Line Size and Wall Thickness**

- Line Size Determination
- Flow Rate and Surge Factor Considerations
- Pressure Drop Considerations
- Maximum/Minimum Velocities
- Erosional Velocity
- Single-Phase Liquid and Gas Line Sizing
- Two-Phase Line Sizing
  - Wall Thickness Determination
- Industry Standards and Design Code Requirements
- General Hoop Stress Formula
- ASME/ANSI B 31.3; B 31.4 and B31.8 Equations
- Location Class Determination
- ASME/ANSI B31.3 and B31.8 Comparison

### **Pressure Ratings and Determining Pressure Breaks Values**

- Piping Components
  - Methods of Connecting Pipe
  - Fittings
- Design Procedure
- ANSI B16.5 and API 6A Pressure Ratings
- Determination of Pressure Breaks

## **Pipe, Valve and Fittings Specifications**

- Valve Specifications
- Valve Terminology
- Block Valves
- Plug Valves
- Ball Valves
- Globe Valves
- Butterfly Valves
- Special Purpose Valves
- Valve selection
- Materials of Construction
- Factors Modifying the Valve Type

## **Piping Systems**

- Terminology
- Steel Lines
  - Material Specification
  - Pipe Manufacturing Methods
- Non-Metallic Lines
  - Material Specification
  - Joining Methods
  - Standards, Codes, and Recommended Practices
- Design Practices
  - Transmission, Flowlines and Distribution Lines
  - Manifolds
- Plant Piping Systems
- Designing Loop Systems
  - Loop Capacity and Length
  - Equivalent Diameter
  - Flow Splitting and Branch Lines
  - Complex Liquid and Gas Gathering Systems

## **Piping System Design**

- Piping Layout
- Pipe Support Spacing
- Anchor Blocks

- Manifolds
- Foundation Integrity
- Piping Vessels, Heat Exchangers, and Fired Heaters
- Piping Machinery
  - Centrifugal and Reciprocating Compressors
  - Centrifugal and Reciprocating Pumps
  - Gas Engines and Turbines
- Pipe Stress
  - Weight Stress
  - Internal Pressure Stress
  - Thermal Stress
  - Expansion Piping
  - Pipe Dynamics
  - Special Piping Considerations
  - Hot Tapping
  - Hydrostatic Testing Stubs
  - Dynamic Loading

### **Pipeline and Gathering Systems Design Considerations**

- Right-of-way Considerations
- Pipe Selection
- Design Considerations
- Construction Considerations
- Ditch and Coating Considerations
- Burying and Crossings
- Cathodic Protection

### **Pipeline Inspection and Testing**

- ASME/ANSI B31.3; B31.4 and B31.8 Code Requirements
- Hydraulic/Pneumatic Tests
  - Equipment Requirements
  - Test Pressure Requirements
  - Test Records
- X-Ray Requirements
  - Visual Examination

### **Pipeline Pigging**

- Principles and Objectives
- Pigging During Construction
- Pigging During Operation
- Inspection Pigging
- Pigging for General Maintenance and Repair
- Pigging During Renovation/Rehabilitation
- Types and Sizes
- Designing a Pipeline for Pigging
- Pig Traps and Stations
- Equipment Description and Uses
- Designing and Running a Cleaning Program

### **Control of Pipeline Corrosion**

- Fundamentals of Corrosion
  - Reactions, Electrolyte Composition, and Physical Variables
  - Types of Corrosion
- Corrosion Inhibitors
  - Theories and Characteristics
  - Selection
- Cathodic Protection
  - Basic Principles
  - Current Requirements
  - Components and Operating Characteristics of Galvanic and Impressed
  - Current Systems
- Evaluation of System Performance, Interpretation of Data and Common
- Measurement Errors
  - Metallurgy and Materials Selection
    - Metallurgical Principles, Heat Treatment, and Alloys
    - Materials Selection
  - Coatings Linings and Non-Metallic's
  - Types of Coatings, Selection, and Application
  - Selection and Use of Non-Metallic Piping
  - Corrosion Monitoring

- Coupons, Nipples Resistance, Polarization, Galvanic and Hydrogen Probes
- Iron Counts and other Chemical Tests
- Clipper Tools and Wall Thickness Calculations

### **Relief Valves and Pressure Vacuum Relief Devices**

- Relieving Devices, Applications and Limitations
- Relief Valve Sizing
- Pressure Vacuum Relief Sizing
- Installation Considerations
- Relief System Piping Design
- Venting Considerations
- Applicable Codes, Standards, and Recommended Practices

### **Flare and Vent Disposal Piping Systems**

- Back-pressure Considerations
- Applicable codes
- Flare and Vent Piping Systems

### **Pipeline Repair**

- In-Service Temporary Repairs
- Permanent Repairs
- Case Studies

### **WHO SHOULD ATTEND**

- New engineers, asset management team members, design and construction engineers, team leaders/coordinators, operations engineers, construction coordinators, maintenance team leaders/engineers, operations team leaders, senior operations and maintenance personnel and other personnel who are or will be responsible for designing, selecting, sizing, specifying, installing, testing, operating and maintaining plant piping and oil and gas pipelines

- Experienced professionals who want to review or broaden their understanding of facility piping and pipelines
- Professionals with little to moderate piping or pipeline design and operations background
- Other professionals who want a better understanding of the subject matter.

## ABOUT THE INSTRUCTOR - DR. MAURICE STEWART



Dr. Maurice Stewart is internationally respected for his teaching excellence and over 45 years of experience in all aspects of facilities engineering. He has provided consultation and/or instruction to tens of thousands of professionals in numerous companies in virtually every oil and gas production sector in the world.

He has authored or co-authored 12 books, including the widely acclaimed ***“Surface Production Operations”*** series which continues to be the standard for the industry.

Also, he has published numerous technical articles in industry publications, co-authored multiple chapters in the ***“Facilities and Construction Engineering, Volume III of the Petroleum Engineering Handbook”***, taught numerous short courses for the Society of Petroleum Engineers (SPE), and was on the Petroleum Engineering faculty of Tulane University and Louisiana State University where he developed and taught eight graduate-level courses in surface production operations.

## DAILY WEBINAR HOURS

Session 1 – 8:00 – 9:30



Session 2 – 10:00 – 11:00

Session 3 – 11:30 – 12:30

Jakarta Time (WIB)

There will be assignments to be completed before the next day's session.

## **REGISTRATION INFORMATION**

Two ways to register:

1. Register online on [www.lditraining.com](http://www.lditraining.com)
2. Email your registration message to LDI Training at [lditrain@indo.net.id](mailto:lditrain@indo.net.id)

For more information about the course, please contact PT Loka Datamas Indah by:

- Email: [lditrain@indo.net.id](mailto:lditrain@indo.net.id)
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