MERCURY

Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance

02 - 06 May 2027
Kuala Lumpur (Malaysia)

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Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance

Ref.: 121919_1058236 **Date:** 02 - 06 May 2027 **Location:** Kuala Lumpur (Malaysia) **Fees:** 4900 **Euro**

Introduction

The Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance course builds advanced process-engineering knowledge for selecting, sizing, evaluating, and optimizing compressors and pumps in process industries. It examines fluid properties, thermodynamics, hydraulic principles, compression requirements, system resistance, equipment performance curves, operating envelopes, and process control. Participants will evaluate centrifugal and positive displacement equipment according to process conditions, operating requirements, and system behavior. The program covers compressor power, efficiency, pressure ratio, surge, stonewall or choke conditions, pump head, power, NPSH, cavitation, and system curves. Practical engineering scenarios connect equipment performance with process changes, energy consumption, throughput, bottlenecks, and off-design operation. It enables participants to interpret technical information and apply process engineering calculations to compressor and pump selection, performance assessment, troubleshooting, and optimization.

Targeted Groups

This Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance training targets professionals seeking knowledge and skills:

- Process Engineers involved in equipment selection and process design.
- Senior Process Engineers evaluating complex rotating-equipment requirements.
- Process Design Engineers preparing equipment specifications and calculations.
- Production Engineers assessing operating performance and throughput.
- Operations Engineers monitoring equipment and process conditions.
- Project Engineers supporting equipment sizing and technical decisions.
- Technical Engineers evaluating compressor and pump performance.
- Engineering professionals working in oil and gas, refining, petrochemical, chemical, and process industries.

Course Objectives

Participants will achieve the following objectives by completing the Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance course:

- Apply gas laws, thermodynamics, and fluid-flow principles to equipment applications.
- Evaluate process conditions and determine compressor and pump requirements.
- Select suitable compressor and pump types for specific process services.
- Calculate compressor flow, pressure ratio, head, efficiency, temperature, and power.
- Calculate pump flow, differential head, hydraulic power, shaft power, and efficiency.
- Interpret compressor and pump performance curves and operating envelopes.
- Evaluate centrifugal compressor surge, stonewall, choke, and anti-surge requirements.
- Develop system curves and determine pump operating points.
- Calculate NPSH Available and NPSH Required and assess cavitation risks.
- Assess fluid properties, system resistance, and process impacts on performance.
- Evaluate pumps operating in series and parallel configurations.

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- Analyze compressor and pump control strategies and process interactions.
- Assess off-design operation and identify process-related performance limitations.
- Evaluate energy consumption and identify equipment optimization opportunities.
- Apply engineering calculations to practical oil and gas, refinery, petrochemical, and process applications.

Targeted Competencies

Participants will gain the following competencies during the Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance program:

- Compressor and pump selection based on process requirements.
- Process equipment sizing and engineering calculations.
- Compressor performance and operating-envelope interpretation.
- Pump performance-curve and system-curve analysis.
- Surge, stonewall, choke, and anti-surge assessment.
- NPSH evaluation and cavitation-risk identification.
- Off-design performance and process-side troubleshooting.
- Series and parallel equipment analysis.
- Process-control and equipment interaction assessment.
- Energy-efficiency and rotating-equipment optimization.
- Process bottleneck and hydraulic-limitation identification.
- Throughput and operating-condition evaluation.

Real-world Case Studies

In this Advanced Compressors & Pumps for Process Engineering: Selection, Sizing & Performance training, participants develop skills through the following cases:

- Select compressors for changing gas composition, pressure, temperature, and flow requirements.
- Evaluate centrifugal compressor operation approaching surge and stonewall limits.
- Size pumps against changing system resistance and operating requirements.
- Assess NPSH conditions and identify potential causes of cavitation.
- Compare series and parallel pump configurations for process capacity.
- Analyze refinery and petrochemical bottlenecks affecting compressor and pump performance.
- Evaluate equipment efficiency during normal, turndown, and maximum operating conditions.

Course Content

Unit 1: Process Engineering Fundamentals for Compressors & Pumps

- Role of compressors and pumps in process plants.
- Gas laws and real-gas behavior.
- Pressure, temperature, density, molecular weight, compressibility, and specific gravity.
- Process flow and pressure requirements.
- Basic thermodynamics of compression.
- Isothermal, adiabatic, and polytropic compression.
- Polytropic and isentropic efficiency.
- Compression ratio and discharge temperature.
- Fluid-flow fundamentals for liquid systems.

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- Pressure drop, static head, friction head, and total dynamic head.
- Understanding process datasheets and equipment specifications.

Unit 2: Compressor Technology, Selection & Process Sizing

- Compressor classification and process applications.
- Selecting compressor type according to process conditions.
- Compressor capacity and flow calculations.
- Compression ratio calculations.
- Compressor head and power requirements.
- Polytropic efficiency calculations.
- Multistage compression.
- Intercooling and aftercooling.
- Effect of suction temperature and pressure on compressor performance.
- Effect of gas composition and molecular weight.
- Compressor performance curves.
- Operating point and operating envelope.
- Process considerations in compressor specification and selection.

Unit 3: Advanced Compressor Performance & Process Control

- Centrifugal compressor performance characteristics.
- Compressor maps and performance curves.
- Surge limits and surge mechanisms.
- Stonewall/choke conditions.
- Anti-surge control principles.
- Recycle and bypass systems.
- Capacity control methods.
- Variable-speed operation.
- Compressor unloading and process control.
- Off-design compressor performance.
- Parallel and series compressor operation.
- Impact of process changes on compressor performance.
- Compressor system pressure-drop considerations.
- Gas receivers and process-system sizing considerations.
- Energy efficiency and compressor performance optimization.
- Practical compressor performance calculation exercises.

Unit 4: Pump Technology, Selection & Performance Calculations

- Classification of pumps and process applications.
- Centrifugal versus positive displacement pumps.
- Selecting pumps based on process fluid and operating conditions.
- Flow rate and differential pressure requirements.
- Static head, friction losses, and total dynamic head.
- Pump hydraulic power and shaft power calculations.
- Pump efficiency.
- Pump characteristic curves.
- Developing and interpreting system curves.
- Determining the pump operating point.
- Effect of system resistance on pump performance.
- Best Efficiency Point BEP and preferred operating region.
- Pump affinity laws.

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- Variable-speed pump operation.
- Pumps in series and parallel.
- NPSH Available and NPSH Required.
- Cavitation and process conditions leading to cavitation.
- Suction-system design considerations.
- Pump selection and sizing exercises.

Unit 5: Integrated Process Analysis & Optimization of Compressor and Pump Systems

- Process simulation and equipment performance evaluation.
- Process-side evaluation of compressor and pump performance.
- Identifying process bottlenecks and hydraulic limitations.
- Evaluating changes in throughput and operating conditions.
- Effect of pressure, temperature, composition, and flow changes.
- Control valve and rotating-equipment interaction.
- Equipment versus system performance.
- Energy consumption and specific energy calculations.
- Compressor and pump energy optimization.
- Evaluating equipment performance at normal, turndown, and maximum operating conditions.
- Process debottlenecking involving compressors and pumps.
- Evaluating existing equipment for increased plant throughput.
- Practical refinery, petrochemical, oil & gas, and process-industry case studies.
- Engineering calculation exercises for equipment selection and performance evaluation.

Final Insights & Key Takeaways

The course develops integrated expertise in compressor and pump selection, sizing, performance evaluation, process control, troubleshooting, and energy optimization. Participants strengthen their ability to connect equipment behavior with process requirements, system resistance, operating conditions, throughput, and practical process-engineering decisions.

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