

Industrial Fluid Flow and Heat Transfer Training Course

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Overview

Industrial Fluid Flow and Heat Transfer Training Course is a one-week intermediate course for process, mechanical, plant, operations, and maintenance engineering teams who leave with a Thermal-Hydraulic Performance Workbook. The course connects fluid properties, conservation equations, pressure-loss analysis, pump-system curves, thermal resistance networks, heat-exchanger balances, measurement uncertainty, and coupled thermal-hydraulic diagnostics. Participants use calculations and operating evidence to investigate industrial performance. Agile Leaders Training Center delivers this course on industrial fluid flow and heat transfer.

Who Should Attend

- Functions responsible for process flow, pressure, temperature, and energy balances
- Teams responsible for piping, pumping, utility, and thermal-system performance
- Functions responsible for plant operations and deviation investigation
- Teams responsible for maintenance diagnostics and equipment condition evidence
- Technical project groups responsible for system calculations and option reviews

The course assumes participants use engineering units, algebra, process data, or equipment records and leaves out exam preparation, detailed equipment fabrication, advanced computational fluid dynamics, and narrow technology certification.

Departments and Industries

The course supports thermal-hydraulic analysis across industrial operations and engineered facilities.

- Process, mechanical, energy, and plant engineering
- Operations, maintenance, reliability, and technical services
- Chemicals, petrochemicals, refining, and food processing
- Power generation, water, utilities, and district energy
- Manufacturing, mining, pharmaceuticals, and building services

Learning Objectives

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

- Apply conservation equations to industrial flow systems.
- Analyze regimes, friction, fittings, and pressure losses.
- Evaluate pump curves, cavitation, and flow measurements.
- Build conduction, convection, and radiation resistance models.
- Analyze exchanger balances and transient thermal behavior.
- Diagnose coupled thermal-hydraulic performance from measured evidence.

Course Agenda

Day 1: Establish Fluid Flow Fundamentals

- Fluid Property, State, and Unit Consistency Worksheet
- Control-Volume Mass, Momentum, and Energy Balance Method
- Bernoulli Equation Assumption and Loss-Term Map
- Reynolds Number and Laminar-Turbulent Regime Classification
- Dimensional Analysis and Similarity Variable Checklist

Day 2: Analyze Piping and Pump Performance

- Darcy-Weisbach Pipe Friction Calculation Sheet
- Fitting Loss Coefficient and Network Pressure Profile
- Pump Curve, System Curve, and Operating-Point Diagram
- Net Positive Suction Head and Cavitation Risk Assessment
- Flow-Meter Selection, Installation, and Uncertainty Register

Day 3: Model Heat Transfer Mechanisms

- Steady and Transient Conduction Resistance Network
- Internal Forced-Convection Correlation Selection Map
- External and Natural-Convection Boundary Assessment
- Surface Radiation Exchange and Emissivity Calculation Sheet
- Insulation Thickness and Thermal-Loss Comparison Model

Day 4: Integrate Thermal-Hydraulic Evidence

- Heat-Exchanger Energy Balance and Effectiveness Worksheet
- Thermal Capacitance and Transient Response Plot
- Coupled Flow, Pressure, and Temperature Diagnostic Map
- Sensor Calibration, Data Quality, and Uncertainty Budget
- Industrial Deviation Cause-and-Evidence Troubleshooting Matrix

Day 5: Practice Industrial Analysis

- Exercise: Build a Control-Volume Flow Balance
- Exercise: Calculate a Pipe Network and Pump Operating Point
- Exercise: Model a Thermal Resistance and Heat Loss
- Exercise: Diagnose a Coupled Flow and Temperature Deviation
- Capstone Exercise: Build the Thermal-Hydraulic Performance Workbook

Practical Exercises

The course uses suggested activities to connect calculations with operating evidence and industrial decisions.

- Suggested activity: calculate pressure losses and a pump operating point for a water utility network.
- Suggested activity: compare conduction, convection, radiation, and insulation effects for a process-heating surface.
- Suggested activity: reconcile exchanger duty with measured flow and temperature data in a manufacturing case.
- Suggested activity: diagnose a coupled thermal-hydraulic deviation and document uncertainty and verification actions.

FAQs

Who suits industrial fluid flow and heat transfer training and what does it assume?

Industrial fluid flow and heat transfer training suits technical teams that already use engineering units, process measurements, equipment records, or basic balance calculations.

How does industrial fluid flow and heat transfer training differ from general thermodynamics?

Industrial fluid flow and heat transfer training applies conservation, pressure-loss, pumping, convection, radiation, and exchanger methods to operating systems, while general thermodynamics emphasizes states, properties, cycles, and energy principles.

How are pipe pressure losses calculated in industrial fluid flow?

Pipe pressure losses are calculated from flow regime, friction, diameter, length, roughness, fittings, elevation, and fluid properties, then reconciled with the system pressure profile.

How do pump and system curves support industrial flow analysis?

Pump and system curves locate the expected operating point and show how resistance, speed, control position, or equipment condition can shift flow and pressure.

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How is measurement uncertainty used in heat transfer analysis?

Measurement uncertainty qualifies the confidence placed in flow, pressure, and temperature evidence before heat duty, coefficients, losses, or diagnostic conclusions are accepted.

Conclusion

Participants take back a Thermal-Hydraulic Performance Workbook. The workbook connects fluid properties, balances, flow regimes, pipe losses, pump behavior, heat-transfer mechanisms, exchanger duty, transients, measurements, and uncertainty. It changes disconnected calculations into a traceable method for analyzing and troubleshooting industrial flow and thermal performance.

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