MERCURY

Compressor and Pump Control for Rotating Equipment

27 June – 8 July 2027
Kuala Lumpur (Malaysia)

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Ref: 6024_300490 **Date:** 27 June – 8 July 2027 **Location:** Kuala Lumpur (Malaysia) **Fees:** 8500 Euro

Compressor and Pump Control Technology for Rotating Equipment is a 2-week course for engineers, supervisors and technicians who run, protect and troubleshoot compressor and pump trains in process plants. You work through capacity control, anti-surge protection, pump hydraulics and fault diagnosis, and leave with a completed Machine Control Review Pack for one of your own units. Mercury Training Center delivers this compressor and pump control course.

About This Course

Plants lose throughput and machines when surge lines, recycle valves, minimum-flow protection and speed control are set without regard to the process the machine serves. You should already operate, inspect or engineer rotating machines. You practice on head-flow curves, control narratives, trip records and vibration data drawn from oil and gas, power and water plants.

Who It Is For

- Running compression and pumping units on shift and responding to alarms and trips.
- Planning inspections, overhauls and spare parts for pump and compressor fleets.
- Specifying, tuning and testing control loops, anti-surge controllers and variable-speed drives.
- Owning the reliability and condition monitoring of critical machine trains.
- Selecting and commissioning new pumps and compressors in process and utility projects.

This course is not for readers new to industrial plant, who are better served by an introductory course on rotating machines, or for designers of impellers and casings, who need a specialist machine design course.

Competencies You Will Build

- Capacity Control Selection: choosing speed, throttling, recycle or unloading control for a given duty.
- Surge Protection Review: checking surge control lines and recycle valves on a centrifugal train.
- Pump Hydraulic Matching: setting minimum-flow and NPSH margins against a system curve.
- Fault Diagnosis: tracing a trip or vibration rise to its hydraulic, mechanical or control cause.
- Sealing and Lubrication Choice: specifying seal plans and oil care that fit the fluid.
- Drive and Valve Matching: sizing control valves and variable-frequency drives to the machine they govern.

What You Will Be Able to Do

By the end of the course you will be able to:

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- Given a centrifugal compressor map and process data, plot the surge control line and check the recycle valve capacity.
- From a pump curve and piping data, build the system curve and mark the operating window and NPSH margin.
- Using vibration spectra and oil sample results, rank likely fault causes and propose a corrective action.
- From a reciprocating compressor duty sheet, choose a capacity control method and estimate the power saving.
- Given a seal failure record, select a seal plan to API 682 and define the monitoring it needs.
- Using a control narrative and trip log, write revised alarm and trip settings for one machine train.

Course Content

Day 1: Gas Laws and Machine Families

- Ideal and Real Gas Behavior Applied to Process Gas Duties
- Polytropic Head, Efficiency and Power Calculation for Gas Compression
- Volumetric Flow and Volumetric Efficiency in Reciprocating and Rotary Machines
- Positive Displacement Versus Centrifugal and Axial Machine Selection by Duty
- Receiver Sizing and Unloading Arrangements for Plant and Instrument Air

Day 2: Positive Displacement Compressors

- Reciprocating Valves, Packing and Rider Bands in Gas Service API 618
- Clearance Pockets, Valve Unloaders and Step Control for Reciprocating Capacity
- Rotary Screw and Lobe Machines with Slide Valve and Speed Control
- Diaphragm Compressors for Toxic and High-Purity Gas Duties
- Filter Separators and Liquid Removal Ahead of Compression Stages

Day 3: Centrifugal and Axial Compressors

- Centrifugal and Axial Components and Head-Flow Maps API 617
- Off-Design Operation, Rotating Stall and Stonewall Under Changing Gas Composition
- Rotor Balancing and Shop Testing Requirements for New Compression Trains
- Suction Throttling, Inlet Guide Vanes and Speed Variation as Capacity Control
- Lube Oil Consoles, Coolers and Interstage Knock-Out Drums

Day 4: Surge and Anti-Surge Control

- Surge Limit Line and Surge Control Line Setting on a Compressor Map
- Recycle Valve Sizing and Stroke Speed for Anti-Surge Protection
- Anti-Surge Controller Tuning and Response to Emergency Shutdown Trips
- Choke Protection and Load Sharing Between Parallel Compression Trains
- Surge Margin Review Exercise on a Gas Export Train

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Day 5: Gas Seals, Bearings and Lubrication

- Dry Gas Seal Arrangements and Seal Gas Panels API 692
- Oil Film, Labyrinth and Bushing Seals with Leakage Monitoring
- Journal, Thrust and Magnetic Bearing Selection for High-Speed Rotors
- Lubricant Viscosity, Greases and Contamination Control in Machine Oil Consoles
- Used Oil Sampling and Trending for Early Wear Detection

Day 6: Centrifugal Pump Hydraulics

- Pump Categories and Duty Matching for Process, Utility and Water Service API 610
- System Curve Construction and Operating Point on Pump Curves
- NPSH Available Versus Required and Cavitation Prevention ANSI/HI 9.6.1
- Minimum Continuous Flow Protection and Recirculation Valves
- Impellers, Diffusers, Casings and Hydraulic Balancing Devices

Day 7: Pump Sealing and Positive Displacement Pumps

- Mechanical Seal Components, Flush Plans and Failure Modes API 682
- Seal Refurbishment and Leakage Diagnosis on Hydrocarbon Pumps
- Piston, Plunger and Diaphragm Pumps for Injection and Metering API 674, API 675
- Screw, Lobe, Cam and Vane Pumps for Viscous Crude and Lube Transfer API 676
- Canned Motor and Magnetic Drive Pumps for Leak-Free Duties

Day 8: Pump Control, Valves and Drives

- Throttling Versus Variable-Frequency Drive Flow Control on Pump Stations
- Control Valve Selection, Cavitation and Noise in Pump Discharge Lines
- Actuators, Positioners and Smart Transmitters in Machine Control Loops
- Electric Motor and Steam Turbine Drivers Matched to Machine Loads
- Water Hammer and Pressure Surge Control in Long Pipelines

Day 9: Condition Monitoring and Troubleshooting

- Vibration Measurement and Evaluation to ISO 20816 on Machine Trains
- Resonance, Misalignment and Unbalance Diagnosis from Vibration Spectra
- Troubleshooting Centrifugal, Rotary and Reciprocating Pumps from Field Symptoms
- Reciprocating Valve and Packing Fault Diagnosis from Temperature Trends
- Inspection, Overhaul and Commissioning Checklists for Returning Machines to Service

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Day 10: Practice on Your Own Machine Train

- Capacity Control Choice Exercise for a Reciprocating Gas Booster
- System Curve and NPSH Check Exercise on a Cooling Water Pump Station
- Trip and Vibration Diagnosis Exercise on a Centrifugal Compression Train
- Seal Plan and Lubrication Review Exercise for a Hot Hydrocarbon Pump
- Completing the Machine Control Review Pack for Your Own Unit

Case Studies and Exercises

The items below are suggested activities.

- Case study: a gas processing compressor trips on surge after a change in feed gas; you decide new surge control settings and recycle valve actions.
- Case study: a power station cooling water pump suffers repeated cavitation damage; you produce a revised operating window and minimum-flow setting.
- Exercise: a petrochemical metering pump delivers off target; you choose a capacity control and calibration approach.
- Exercise: a water utility pump station runs on throttling valves; you compare a variable-frequency drive option and recommend one.

What You Take Back

The Machine Control Review Pack records one compressor or pump train at your site: its operating window, control settings and known faults. In your first month back you use it to review alarm and trip settings with operations and to plan the next inspection with the planning team.

- A head-flow or pump curve marked with the surge or minimum-flow limit and the normal operating point.
- A capacity control sheet with anti-surge or recirculation settings.
- A fault diagnosis table linking vibration, oil and temperature symptoms to causes.
- A seal and lubrication checklist for the next overhaul.

Quick Answers FAQ

What should I know before a compressor and pump control course?

You should already work with pumps or compressors in operation, inspection or engineering, read P&IDs and pump curves, and know basic units of pressure, flow and power.

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How does compressor and pump control training differ from a shorter course on compressors alone?

It runs two weeks and covers pumps as well as compressors, adding pump hydraulics, NPSH, minimum-flow protection, variable-speed drives and pump troubleshooting. A shorter compressor course stays with compressor types, sealing and upkeep.

Why do centrifugal compressors surge, and how does anti-surge control prevent it?

Surge happens when flow falls below the point where the machine can hold its discharge pressure, so gas briefly reverses through it. Anti-surge control compares measured flow and head with a control line set at a margin from the surge limit and opens a recycle valve first.

What do I take back from compressor and pump control training?

You take back a completed Machine Control Review Pack for one of your own compressor or pump trains, with its operating window, control and trip settings, a fault diagnosis table and a seal and lubrication checklist ready to review with operations.

For Your Manager

After the course, the team member will be able to check surge and minimum-flow protection, choose capacity control methods and trace machine trips to their cause on compressor and pump trains. They return with a completed Machine Control Review Pack for one unit, first used in a review of alarm and trip settings with operations and in planning the next overhaul.

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