

Process Heat Transfer Augmentation Techniques Training Course

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Overview

Process Heat Transfer Augmentation Techniques Training Course is a one-week advanced course for process, thermal, operations, and energy engineering teams who leave with a Heat Transfer Augmentation Decision Pack. The course addresses how to raise thermal duty without accepting unexamined pressure drop, fouling, integrity, or operability consequences. Participants use thermal-hydraulic baselines, passive and active enhancement methods, evidence screening, and techno-economic comparison. Agile Leaders Training Center delivers this course on process heat transfer augmentation techniques.

Who Should Attend

- Functions responsible for process heat-transfer performance and thermal duty
- Teams responsible for heat-exchanger troubleshooting, debottlenecking, and retrofit studies
- Functions responsible for operations, energy use, and pumping constraints
- Teams responsible for equipment integrity, fouling control, and maintainability
- Technical project groups responsible for option screening and investment recommendations

The course assumes participants already use heat-transfer calculations, process data, or equipment performance evidence and leaves out introductory thermodynamics, general exchanger design, and inspection-only training.

Departments and Industries

The course supports augmentation decisions across process plants and other thermal systems.

- Process, thermal, mechanical, and energy engineering
- Operations, maintenance, reliability, and asset integrity
- Oil and gas, petrochemicals, chemicals, and refining
- Power generation, utilities, water, and district energy
- Food processing, pharmaceuticals, metals, and manufacturing

Learning Objectives

By the end of this course, participants will be able to:

- Build thermal-hydraulic baselines for augmentation studies.
- Compare passive, active, and compound enhancement methods.
- Analyze boiling, condensation, fouling, and pressure-drop effects.
- Evaluate CFD, test, and operating evidence for candidate options.
- Prioritize retrofit concepts through integrity and operability gates.
- Build a defensible techno-economic augmentation recommendation.

Course Agenda

Day 1: Establish the Performance Baseline

- Heat-Duty, Temperature-Approach, and Overall-Coefficient Baseline Sheet
- Nusselt Number, Reynolds Number, and Prandtl Number Calculation Map
- Friction-Factor, Pressure-Drop, and Pumping-Power Assessment
- Flow-Regime, Boundary-Layer, and Thermal-Resistance Diagnostic
- Fouling-Factor, Material-Compatibility, and Operating-Envelope Register

Day 2: Screen Passive Enhancement Methods

- Extended-Surface and Enhanced-Tube Selection Matrix
- Twisted-Tape, Wire-Coil, and Insert Screening Method
- Rib, Corrugation, and Roughened-Surface Evaluation Grid
- Swirl-Flow Device and Coiled-Tube Application Map
- Passive Enhancement Thermal Performance Factor Comparison

Day 3: Evaluate Active and Phase-Change Methods

- Vibration and Pulsation Enhancement Feasibility Checklist
- Electrohydrodynamic and Field-Assisted Method Screening Gate
- Injection, Suction, and Jet-Impingement Application Assessment
- Boiling Enhancement Critical-Constraint Review
- Condensation Enhancement Surface and Drainage Evaluation

Day 4: Select and Justify an Augmentation Option

- CFD Model Assumption and Validation Evidence Checklist
- Experimental Data Quality and Scale-Up Assessment
- Manufacturability, Installation, and Retrofit Constraint Matrix
- Operability, Integrity, Maintainability, and Fouling Risk Gate
- Energy Impact, Lifecycle Cost, and Techno-Economic Ranking Model

Day 5: Practice Augmentation Decisions

- Exercise: Reconstruct a Thermal-Hydraulic Performance Baseline
- Exercise: Compare Passive Enhancement Candidates
- Exercise: Test Active and Phase-Change Options
- Exercise: Rank Retrofit Concepts through Evidence and Risk Gates
- Capstone Exercise: Build the Heat Transfer Augmentation Decision Pack

Practical Exercises

The course uses suggested activities to connect thermal evidence with executable augmentation choices.

- Suggested activity: diagnose a process exchanger using duty, coefficients, flow regime, pressure drop, and fouling evidence.
- Suggested activity: compare inserts, enhanced surfaces, and swirl devices through thermal performance factor and pumping impact.
- Suggested activity: screen an active or phase-change enhancement against operating and integrity constraints.
- Suggested activity: prepare a retrofit recommendation with evidence, risk, energy, and lifecycle-cost gates.

FAQs

Who suits process heat transfer augmentation training and what does it assume?

Process heat transfer augmentation training suits experienced engineering and operations teams that already work with heat-transfer calculations, process data, exchanger performance, or retrofit studies.

How does heat transfer augmentation training differ from general heat exchanger design?

Heat transfer augmentation training evaluates enhancement methods and retrofit tradeoffs for existing or proposed thermal equipment, while general heat exchanger design focuses on sizing, configuration, and mechanical design fundamentals.

How are pressure drop and pumping power considered in heat transfer augmentation?

Pressure drop and pumping power are evaluated alongside heat-transfer gain because an option that raises the coefficient can still reduce system value through friction, energy demand, or hydraulic limits.

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Which passive heat transfer enhancement methods are commonly compared?

Passive heat transfer enhancement commonly compares extended or roughened surfaces, enhanced tubes, inserts, twisted tapes, wire coils, ribs, corrugations, swirl devices, and coiled passages against the applicable flow regime and constraints.

How is CFD evidence used in process heat transfer augmentation?

CFD evidence supports process heat transfer augmentation when assumptions, boundary conditions, mesh behavior, and validation data are documented and compared with experimental or operating evidence.

Conclusion

Participants take back a Heat Transfer Augmentation Decision Pack. The pack connects the performance baseline, enhancement mechanisms, pressure-drop effects, fouling, evidence quality, retrofit constraints, integrity, energy impact, and lifecycle economics. It changes isolated thermal ideas into a traceable basis for selecting, rejecting, or testing an augmentation option.

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