Shell & Tube Heat Exchanger Mechanical And Thermal Design & Maintenance

Training Program

Introduction:

The course is directed to the participants to enable them to unerstand the basic idea of the shell and tube devices and taking care of the new and advanced technology that is available nowadays. The course will discuss the control systems associated with the shell and tube systems and will assist the participants to apply the good and proper starting and operation procedures. In addition, the maintenance strategies will be discussed for the sake of the true understanding of the maintenance activities and philosophy.

Who Should Attend?

- Heads of maintenance and operation
- Mechanical and Chemical Engineers
- Equipment Specialists
- Technical Engineers
- Rotating Equipment Engineers
- Vibration Monitoring Engineers
- Planning Engineers

- Lubrication and Plant Engineers

Course Objectives:

- Examine Different Types Of Shell And Tube Heat Exchangers
- Review Thermal Design Features
- Study Mechanical Design Features
- Understand Heat Transfer Coefficient To Finned Surfaces
- Find Out About Heat Transfer Augmentation Techniques
- Learn Failure Modes And Maintenance Of Shell And Tube Heat Exchangers
- Discuss Circuit For Heat Exchanger Selection

Course Outline:

Day 1 :

- Construction and Types The Relevant Codes
- Ubular Relevant Manufacturers Association Inc (TEMA)
- ASMA code for pressure vessels Types of shell and tube heat exchangers
- Fixed tubesheet
- U-tube
- Floating
- head types
- Special design Head Types
- Bolted channel
- Bonnet
- Bolted cone

Day 2 :

- Thermal Design Features Design Parameters
- Tube diameter
- Tube thickness
- Tube length
- Tube pitch Special Tubes
- Bi-metal
- Finned tubes
- Robed and fluted
- Tube inserts Other Parameters
- Number of passes
- Tube arrangements
- TEMA designation system
- Shell diameter

Day 3 :

- Mechanical Design Features Design Codes
- Pressure vessel codes
- Acceptable materials and fabrication Flange Systems
- Tight joint, bolts and gaskets
- ASME standard flange
- Pressure
- temperature rating for flanges Stationary Head-Shell Joints
- Convectional construction
- High-pressure exchanger design Bolted High-Pressure Closures:
- Hemi-end
- nward facing
- Full Demeter Non-bolted High

- Pressure Closures Delta ring - Double cone - Shear ring Fabrication:
- Barrels
- Nozzles
- Flanges
- Bolting and bolt tightening
- Gaskets
- Expansion joints
- Expanded Tube
- Tubesheet Joints:
- Roller expansion
- Uniform tube
- end expansion
- Hydraulic expansion Explosively Formed Tube-end Joints:
- Explosive expansion
- Explosive plugging
- Explosive welding Testing:
- Hydraulic testing
- Helium and steam / helium testing

Day 4 :

- Heat Transfer and pressure Loss Fundamentals:
- Modes of heat transfer
- Laminar and turbulent flow
- Film heat transfer coefficient
- Overall heat transfer coefficient calculation
- Controlling heat transfer coefficient
- Viscosity correction factor Pressure Loss Calculations:
- Tube bank
- Fanning friction factor

- Pressure losses inside and outside tube bank
- Finned tube banks Mean Temperature difference Calculations:
- Counter-current and co-current flow F curve:
- general application
- F curve: shell-and tube exchangers
- F curve: cross-flow exchangers Fouling
- Fouling mechanisms
- Fouling growth
- Cost of fouling
- Heat transfer calculation in the presence of fouling
- Pressure loss calculation in presence of fouling Heat Transfer Augmentation Techniques
- Extended surfaces
- Fin efficiency
- Heat transfer coefficient to finned surfaces
- Roughened surfaces
- Twisted tape insert
- Additional techniquesFailure Modes and Maintenance Failure Modes:

Day 5 :

- Deformation: plastic, elastic
- Fracture: cracks, fatigue fracture, pitting
- Surface changes: hairline cracks, cavitations, wear
- Material changes: contamination, corrosion, wear
- Displacement: lessening, seizure, and excessive clearance
- Leakage
- Contamination Maintenance Strategies:
- On-failure
- Fixed time
- Condition based

- Design out Fouling Problems:
- Design to minimize fouling Failures Due To induced Vibration:
- Tube failure
- Excitation mechanisms
- Vortex shedding
- Turbulent buffeting Predictive Methods:
- Tube natural frequency
- Cross-flow areas and velocities
- Fluid-elastic whirling Application to Design:
- Design recommendations
- Zones for vibration design
- Anti-vibration characteristics Corrosion Problems