

€ TRAINING

Pipes and Piping Systems Optimization



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Introduction:

The present state of the art design of piping systems is based on the close interaction and collaboration between system designers and operators. The operator's experience with running complex piping systems for long periods is an important factor in improving the design. The most delicate design problems are encountered during the expansion of systems when they are made larger or more complex. For a piping system to operate in a problem-free manner, the design and installation of a piping system requires attention to multiple factors. During the past few decades, pipeline systems and technologies have been progressing at a fast pace in all aspects of the design, operation, and automatic control. The systems have grown in size and intricacy, and today's trends in the industry are aimed at enlarging the flow rates, pipe diameters and working pressures for a wide variety of fluids to be handled, including very complex and difficult ones. All of these factors impose strong requirements on careful design, precise operation and complex control.

Pipeline operation engineers and managers have to be sufficiently familiar with the details of fluid flow in piping systems as well as with modern technologies, to make informed decisions on various technical aspects of the designed system and its future operation. There is a need for detailed monitoring of everyday operations, as well as computer-based centralized automatic control of the operation of large systems. At the same time, environmental concerns and safety issues require highly sophisticated monitoring and control systems

Course Objectives:

At the end of this course the participants will be able to:

- Understand the requirements of industry standards for pipeline inspection
- Appreciate the technical characteristics of piping systems, their applications in the process and chemical industry
- Know the methods of the hydraulic and mechanical design of piping systems according to existing world standards and codes
- Learn the procedures for the selection of best piping systems based on the optimization technique, resulting in pipe diameter and cost of material
- Use the methods of diagnosing and estimating the degree of deterioration of pipelines
- Recognize the guidelines for improving the efficiency of the overall piping system

Targeted Audience:

- Plant professionals dealing with operation pipeline systems
- Engineers responsible for the reliability of operation
- Engineers and technical staff in charge of inspection and condition monitoring
- Technical professionals involved in technical support and maintenance and repair
- Engineers in charge of the planning of new pipelines and retrofitting old ones

Course Outlines:

Unit 1: Overview of Piping Systems:

- Main features of various types of piping systems
- Classification of piping systems based on the design and application
- World standards and codes on design properties of pipes
- Main steps in the design and construction of piping systems
- Physical and transport properties of fluids: density, viscosity, particle contents
- Basics of flow analysis in pipes - laminar and turbulent flow regimes

Unit 2: Calculation of Pressure and Velocity Distribution in Piping Systems:

- Calculation of pressure losses and horsepower required for fluid transportation
- Selection and sizing of pipes for different applications: liquids, gases, slurries, etc.
- Calculation of minor losses in the piping system
- Basics of mechanical design: a selection of pressure class of pipe and stress ratios
- Hydrostatic testing: allowable operating pressure and hydrostatic test pressure
- Pipe construction: pipes above-ground and pipes buried

Unit 3: Pumps and Compressors Used in Pipelines:

- Pump interaction with the system, cavitations: work in series and parallel
- Multi-pump stations and tanks
- Pump calculation and selection
- Compressor interaction with the system, avoiding surge, stall, and choking
- Multi-compressor stations and gas holders
- Compressor calculation and selection
- Pipe networks and pipe branching: problems with transients and their control

Unit 4: Control Valves in Pipelines:

- Control valves: selection, sizing, and cavitation issues
- Flow measurements and monitoring instrumentation
- Pipeline system automation control
- Guidelines for pipeline installation, operation, and maintenance
- Inspection, examination, and testing of pipelines
- The vibration of pipes and pipelines and their mechanical support and anchorage

Unit 5: Operation and Maintenance of Piping Systems:

- Leak detection and prevention and failure risk analysis
- Pipeline protection for prevention of corrosion and erosion
- Environmental concerns: impact of above-ground and buried pipelines
- Off-shore pipelines: design and operation
- Special consideration for safety and supervision
- Pipeline feasibility study and economic analysis: capital and operation costs