
Process Plant Heat Transfer and Pressure Drop Troubleshooting Training Course

9 – 13 May 2027
Manama





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Ref: 145_15416 Date: 9 – 13 May 2027 Location: Manama Fees: 4300 GBP

Programme Summary

Process heat transfer and pressure drop troubleshooting is a one-week training course for senior plant and process engineering leaders at advanced level, culminating in a thermal and hydraulic debottlenecking case for a unit they oversee. Throughput limits often trace back to fouled exchangers, undersized lines or pumps running off their curves, yet the cause is argued rather than measured. The approach moves from first principles through plant data diagnosis to investment decisions. Mars Training Centre UK delivers this programme in process heat transfer and fluid flow for oil, gas, petrochemical and power plants.

The Business Case

Thermal and hydraulic constraints cap throughput and raise fuel and power use long before they appear as failures. Leaders who read exchanger and pump performance from plant data decide when to clean, modify or invest in heat recovery, instead of reacting after production is lost.

- Unit Throughput: Rises as the true hydraulic or thermal bottleneck is identified and removed first.
- Energy Intensity: Falls as fouling is managed and recoverable heat is put back into the process.
- Cleaning and Modification Spend: Is timed and sized on evidence rather than fixed intervals or opinion.

Principles and Evidence Base

- Darcy-Weisbach Equation and Moody Diagram: These friction relations underpin network hydraulics in Session 1.
- API 610 and IEC 60534: These pump and control valve standards frame Session 2.
- TEMA Standards and API 660: Their exchanger classes and fouling resistances guide Session 3.
- Pinch Analysis: Its targets set the energy recovery potential in Session 4.

Intended Participants

- Leaders who decide how plant capacity limits are investigated and resolved.
- Managers who approve exchanger cleaning programmes and equipment modifications.
- Engineering heads who review debottlenecking and energy recovery proposals.
- Technical services leads who set performance monitoring practice for rotating and static equipment.

The programme serves refining, gas processing, petrochemicals and power generation.



Learning Outcomes

1. Participants will be able to evaluate pressure drop across a piping network.
2. Participants will be able to diagnose pump and control valve constraints from operating data and system curves.
3. Participants will be able to construct an exchanger performance trend from overall heat transfer coefficient and fouling resistance.
4. Participants will be able to justify a cleaning interval using fouling and energy cost economics.
5. Participants will be able to prioritise heat integration opportunities using pinch analysis targets.
6. Participants will be able to recommend a debottlenecking option with quantified throughput and energy effects.

Programme Structure

Day 1: Fluid Flow and Pressure Drop in Plant Networks

Where is pressure lost, and which segment controls capacity?

- Darcy-Weisbach Friction, Moody Diagram and Colebrook Equation
- Fittings, Equivalent Length and Network Pressure Profiles
- Two-Phase Flow Regimes and Slug Flow Effects
- Line Sizing Criteria for Velocity, Erosion and Noise
- Hydraulic Survey Planning from Plant Instrumentation

Day 2: Pump and Control Valve Behaviour

Are pumps and valves limiting the unit, or the system around them?

- Pump Curves, System Curves and Operating Point Shifts
- NPSH Available Versus Required and Cavitation Signs
- API 610 Preferred Operating Region and Recirculation
- Control Valve Sizing and Travel Limits to IEC 60534
- Parallel and Series Pumping Options

Day 3: Heat Exchanger Rating and Process Heat Transfer Monitoring

How well is each exchanger performing against its design?

- LMTD and Effectiveness-NTU Rating Methods
- Overall Heat Transfer Coefficient Reconciliation from Plant Data
- TEMA Exchanger Classes and API 660 Design Basis
- Air-Cooled Exchangers and API 661 Performance Limits
- Fouling Resistance Trending and Data Validation



Day 4: Fouling Economics and Heat Integration

When should an exchanger be cleaned, and where can heat be recovered?

- Fouling Mechanisms in Crude, Gas and Cooling Water Service
- Cleaning Interval Optimisation and Cost of Fouling
- Mitigation Options: Inserts, Velocity and Chemical Treatment
- Pinch Analysis Targets and Composite Curves
- Heat Exchanger Network Retrofit Screening

Day 5: Applying Diagnosis to Debottlenecking Decisions

Which constraint should be removed first, and at what return?

- Ranking Day 1 and Day 2 Hydraulic Limits Against Day 3 Thermal Limits
- Debottlenecking Options and Capacity Gain Estimates
- Energy Recovery Investment Appraisal from Day 4 Targets
- Monitoring Dashboards for Exchanger and Pump Performance
- Thermal and Hydraulic Debottlenecking Case Completion

Methodology

The programme is built around a data workshop: participants reconcile operating data from refinery, gas plant and power station cases, build system curves and trend exchanger performance in spreadsheets. Each session moves from a short briefing to group diagnosis and a review of the decisions the evidence supports.

- Suggested activity: Locating the hydraulic bottleneck on a crude preheat train from pressure survey data.
- Suggested activity: Calculating the optimum cleaning interval for a fouling exchanger.
- Suggested activity: Screening heat recovery options against pinch targets for a gas plant.

Capstone Output

Each participant completes a thermal and hydraulic debottlenecking case for a unit from their own plant or a case study. It sets out ranked constraints, supporting calculations, options, expected capacity and energy effects and a recommendation for management approval.

Frequently Asked Questions

Is process heat transfer and pressure drop troubleshooting suitable for engineering managers?

Yes. It is set at advanced level for leaders who direct plant investigations, and assumes an engineering degree and operating experience.



Which standards does process heat transfer and pressure drop troubleshooting rest on?

It rests on the Darcy-Weisbach relation, API 610 for centrifugal pumps, IEC 60534 for control valves, TEMA Standards with API 660 and API 661 for exchangers, and pinch analysis for heat integration.

How is the heat transfer and pressure drop debottlenecking case used at work?

You can use it to brief management on a capacity limit or support a cleaning or modification request.

How does heat transfer and pressure drop troubleshooting differ from heat exchanger design training?

It diagnoses and improves equipment already in service, using plant data, rather than sizing new exchangers or piping from first design.