Thermal Design using HTRI Software

Course Objectives

- To provide participants with a strong understanding of heat transfer principles and their application in industrial thermal equipment design.
- To develop practical skills in using HTRI software for thermal design, rating, and optimization of heat exchangers.
- To enable learners to perform shell & tube, air-cooled, and plate heat exchanger calculations using real process data.
- To train participants in evaluating exchanger performance, troubleshooting operational issues, and improving efficiency.
- To familiarize learners with industry standards, reporting methods, and best engineering practices in thermal design.

Course Outcomes

- Participants will be able to perform complete thermal design and rating of various heat exchangers using HTRI software.
- Learners will gain the ability to analyze pressure drop, fouling effects, and heat transfer performance of exchangers.
- Participants will be able to optimize exchanger designs for cost, energy efficiency, and process requirements.
- Learners will understand how to troubleshoot underperforming equipment and recommend corrective actions.
- Participants will be capable of generating professional design reports and supporting engineering documentation.

Target Audience

- Mechanical Engineers involved in thermal equipment and heat exchanger design.
- Chemical and Process Engineers working in refineries, petrochemical, oil & gas, and power industries.
- Design Engineers and Project Engineers responsible for process plant equipment selection.
- Maintenance and Operations Engineers handling exchanger performance monitoring and troubleshooting.
- Engineering students and fresh graduates seeking specialization in thermal design and HTRI software.

Course Outline

The course comprises **40**-hours of theory and labs and is divided into **11** different Modules. Each chapter will be followed by hands-on lab exercises to reinforce learning and gauge understanding of the topics covered.

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Module 1: Introduction to Heat Transfer & HTRI

1.1 Fundamentals of Heat Transfer
1.2 Modes of Heat Transfer: Conduction, Convection, Radiation
1.3 Role of Thermal Design in Process Industries
1.4 Introduction to HTRI Software Suite
1.5 Overview of HTRI Applications in Industry
1.6 Navigating the HTRI User Interface

Module 2: Heat Exchanger Basics

2.1 Types of Heat Exchangers
2.2 Shell & Tube Heat Exchangers
2.3 Air-Cooled Heat Exchangers
2.4 Plate Heat Exchangers
2.5 Selection Criteria for Heat Exchangers
2.6 TEMA Standards and Codes

Module 3: Process Data Collection & Design Inputs

3.1 Understanding Process Datasheets
3.2 Fluid Properties and Thermodynamics
3.3 Stream Data Preparation
3.4 Operating Conditions and Design Margins
3.5 Fouling Factors and Allowable Pressure Drop
3.6 Units and Engineering Standards

Module 4: HTRI Xchanger Suite Overview

4.1 Introduction to Xist, Xace, Xhpe, Xphe Modules
4.2 Software Setup and Preferences
4.3 Creating New Projects
4.4 Input Sections and Data Validation
4.5 Case Management and File Handling

Module 5: Shell & Tube Heat Exchanger Design using Xist

5.1 Geometry Selection and Configuration
5.2 Thermal Rating Calculations
5.3 Mechanical Parameters Input
5.4 Pressure Drop Evaluation
5.5 Baffle Design and Optimization
5.6 Vibration and Performance Checks

Module 6: Air-Cooled Heat Exchanger Design using Xace

6.1 Air Cooler Fundamentals
6.2 Fan Types and Performance Curves
6.3 Thermal Design of Fin Tubes
6.4 Ambient Conditions Impact
6.5 Draft Selection and Optimization
6.6 Pressure Drop and Energy Consumption

Module 7: Plate Heat Exchanger Design

7.1 Plate Heat Exchanger Fundamentals
7.2 Plate Pattern Selection
7.3 Thermal Rating and Optimization
7.4 Pressure Drop Analysis
7.5 Application Case Studies

Module 8: Heat Exchanger Rating & Troubleshooting

8.1 Existing Equipment Performance Evaluation
8.2 Debottlenecking Techniques
8.3 Fouling Impact Assessment
8.4 Diagnosing Underperformance
8.5 Revamp Opportunities

Module 9: Optimization Techniques in HTRI

9.1 Cost vs Performance Analysis
9.2 Surface Area Optimization
9.3 Pressure Drop Balancing
9.4 Energy Efficiency Improvement
9.5 Sensitivity Analysis

Module 10: Mechanical Considerations

10.1 Tube Layout and Tube Sheet Concepts
10.2 Material Selection
10.3 Thermal Expansion Considerations

10.4 Vibration and Reliability Checks
10.5 Mechanical Design Coordination

Module 11: Reports & Documentation

11.1 Generating Design Reports
11.2 Datasheets and Calculation Sheets
11.3 Exporting Results to Excel/PDF
11.4 Revision Control and Documentation Standards