

## PD410 Detail Engineering of Piping Systems

Module 1		Introduction to Plant Design
	1.1	Piping Introduction
	1.2	A Typical Plant Design Project
	1.3	Plant Layout
	1.4	Process Flow Diagram
	1.5	Piping and Instrumentation Diagrams
	1.6	Piping Layouts
	1.7	Isometrics
Module 2		P&ID's Symbols, Piping Specifications and Line Lists
	2.1	P&ID's
	2.2	Piping and Equipment Designations and Symbols
	2.3	Instrumentation Designations and Symbols
	2.4	Piping Line Lists
	2.5	Piping Documentation
	2.5.1	Drawing List
	2.5.2	Equipment List
	2.5.3	Piping Specifications
Module 3		
Module 3		Piping
Module 3	3.1	<b>Piping</b> Piping
Module 3	3.1 3.2	, -
Module 3		Piping
Module 3	3.2	Piping Pipe Manufacture
Module 3	3.2 3.3	Piping Pipe Manufacture Pipe Fabrication Practices
Module 3	3.2 3.3 <i>3.3.1</i>	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication
Module 3	3.2 3.3 3.3.1 3.3.2	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing
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Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.4 3.5	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing Pipe Designation Fittings
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.4 3.5 3.5	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing Pipe Designation Fittings Butt Weld Fittings
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.4 3.5 3.5 3.5.1 3.5.2	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing Pipe Designation Fittings Butt Weld Fittings Threaded and Socket Weld Fittings
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.4 3.5 3.5.1 3.5.2 3.5.3	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing Pipe Designation Fittings Butt Weld Fittings Threaded and Socket Weld Fittings Victaulic Fittings
Module 3	3.2 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.4 3.5 3.5 3.5.1 3.5.2 3.5.3 3.5.4	Piping Pipe Manufacture Pipe Fabrication Practices Shop Fabrication Field Fabrication Joining Pipes Modular Design Pressure Testing Pipe Designation Fittings Butt Weld Fittings Threaded and Socket Weld Fittings Victaulic Fittings Compression Fittings



	3.8	Shop Inspection
	3.9	Installation
Module 4		Valves
	4.1	Valve Function
	4.2	Gate Valves
	4.3	Globe Valves
	4.4	Plug Valves
	4.5	Ball Valves
	4.6	Check Valves
	4.6.1	Swing Check Valves
	4.6.2	Lift Disc Check Valves
	4.6.3	Ball Check Valves
	4.6.4	Wafer Check Valves
	4.6.5	Silent Check Valves
	4.7	Butterfly Valves
	4.8	Diaphragm Valves
	4.9	Pinch Valves
	4.10	Valve Symbols
	4.11	Valve Dimensions
Module 5		Pipe Supports
	7.1	Pipe Supporting Systems
	7.2	Recommended Pipe Spans
	7.3	Pipe Spacing
	7.4	Pipe Shoes
	7.5	Base Ells and Dummy Legs
	7.6	Pipe Guides
	7.7	Pipe Restraints (Limit Stops)
	7.8	Rod Hangers
	7.9	Variable Spring Hangers
	7.10	Constant Load Hangers
Module 6		Steam Piping
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	8.1	Steam Piping
	8.2	Steam Traps
	8.3	Steam Trap Selection
	8.4	Steam Control Sets



	8.5	Steam Tracing
	8.6	Hose Stations
	8.7	Expansion of Steam Lines
Module 7		Pumps
	11.1	Centrifugal Pumps
	11.2	ANSI End Suction Pump
	11.3	API 610 Pumps
	11.4	Pump Piping
	11.5	Cavitation
	11.6	Pump Curves
	11.7	Pump Calculation
Module 8		Thermal Expansion
	18.1	Piping Stress Analysis Logic
	18.2	Minimum Flexibility Requirements
	18.3	Allowable Expansion Stress Range
	18.3	Flexibility
	18.4	Stress Analysts' Function
	18.5	Allowable Expansion Stress Range
	18.6	Codes and Regulations
	18.7	Scope of Code Rules
	18.8	Flange Leakage
	18.9	Building Flexibility into your Layouts
	18.10	Loads at Pumps
	18.11	Loads at Steam Turbines
	18.12	Loads at Compressors
	18.13	Loads at Exchangers
	18.14	Loads at Vertical Vessels
	18.15	Excessive Thrusts or Moments on Connected Equipment
Module 9		Line Sizing
	19.1	Calculating Wall Thickness
	19.2	Code Formula for Wall Thickness
	19.3	Wall Thickness Example Problems
	19.4	Friction Loss Calculations for Water
	19.5	Friction Loss Calculations for Viscous Fluids
	19.6	Friction Loss Calculations for Gases, Vapors, Steam and Air



Module 10

**Review, Case Studies and Assignment**