

Course No. 1348

Heat Exchangers, Distillation & Separation Processes Training Course

PROCESS ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Heat Exchangers, Distillation & Separation Processes Training Course provides a practical and technically focused framework for understanding, operating, troubleshooting, and improving critical thermal and separation systems. The course is designed for professionals responsible for process efficiency, product quality, energy performance, asset reliability, safety, and production continuity in industrial and utility environments.

Heat transfer and separation processes are central to oil and gas, petrochemical, power, water, manufacturing, pharmaceutical, food processing, and large-scale utility operations. Heat exchangers, distillation columns, separators, tanks, filters, condensers, reboilers, pumps, and associated control systems directly influence throughput, product specification, energy consumption, equipment integrity, and operating cost. Weak operating discipline, inadequate monitoring, fouling, poor control, or unsuitable design assumptions can create process instability, off-specification production, excessive energy use, and avoidable downtime.

This Heat Exchangers, Distillation & Separation Processes Training Course examines the principles that govern heat transfer, phase separation, distillation, fluid behaviour, pressure and temperature control, and process performance. Participants will learn how to interpret operating data, identify deviations, assess equipment condition, recognize common failure mechanisms, and evaluate practical improvement opportunities without compromising process safety or quality requirements.

The course also connects technical process knowledge with maintenance, reliability, energy efficiency, process control, inspection, asset management, and operational decision-making. It enables executives and managers to understand the operational and investment implications of process constraints, while equipping engineers, supervisors, and specialists with practical tools for improving equipment performance and sustaining reliable operation.

Through case-based discussions, technical exercises, and structured implementation planning, participants will develop the capability to assess heat exchanger, distillation, and separation performance systematically. The program supports organizations in strengthening process optimization, reducing avoidable losses, improving equipment availability, and maintaining safe, stable, and efficient process operations.

Objectives

- Analyze the operating principles of heat exchangers, distillation systems, and separation processes in relation to safety, quality, reliability, energy use, and throughput during the course.
- Assess process data, including flow, pressure, temperature, composition, heat duty, and product quality, to identify performance deviations in selected systems.
- Develop operating profiles that define critical process variables, normal operating ranges, alarms, constraints, and performance expectations.
- Evaluate heat transfer performance, fouling behaviour, pressure drop, thermal efficiency, and maintenance requirements for common heat exchanger applications.
- Apply mass and energy balance principles to assess separation efficiency, distillation performance, utility consumption, and process losses.
- Design practical monitoring approaches for heat exchangers, distillation columns, separators, condensers, reboilers, and associated process equipment.
- Improve process stability by identifying actions related to operating set points, feed conditions, reflux, reboiler duty, cooling, pressure control, and equipment loading.
- Strengthen troubleshooting practices by applying structured methods to identify technical, operational, control-related, and maintenance-related causes of underperformance.
- Evaluate separation equipment performance based on phase behaviour, residence time, flow conditions, interface control, product specifications, and operational risk.
- Implement practical measures to reduce fouling, corrosion, leakage, contamination, entrainment, flooding, foaming, and other common process problems.
- Assess the relationship between process equipment performance, maintenance planning, inspection, reliability, energy management, and production targets.
- Develop a time-bound action plan to improve heat exchanger, distillation, and separation process performance after the course.

Who Should Attend

The Heat Exchangers, Distillation & Separation Processes Training Course is designed for operations managers, production managers, process engineering managers, maintenance managers, reliability managers, utilities managers, asset managers, plant managers, facilities managers, project managers, and technical services leaders. It is particularly relevant for executives, directors, and decision makers responsible for operational efficiency, process safety, energy consumption, product quality, asset availability, production capacity, and capital improvement decisions.

The course is suitable for process engineers, chemical engineers, mechanical engineers, production engineers, utilities engineers, energy engineers, maintenance engineers, reliability engineers, inspection engineers, integrity specialists, instrumentation and control engineers, automation specialists, technical supervisors, shift supervisors, and field operators. It supports professionals involved in operating, monitoring, designing, maintaining, inspecting, modifying, commissioning, or troubleshooting process equipment and thermal systems.

Procurement, supply chain, quality, HSE, risk management, internal audit, project management, digital transformation, contractor management, and operational excellence professionals may also benefit where their roles involve equipment specifications, utility performance, process risk, product quality, maintenance services, capital projects, or performance assurance. The course promotes stronger coordination between operations, engineering, maintenance, process safety, and management functions.

Learning Outcomes

- Explain the role of heat exchangers, distillation columns, and separation equipment in process performance, quality, energy efficiency, and operational reliability.
- Interpret process flow, pressure, temperature, composition, utility, and quality data to identify operating deviations and performance trends.
- Apply basic heat transfer concepts to assess thermal duty, temperature approach, fouling, pressure drop, and exchanger effectiveness.
- Identify the operating principles and major components of shell-and-tube, plate, air-cooled, and other common heat exchanger systems.
- Assess distillation performance using concepts of vapour-liquid equilibrium, reflux, reboiling, condensation, pressure, temperature profiles, and product specifications.
- Recognize common distillation problems, including flooding, weeping, entrainment, foaming, pressure instability, off-specification products, and heat imbalance.
- Evaluate liquid-liquid, gas-liquid, solid-liquid, and mechanical separation processes according to process duty and operating conditions.
- Identify common process issues, including fouling, scaling, corrosion, leakage, contamination, poor phase separation, and equipment vibration.
- Develop practical troubleshooting plans that combine process data, field observations, maintenance history, inspection findings, and control-system information.

- Improve operating practices involving feed conditions, flow rates, set points, pressure control, reflux ratio, reboiler duty, cooling duty, and equipment sequencing.
- Integrate process performance improvements with preventive maintenance, inspection, cleaning, reliability, safety, and energy-management activities.
- Produce an initial improvement roadmap for heat exchangers, distillation systems, and separation processes within the participant's workplace.

Course Outline

DAY 01

Heat Transfer and Separation Process Fundamentals

- The role of heat exchangers, distillation, and separation processes in production, quality, energy efficiency, reliability, and process safety.
- Process fundamentals: temperature, pressure, flow, phase behaviour, heat transfer, mass transfer, residence time, and operating constraints.
- Overview of heat exchanger systems, distillation columns, separators, condensers, reboilers, vessels, filters, and associated utility equipment.
- Process performance indicators: heat duty, temperature approach, pressure drop, product quality, recovery, throughput, energy use, and equipment availability.

PRACTICAL APPLICATION OR DISCUSSION

Reviewing a selected process system and identifying critical equipment, variables, constraints, and operational risks.

DAY 02

Heat Exchanger Operation, Performance, and Troubleshooting

- Heat transfer mechanisms, thermal duty, temperature driving force, heat-transfer coefficients, exchanger effectiveness, and energy performance.
- Heat exchanger types and applications: shell-and-tube, plate, air-cooled, double-pipe, condensers, evaporators, and reboilers.
- Fouling, scaling, corrosion, leakage, vibration, tube failure, pressure drop, flow distribution, and maintenance implications.

DAY 02 — CONTINUED

- Monitoring heat exchanger performance using temperatures, pressures, flow rates, utility use, thermal trends, inspection records, and operating data.

PRACTICAL APPLICATION OR DISCUSSION

Assessing heat exchanger performance data and developing actions to address fouling, thermal loss, or pressure-drop concerns.

DAY 03

Distillation Principles and Column Performance

- Distillation fundamentals: vapour-liquid equilibrium, relative volatility, trays, packing, reflux, reboiling, condensation, and product recovery.
- Major distillation column components: feed systems, trays or packing, condensers, reflux drums, reboilers, side draws, and control arrangements.
- Operating variables: feed condition, pressure, temperature profile, reflux ratio, reboiler duty, condenser duty, column differential pressure, and product specifications.
- Common distillation problems: flooding, weeping, entrainment, foaming, maldistribution, pressure instability, off-specification products, and energy imbalance.

PRACTICAL APPLICATION OR DISCUSSION

Reviewing a distillation operating scenario and identifying causes of reduced separation efficiency or product-quality deviation.

DAY 04

Separation Equipment and Process Optimization

- Principles of gas-liquid, liquid-liquid, solid-liquid, and mechanical separation processes in industrial and utility applications.
- Operating and design considerations for separators, flash drums, knockout vessels, decanters, filters, hydrocyclones, and storage systems.
- Interface management, residence time, flow distribution, level control, pressure control, carryover, contamination, and separation efficiency.

DAY 04 — CONTINUED

- Optimizing feed conditions, operating pressure, temperature, flow distribution, utilities, control settings, and equipment loading.

PRACTICAL APPLICATION OR DISCUSSION

Assessing a separation process and developing improvement options for recovery, phase quality, reliability, or capacity.

DAY 05

Integrated Performance Improvement and Sustainable Operation

- Linking heat exchanger, distillation, and separation performance with process control, maintenance, inspection, reliability, energy efficiency, and asset management.
- Structured troubleshooting methods using process trends, mass and energy balances, field observations, root cause analysis, and maintenance history.
- Managing operational changes, testing improvement actions, updating procedures, controlling process risk, and verifying results.
- Performance governance, key performance indicators, management review, action tracking, lessons learned, and continuous improvement.

FINAL WORKSHOP, ACTION PLAN, OR IMPLEMENTATION EXERCISE

Developing a 90-day Heat Exchangers, Distillation & Separation Processes improvement plan with priority equipment, performance issues, proposed actions, accountable owners, milestones, and review measures.

Register or Request More Information

Course page: <https://quest-training.com/courses/heat-exchangers-distillation-separation-processes-training-course>

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