Pumps, Compressors and Steam Turbines: Operation, Troubleshooting and Maintenance

3 – 7 October 2027
Riyadh - KAFD district five-star



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Introduction:

Pumps, compressors and steam turbines move almost every stream in a process plant, yet repeat seal leaks, cavitating pumps, surging compressors and turbine trips still cost production because operators and maintainers read symptoms differently. This Core Concept rotating equipment course builds a shared, practical understanding of how these machines work, where they sit on their performance curves and why they fail. Participants learn to diagnose faults from pressure, flow, temperature and vibration evidence and to apply correct operating and repair practices, producing a Rotating Equipment Troubleshooting Guide and Inspection Checklist for one of their own machine trains.

Course Objectives:

- Read centrifugal and positive displacement pump curves against the system curve to confirm the operating point and select or rerate a pump
- Calculate NPSH available against NPSH required and correct suction conditions that cause cavitation
- Operate centrifugal and reciprocating compressors within their performance maps and verify that anti-surge protection keeps an adequate surge margin
- Explain steam turbine staging, governing and overspeed protection and carry out safe start-up, loading and shutdown checks
- Diagnose mechanical seal, bearing, misalignment and unbalance faults from vibration, temperature and leakage symptoms
- Prepare a troubleshooting guide and inspection checklist that links each common failure symptom to its cause, check and corrective action

Target Audience:

- Mechanical engineers responsible for the performance and repair of pumps, compressors and turbines
- Operations engineers and shift supervisors who start, run and shut down machine trains
- Rotating equipment technicians who carry out alignment, seal replacement and bearing work
- Condition monitoring and inspection staff who collect and interpret vibration and temperature readings
- Utilities and steam system staff who operate turbine drivers and boiler feed pumps

Course Outline:

Day 1: Pump Hydraulics, Performance Curves and Cavitation

- Rotating Equipment Classification: Dynamic Versus Positive Displacement Machines
- Centrifugal Pump Head, Flow, Power and Efficiency Curves with the Best Efficiency Point
- System Curve Construction from Static Head and Friction Losses
- NPSH Available Versus NPSH Required Calculation and Margin Check
- Cavitation Mechanisms, Noise Signature and Impeller Erosion Patterns

Day 2: Pump Selection, Seals, Bearings and Positive Displacement Pumps

- Pump Selection Worksheet: Duty Point, Parallel and Series Operation and Affinity Laws
- Reciprocating, Gear, Screw and Diaphragm Pump Behaviour and Relief Valve Protection
- Mechanical Seal Types, Seal Flush Arrangements and Seal Failure Analysis
- Rolling Element and Hydrodynamic Journal Bearing Lubrication and Temperature Limits
- Pump Commissioning, Priming, Minimum Flow Protection and Start-Up Procedure

Day 3: Compressors: Performance Maps, Surge and Reciprocating Machines

- Gas Laws, Compression Ratio and Discharge Temperature Calculation
- Centrifugal Compressor Performance Map, Surge Line and Stonewall Limit
- Anti-Surge Control Loop: Recycle Valve, Surge Control Line and Surge Margin Setting
- Reciprocating Compressor Valves, Piston Rings, Packing and Capacity Control Steps
- Compressor Lube and Seal Oil Systems, Interstage Cooling and Liquid Knock-Out

Day 4: Steam Turbines, Alignment, Balancing and Vibration Diagnosis

- Impulse and Reaction Staging with Condensing, Back-Pressure and Extraction Turbine Types
- Turbine Governing with Speed Droop, Trip and Throttle Valves and Overspeed Trip Testing
- Shaft Alignment by Reverse Dial Indicator and Laser Methods with Soft Foot Correction
- Rotor Unbalance, Single-Plane and Two-Plane Field Balancing Procedure
- Vibration Symptom Chart: Unbalance, Misalignment, Looseness, Bearing Defects and Resonance

Day 5: Inspection Walkthrough and Troubleshooting Guide Build

- Inspection Walkthrough of a Pump Train: Suction Conditions, Seal Leakage and Bearing Temperatures
- Compressor Surge Event and Steam Turbine Trip Case Diagnosis
- Rotating Equipment Reliability Programme Overview: Criticality, Spares and Bad-Actor Tracking
- Rotating Equipment Troubleshooting Guide Drafting: Symptom, Cause, Check and Action Table
- Machine Train Inspection Checklist Finalisation and Peer Review

Skills You Will Gain:

- Pump Curve Interpretation
- Suction Condition Assessment
- Compressor Surge Protection
- Steam Turbine Operation
- Shaft Alignment Practice
- Field Balancing
- Vibration Symptom Diagnosis
- Mechanical Seal Troubleshooting

Why Attend This Course:

- Return with a Rotating Equipment Troubleshooting Guide and Inspection Checklist built for one of your own machine trains
- Stop repeat seal, bearing and cavitation failures by tracing them to operating point and installation causes
- Talk to operations, maintenance and vendors in the same terms when a pump, compressor or turbine misbehaves
- Compare field practice with engineers from refining, petrochemicals, power, water and mining plants

Conclusion:

Pumps, compressors and steam turbines run reliably when they are selected for the right duty, operated inside their curves and maintained with correct alignment, balance, sealing and lubrication. This course moves from pump hydraulics, NPSH and cavitation, through pump selection, seals and bearings, to compressor maps, surge control and reciprocating machines, and then to steam turbine governing, alignment, balancing and vibration diagnosis. The final day applies these methods in an inspection walkthrough and produces a Rotating Equipment Troubleshooting Guide and Inspection Checklist ready for site use.