

Pipelines: Design, Construction and Operation

Course Objectives:

Pipeline systems are very essential parts of any industrial and practical engineering application. Designing of pipelines components and their operation and maintenance as well are in fact one of the very important practices of most engineers and technicians. Availability, efficiency and extended reliable performance of power plants, pumping and fluid handling stations and all similar facilities are greatly influenced by accurate design, selection, efficient operation and proper maintenance of their piping systems and the associated components and flow measurement equipments.

Designing of piping system is to apply all relevant “Fluid Mechanics” concepts concerning flow in pipes and ducts to solve various practical problems of engineering importance related to fluid motion in pipelines components. Some of the involved fluid mechanics concepts: Viscosity of fluids, characteristics of laminar and turbulent pipe flows, critical Reynolds numbers, major pressure and head losses and types of minor losses in different fitting components. Manual and control valves are also essential parts of pipelines.

Valves control flow parameters such as: rate, pressure, direction, and water hammer protection valves. Valves are constructed to withstand specific range of flow rate, temperature, pressure, corrosion, and mechanical stress. Emergency and pressure relief valves and ruptured disks are practically the key elements in the safe operation of any high pressure and high temperature process. The correct selection and application as well as the safe operation and maintenance requirements of those critical components shall affect greatly cost optimisation, plant availability, personnel and equipment safety as well as fluid leakage and many related environmental issues

This Course has been designed to give participants the skills and knowledge to:

- Understand the basics and fundamental backgrounds about fluid flow in pipes and ducts and all various components of pipeline systems.
- Understand the basics and fundamental backgrounds about Viscosity of fluids, characteristics of laminar and turbulent pipe flows, critical Reynolds numbers.
- Care-full examination of how to calculate major pressure and head losses and types of minor losses in different pipeline fittings and components.
- Understand the basics about types of manual and control valves as essential parts of pipelines. This shall include their various functions, materials, sizes, geometry considerations and the most essential flow characteristics through each type.
- Care-full examination of pressure drop relations and flow coefficient calculations for each valve type. How to select the proper valve size for a given flow is also considered.
- Investigate the various international standards for valve rating, material selection and methods for correct valve sizing for different type of fluids..
- Care-full examination of various types of emergency and pressure relief valves and ruptured disks.
- Care-full examination of various types of automatic control valves and water hammer protection valves.

- Care-full examination of various types of pipelines associated flow measurement components and equipments.

Instructional & Beneficial Methods:

This program will provide the skills and practical knowledge with the necessary theoretical background to identify various types of pipelines, fittings and flow measurement components used in all engineering applications. It will also cover the main functions of valves and the related pressure drop characteristics. Latest designs and techniques to do correct selection and sizing to improve reliability and performance are discussed.

By use of an extensive number of colourful images and graphics presentations blending applicational experience, technical developments and sufficient simplified theory the topics are interactively discussed and justified to pass on working knowledge, ability and confidence in day to day working environment

Recollection and further development after the course are aided by a detailed workbook with clear concise information encouraging practical use whenever necessary during the individual's heavily loaded daily workplace programme.

Who Should Attend:

Engineers and Field Personnel involved with maintenance, operation, selection installation and maintenance as well as plant reliability, condition monitoring and for the day to day servicing and operational efficiency. Also plant and maintenance engineers, process engineers and maintenance managers. It is also be invaluable to supervisors who are involved in pump and compressor maintenance activities.

The Instructor:

Dr. Soliman is an Associate professor of fluid mechanics in Mechanical Power Engineering Department – Cairo university. He has a Ph.D. degree, 1987 from university of California, Irvine and has a long teaching and research experience in the area of fluid flow, turbomachines, and gas dynamics and has many research papers published at international conferences and journals. Dr. Soliman has had many years' experience in organizing and lecturing training courses for engineers in Egypt and Gulf area. The courses cover design pipe lines, gas turbines, valve technology, water hammer and fire fighting systems. In short, Dr. Soliman is considered one of the distinguished experts in the field of fluid mechanics and turbomachinery.

Course Content:

Chapter [1] : **Introduction & Basic Concepts:**

-Fundamental Aspects of Fluid Flow Piping Systems, Types and components of Piping Systems, Review of Hydraulic considerations, Major and Minor Losses in Piping Systems, Types of Pipe Fittings, Solved Examples.

Chapter [2] : **PIPEING SYSTEM DESIGN CALCULATIONS**, Solved Practical Cases

Chapter [3] : **Using Computer Software in the design of Piping systems**

Chapter [4] : **Types of Valves (basic functions, selections:**

hydraulic considerations, construction, ratings, materials, Flow through valves, pressure losses, design facts / parameters - Manual Valves (types, selection, connections, operation) - Check Valves (types, selection, design and installation factors)-Reducing and Pressure Relief Valves (direct acting, characteristics) - Automatic Control Valves (spool types, single/multi-stage controls)- Valve Maintenance -Examples for automatic Valves & movies

Chapter [5] : **Types of Flow Meters**

Daily Course Program

Day one:

9:00 – 9:30	Registration	
9:30 – 10:45	Lecture 1	Fundamentals of Piping Systems
10:45 – 11:00	Coffee break	
11:00 – 12:15	Lecture 2	Fluid Flow Aspects of Pipelines+ Movie
12:15 – 13:00	Lunch break	
13:00 – 15:00	Lecture 3	Practical Pipe Flow Examples + Movies

Day Two:

9:30 – 10:45	Lecture 4	Pipe Networks + practical movies
10:45 – 11:00	Coffee break	
11:00 – 12:15	Lecture 5	Computer software for Piping systems
12:15 – 13:00	Lunch break	
13:00 – 15:00	Lecture 6	Water Hammer,

Day Three:

9:30 – 10:45	Lecture 7	Thermo-Fluid Aspects of pipelines
10:45 – 11:00	Coffee break	
11:00 – 12:15	Lecture 8	Flow Through Valves, fundamentals
12:15 – 13:00	Lunch break	
13:00 – 15:00	Lecture 9	Manual Valves

Day Four:

9:30 – 10:45	Lecture 10	Check Valves
10:45 – 11:00	Coffee break	
11:00 – 12:15	Lecture 11	Pressure Relief Valves
12:15 – 13:00	Lunch break	
13:00 – 15:00	Lecture 12	Movies + Automatic Valves

Day Five:

9:30 – 10:45	Lecture 13	Valve testing and Maintenance
10:45 – 11:00	Coffee break	
11:00 – 12:15	Lecture 14	Types of Flow Meters + Movies
12:15 – 13:00	Lunch break	
13:00 – 15:00	Lecture 15	Applications, case studies

- Course Review
- Case Studies , Group Exercises & Discussions
- Course Evaluation , Course Summary