TRAINING TITLE

SHELL AND TUBE HEAT EXCHANGERS-MECHANICAL

Training Duration

5 days

Training Venue and Dates

Ref No. ME124	Shell and Tube Heat Exchangers-Mechanical	5	14-18 Apr. 2025	$5,500	DUBAI, UAE

In any of the 4 or 5-star hotels. The exact venue will be informed later.

Training Fees

- **$5,500 per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Lunch**

Training Certificate

Define Management Consultants Certificate of course completion will be issued to all attendees.

TRAINING DESCRIPTION

The Shell and Tube Heat Exchangers - Mechanical Course is designed for professionals involved in the design, operation, and maintenance of shell and tube heat exchangers. Shell and tube heat exchangers are widely used in industrial applications, such as chemical processing, oil refining, HVAC systems, and power plants. This course provides a detailed understanding of the mechanical aspects of these heat exchangers, including their design, construction, operation, and troubleshooting.

TRAINING OBJECTIVES

By end of course participants will be able to understand

- **Understand Heat Transfer Principles: Learn the fundamental principles of heat transfer and how they apply to shell and tube heat exchangers.**
- **Design Shell and Tube Heat Exchangers: Understand the mechanical design principles for shell and tube heat exchangers, including thermal and hydraulic design.**
- **Understand Fluid Flow and Pressure Drops: Gain knowledge of how fluid flow and pressure drops affect heat exchanger performance and learn how to optimize these parameters.**

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- **Evaluate Heat Exchanger Performance: Learn to assess the performance of heat exchangers, including heat transfer efficiency, fouling, and corrosion issues.**
- **Select Materials for Shell and Tube Heat Exchangers: Understand the material selection process for different operating conditions, including temperature, pressure, and fluid compatibility.**
- **Troubleshoot and Maintain Heat Exchangers: Develop troubleshooting skills to identify and resolve common mechanical problems, such as leaks, fouling, and corrosion.**
- **Understand Safety and Regulatory Requirements: Learn about the safety standards and codes governing the design, operation, and maintenance of shell and tube heat exchangers.**

WHO SHOULD ATTEND?

- **Mechanical engineers and technicians**
- **Process engineers and plant operators**
- **Maintenance personnel**
- **Design engineers and fabricators**
- **Project managers in industries such as oil and gas, power, chemicals, and HVAC**
- **Reliability engineers and asset management teams**
- **Students and professionals looking to specialize in heat exchangers and thermal systems**

TRAINING METHODOLOGY

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.
Very useful Course Materials will be given.

- **30% Lectures**
- **30% Workshops and work presentation**
- **20% Group Work& Practical Exercises**
- **20% Videos& General Discussions**

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COURSE PROGRAM

Day 1: Introduction to Shell and Tube Heat Exchangers

- Overview of Heat Exchangers
  - Types of heat exchangers and their applications
  - The role of shell and tube heat exchangers in industrial processes
  - Basic principles of heat transfer: conduction, convection, and radiation
- Shell and Tube Heat Exchanger Design Basics
  - Key components: shell, tube, baffles, tube sheets, and seals
  - Flow configurations: single-phase and multiphase flow, counterflow, parallel flow, and crossflow
  - Heat exchanger performance and capacity calculations
- Thermal and Hydraulic Design Considerations
  - Basic thermal design equations for shell and tube heat exchangers
  - Factors affecting heat transfer: surface area, temperature difference, and fluid properties
  - Pressure drop calculations: laminar and turbulent flow

Day 2: Mechanical Design of Shell and Tube Heat Exchangers

- Design of Shell and Tube Configuration
  - Design principles for the shell side and tube side of heat exchangers
  - Tube layout: triangular, square, and rotated square patterns
  - Baffle design: types, spacing, and its impact on heat exchanger performance
- Material Selection
  - Criteria for selecting materials based on temperature, pressure, and fluid properties
  - Common materials for shell, tubes, and baffles (e.g., carbon steel, stainless steel, titanium)
  - Corrosion and erosion considerations in material selection
- Pressure Vessel Design Codes and Standards
  - Overview of design codes and standards (ASME, TEMA)
  - Safety factors, design pressure, and temperature requirements
  - Understanding vessel stress and fatigue limits in heat exchanger design

Day 3: Fluid Dynamics and Heat Transfer

- Fluid Flow in Shell and Tube Heat Exchangers
  - Laminar vs. turbulent flow on the tube side and shell side
  - Heat transfer coefficients for different flow arrangements

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  - Fluid velocity, Reynolds number, and its impact on heat transfer and pressure drop
- Heat Transfer Mechanisms
  - Conduction, convection, and their roles in heat exchange efficiency
  - Temperature profiles and the effect of fouling on heat transfer rates
  - Fouling factors and their impact on heat exchanger performance
- Optimization of Heat Transfer
  - Methods to enhance heat transfer (e.g., use of enhanced tubes and fins)
  - Minimizing pressure drop while maintaining heat transfer efficiency
  - Balancing thermal performance with operational costs

Day 4: Performance Evaluation and Troubleshooting

- Heat Exchanger Performance Monitoring
  - Key performance indicators: temperature, pressure, flow rate, and heat duty
  - Use of performance curves and online monitoring tools
  - Identifying signs of poor performance: overheating, underheating, and pressure drop increase
- Troubleshooting Common Issues
  - Leaks, blockages, and corrosion: causes, detection, and prevention
  - Fouling and scaling: identification, cleaning methods, and prevention strategies
  - Tube failures and fatigue: causes and solutions
- Maintenance Best Practices
  - Preventive maintenance vs. reactive maintenance
  - Cleaning and chemical treatment methods
  - Inspections and testing: hydrostatic tests, visual inspections, and ultrasonic testing

Day 5: Advanced Topics and Case Studies

- Advanced Design Considerations
  - Multi-stream heat exchangers and handling complex flow arrangements
  - High-temperature and high-pressure shell and tube heat exchangers
  - Hybrid heat exchanger systems (e.g., integrating with air coolers)
- Safety and Regulatory Compliance
  - Safety considerations in the design and operation of shell and tube heat exchangers
  - Regulatory requirements and industry standards (ASME, PED, API)
  - Pressure vessel safety: design for rupture, leak detection, and pressure relief
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NOTE:

Pre-& Post Tests will be conducted.

Case Studies, Group Exercises, Group Discussions, Last Day reviews, and assessments will be carried out.

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