

HPLC Operation, Troubleshooting and Maintenance Training Course

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Overview

HPLC Operation, Troubleshooting and Maintenance Training Course is a one-week intermediate course for laboratory analysts, quality-control chemists, pharmaceutical analysts, and technical support staff who leave with an HPLC Reliability and Analysis File. The course connects HPLC system operation, chromatographic method setup, sample and mobile-phase preparation, system suitability testing, instrument calibration, HPLC troubleshooting, preventive maintenance, and chromatography data integrity across pharmaceutical and industrial laboratories. Agile Leaders Training Center delivers this course on practical HPLC reliability.

Who Should Attend

- Teams responsible for preparing samples, standards, mobile phases, and analytical sequences
- Functions responsible for operating pumps, injectors, columns, detectors, and chromatography software
- Teams responsible for system suitability, calibration checks, result review, and data integrity
- Functions responsible for diagnosing pressure, baseline, peak-shape, retention, and carryover problems
- Technical groups responsible for preventive maintenance, service records, and return-to-use decisions

The course assumes participants already follow laboratory procedures and interpret basic chromatograms, and leaves out instrument repair authorization, software administration, and method validation approval.

Departments and Industries

The course supports controlled HPLC work across laboratory, manufacturing, environmental, and research settings.

- Pharmaceutical quality control, analytical development, and stability testing
- Food, beverage, chemical, and materials testing laboratories
- Environmental monitoring, water analysis, and public-health laboratories
- Research, biotechnology, and contract analytical services
- Laboratory engineering, metrology, maintenance, and quality assurance

Learning Objectives

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

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- Analyze HPLC flow paths and chromatographic separation behavior.
- Apply controlled sample and mobile-phase preparation methods.
- Use system suitability tests and calibration evidence.
- Diagnose pressure, baseline, retention, peak-shape, and carryover faults.
- Build preventive maintenance and data-integrity controls.
- Evaluate corrective action and return-to-use evidence.

Course Agenda

Day 1: Map HPLC Operation

- HPLC Separation Mechanisms and Reversed-Phase Selectivity Map
- Solvent Reservoir, Degasser, Pump, Mixer, and Flow-Path Diagram
- Autosampler, Injection Volume, Needle-Wash, and Carryover Control Checklist
- Analytical Column Chemistry, Particle Size, Temperature, and Pressure Selection Matrix
- Ultraviolet Detector, Signal Acquisition, Integration, and Chromatogram Review Method

Day 2: Prepare and Configure Analysis

- Reference Standard, Sample Dilution, Filtration, and Stability Preparation Record
- Mobile-Phase Composition, Buffer, pH, Degassing, and Compatibility Worksheet
- Isocratic and Gradient Elution Parameter Setup Sheet
- Sequence Table, Blank, Standard, Sample, Wash, and Reinjection Design
- Retention Factor, Selectivity, Resolution, Efficiency, and Tailing Calculation Set

Day 3: Verify System Performance

- USP <621> Chromatography System Suitability Decision Table
- Flow-Rate, Injection-Precision, Detector-Response, and Wavelength Check Record
- Calibration Status, Performance Qualification, and Traceability Evidence Review
- Control Sample, Bracketing Standard, Drift, and Acceptance Trend Chart
- Raw Data, Audit Trail, Integration Change, and Chromatography Data Integrity Checklist

Day 4: Diagnose and Maintain HPLC

- High Pressure, Low Pressure, Leakage, and Flow Instability Fault Tree
- Baseline Noise, Drift, Spikes, and Detector Contamination Diagnostic Matrix
- Peak Tailing, Fronting, Splitting, Broadening, and Retention Shift Investigation
- Ghost Peak, Carryover, Solvent Mismatch, and Contamination Isolation Sequence
- Pump Seal, Check Valve, Injector, Detector Cell, Column, and Tubing Maintenance Plan

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Day 5: Practice HPLC Decisions

- Exercise: Reconcile Flow Path, Pressure, Signal, and Chromatogram Evidence
- Exercise: Prepare Sample, Mobile Phase, Sequence, and Suitability Controls
- Exercise: Isolate Baseline, Peak-Shape, Retention, and Carryover Causes
- Exercise: Evaluate Maintenance Action and Return-to-Use Evidence
- Capstone Exercise: Build the HPLC Reliability and Analysis File

Practical Exercises

The course uses suggested activities to connect chromatographic evidence with controlled laboratory decisions.

- Suggested activity: trace the HPLC flow path and match pressure or signal symptoms to likely components.
- Suggested activity: calculate suitability parameters and decide whether an analytical sequence can proceed.
- Suggested activity: investigate a changed chromatogram using preparation, method, column, instrument, and data evidence.
- Suggested activity: assemble maintenance findings, corrective actions, verification results, and return-to-use criteria.

FAQs

Who suits HPLC operation, troubleshooting and maintenance training, and what does it assume?

HPLC operation, troubleshooting and maintenance training suits laboratory and quality-control personnel who already follow analytical procedures and interpret basic chromatograms.

How does HPLC troubleshooting differ from analytical method development?

HPLC troubleshooting isolates causes of unexpected pressure, baseline, retention, peak-shape, or carryover behavior, while analytical method development selects and optimizes separation conditions for a defined analytical purpose.

What causes unstable pressure during HPLC system operation?

Unstable HPLC pressure can result from air, leaks, restricted tubing or frits, contaminated check valves, solvent incompatibility, pump-seal wear, or a partially blocked column.

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What evidence supports HPLC return-to-use after maintenance?

HPLC return-to-use requires resolved fault causes, acceptable leak and flow checks, stable detector response, passing suitability results, controlled maintenance records, and documented review of the resulting chromatograms.

Conclusion

Participants take back an HPLC Reliability and Analysis File. The file connects preparation records, method settings, suitability calculations, calibration evidence, diagnostic findings, maintenance actions, data reviews, and return-to-use criteria. It changes isolated chromatographic symptoms into a traceable basis for analysis control, fault diagnosis, preventive care, and defensible laboratory decisions.

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