

Introduction

Heat exchangers are vital and expensive pieces of equipment used across a wide range of industries. This comprehensive conference on heat exchanger types, applications, design, operation, and maintenance provides participants with an in-depth understanding of the fundamental principles of heat transfer and fluid flow. It also covers the design and operational aspects of different types of heat exchangers, including shell and tube units, plate exchangers, air-cooled systems, and specialized designs, with the aim of improving efficiency and extending service life.

The program presents a detailed explanation of the primary categories of industrial heat exchangers, highlighting their unique characteristics and applications. Practical guidelines are provided to support participants in selecting the most suitable type of heat exchanger for specific operational needs.

Participants will also develop a stronger ability to apply internationally recognized codes, standards, and best practices for heat exchanger design and operation, including those set forth by the American Society of Mechanical Engineers, the Tubular Exchanger Manufacturers Association, and the American Petroleum Institute. The conference covers a wide range of topics, including the fabrication process, materials of construction, cost considerations of tubular exchangers, condensers, and reboilers, as well as the causes and mitigation of fouling, and strategies to prevent vibration and damage in exchanger tubes.

Understanding What a Heat Exchanger Is

Training in heat exchangers is essential for professionals responsible for the operation and maintenance of these systems across different industries. This in-depth course addresses every critical aspect of heat exchangers, including their types, applications, design considerations, and maintenance procedures.

The course emphasizes both the theoretical and practical aspects of heat exchangers, ensuring participants develop an advanced understanding of their applications and operational requirements. The program also provides step-by-step maintenance practices to ensure long-term functionality and reliability of heat exchangers in industrial environments.

Intended Audience

- Maintenance professionals
- Inspection personnel
- Process supervisors
- Plant operators
- Plant and technical managers

Objectives of the Conference

By the conclusion of this conference, participants will be able to:

- Explain the essential role and importance of heat exchangers in ensuring cost-effective plant operations
- Understand the basic principles of heat transfer, hydraulics, and fluid flow, and apply them in the thermal design of heat exchangers
- Apply appropriate methodologies for mechanical design in compliance with established industry codes, standards, and recognized best practices
- Identify and implement cost-effective technologies and methods to improve the performance and reliability of heat exchangers
- Gain integrated knowledge in the areas of hydraulic, thermal, and mechanical design of exchangers
- Recognize and predict the causes of performance loss and structural damage in heat exchangers, and take preventive action to reduce risks of failure and unnecessary energy loss

Targeted Competencies

By attending this conference, participants will develop competencies in the following areas:

- Understanding of heat exchanger design features and performance requirements
- Knowledge of heat transfer principles and applications
- Familiarity with international codes and standards for design, fabrication, operation, and maintenance
- Skills in identifying and addressing fouling, corrosion, erosion, and operational performance issues
- Proficiency in inspection methods to assess integrity and extend equipment lifespan

Conference Content

Unit 1: Types and Applications of Heat Exchangers

- Introduction and basic concepts
- Importance of heat exchangers in the petroleum, petrochemical, and process industries
- Principles of heat transfer and heat transfer coefficients
- Overview of different types of heat exchangers and their applications
- Shell and tube exchangers
- Compact exchangers
- Plate exchangers
- Printed circuit exchangers
- Heat pipe exchangers
- Air-cooled exchangers

- Regenerative exchangers
- Geometry of shell and tube exchangers and double-pipe exchangers, including naming systems, configurations, and selection criteria

Unit 2: Thermal and Hydraulic Design of Heat Exchangers

- Determining size and specifications of heat exchangers
- Understanding temperature differences in shell and tube exchangers
- Study of countercurrent, cocurrent, and cross-current flow arrangements
- Flow arrangements and comparisons
- Practical case studies and worked examples
- Velocity analysis and performance derived from first principles
- Pump performance curves including head, capacity, efficiency, and power
- Understanding system curves involving static, friction, and pressure head components
- Analysis of fluid flow and pressure drops in exchangers
- Design aspects of shell and tube exchangers
- Design aspects of plate exchangers
- Considerations in condenser and reboiler design

Unit 3: Mechanical Design of Heat Exchangers

- Principles of mechanical design and recognized construction practices
- International codes and standards including the American Society of Mechanical Engineers Section Eight, American Petroleum Institute standards, and Tubular Exchanger Manufacturers Association guidelines
- Basic designs of shell and tube, plate, and air-cooled exchangers
- Special design considerations for specific operating conditions
- Piping loads on exchanger nozzles
- The influence of service conditions on material selection
- Materials used in the fabrication of exchangers
- Manufacturing processes for different exchanger types

Unit 4: Operation and Maintenance of Heat Exchangers

- Fouling mechanisms in heat exchangers and their economic impact
- Strategies for fouling prevention during design, operation, and maintenance
- Corrosion and erosion issues in exchangers and mitigation approaches
- Inspection methods for condition assessment

- Troubleshooting operational issues
- Monitoring and testing performance of exchangers
- Vibration issues caused by fluid flow, prediction methods, damage risks, and design strategies to prevent vibration, including the use of baffles and advanced tube configurations
- Cleaning techniques for shell and tube exchangers, plate exchangers, and air-cooled exchangers
- Repair strategies and replacement practices for exchangers
- Approaches to cost-effective maintenance and life extension

Unit 5: Performance Enhancement and Optimization of Heat Exchangers

- Techniques for improving heat transfer efficiency
- Use of finned tubes for enhanced thermal performance
- Internal tube enhancements, inserts, and advanced coatings
- Replacement of tube bundles with improved designs
- Advanced baffle systems including rod baffles, helical baffles, and twisted tubes
- Application of pinch technology for energy optimization
- Heat exchanger network optimization
- Basics of heat integration for maximum process efficiency