

COURSE BROCHURE

Refinery Critical Equipment Operation

(Compressors, Turbines & Pumps)

Professional Training Course

Skillslab Training Provider

Skills for Tomorrow's World 



Course Description

Introduction

The Refinery Critical Equipment Operation (Compressors, Turbines & Pumps) course is an advanced professional training program designed to strengthen the operational, technical, and troubleshooting capabilities required for the safe, reliable, and efficient operation of rotating equipment in refineries, petrochemical plants, oil and gas facilities, and process industries.

Compressors, turbines, and pumps are among the most critical assets in refinery operations. Their performance directly influences production continuity, process stability, energy efficiency, maintenance expenditure, equipment availability, and overall plant profitability. Unplanned failure of critical rotating equipment can result in production losses, safety risks, costly maintenance interventions, and significant operational disruption.

This course provides a structured understanding of centrifugal and positive displacement pumps, centrifugal and reciprocating compressors, steam and gas turbines, auxiliary systems, lubrication, sealing, bearings, operating envelopes, performance monitoring, startup and shutdown procedures, troubleshooting, vibration awareness, and equipment protection.

From an executive and organizational perspective, the program supports improved asset reliability, reduced unplanned downtime, optimized maintenance decisions, enhanced energy performance, and stronger operational discipline. Participants learn how operating practices influence equipment lifecycle, process safety, mechanical integrity, and refinery performance.

Through practical exercises, operating scenarios, equipment performance analysis, failure case studies, troubleshooting activities, and real-world refinery examples, participants develop capabilities that can be applied directly to critical rotating equipment operations.

Course Objectives

The Refinery Critical Equipment Operation (Compressors, Turbines & Pumps) course aims to enable participants to:

- Understand the operating principles of critical rotating equipment used in refinery and process operations.
- Differentiate between major pump, compressor, and turbine types and their industrial applications.
- Interpret equipment operating parameters and performance characteristics.
- Apply safe startup, normal operation, shutdown, and emergency operating practices.
- Understand equipment operating envelopes and operational limitations.
- Recognize abnormal operating conditions before they develop into major failures.
- Improve centrifugal pump operation and identify common hydraulic problems.
- Understand compressor performance, capacity control, surge, and associated operational risks.
- Develop practical knowledge of steam and gas turbine operation.
- Understand lubrication, bearing, sealing, and cooling systems.
- Interpret key vibration, temperature, pressure, flow, and performance indicators.
- Apply systematic troubleshooting techniques to rotating equipment problems.
- Identify common equipment failure modes and their operational causes.
- Strengthen coordination between operations, maintenance, reliability, and engineering teams.
- Support refinery reliability, energy efficiency, asset integrity, and operational excellence initiatives.

Course Content

Day 1: Refinery Rotating Equipment Fundamentals and Operational Reliability

- Role of rotating equipment in refinery and petrochemical operations.
- Classification of critical refinery equipment.
- Fundamentals of rotating machinery operation.
- Relationship between process conditions and equipment performance.
- Understanding equipment operating envelopes.
- Design conditions versus actual operating conditions.
- Equipment performance curves and operating points.

- Fundamentals of flow, pressure, head, power, speed, and efficiency.
- Critical equipment availability and reliability concepts.
- Mechanical and process-related equipment failures.
- Bearings and their operational functions.
- Lubrication systems and lubricant condition.
- Mechanical seals and sealing systems.
- Cooling and auxiliary systems.
- Vibration and temperature as indicators of equipment condition.
- Equipment protection, alarms, trips, and shutdown systems.
- Operator responsibilities in rotating equipment reliability.
- Practical exercise on recognizing abnormal equipment operating conditions.

Day 2: Pumps – Operation, Performance, Cavitation, and Troubleshooting

- Classification of refinery pumps.
- Centrifugal pump operating principles.
- Positive displacement pump fundamentals.
- Major pump components and their functions.
- Understanding centrifugal pump performance curves.
- System curves and pump operating points.
- Flow, head, efficiency, and power relationships.
- Suction and discharge conditions.
- Understanding available and required suction head.
- Cavitation causes, symptoms, consequences, and prevention.
- Minimum flow and low-flow operation.
- Pump recirculation and overheating.
- Pump startup and shutdown procedures.
- Priming and venting requirements.
- Parallel and series pump operation.

- Mechanical seal operation and common seal failures.
- Bearing problems and lubrication-related failures.
- Vibration and noise troubleshooting.
- Loss of capacity, pressure, or efficiency.
- Pump overheating and excessive power consumption.
- Practical pump troubleshooting scenarios.

Day 3: Compressors – Operation, Control, Surge, and Performance

- Role of compressors in refinery processes.
- Classification of industrial compressors.
- Centrifugal compressor operating principles.
- Reciprocating compressor operating principles.
- Major compressor components and auxiliary systems.
- Understanding compressor performance maps.
- Pressure ratio, flow, speed, and efficiency.
- Compressor capacity control methods.
- Suction and discharge condition effects.
- Centrifugal compressor surge.
- Surge causes, symptoms, and consequences.
- Anti-surge control principles.
- Choke and operating limitations.
- Compressor startup and shutdown considerations.
- Compressor lubrication systems.
- Dry gas seals and other sealing arrangements.
- Intercooling and aftercooling concepts.
- Reciprocating compressor valves and cylinders.
- Pulsation and vibration considerations.
- High discharge temperature troubleshooting.

- Capacity loss and efficiency deterioration.
- Abnormal noise, vibration, and temperature conditions.
- Practical compressor operating and troubleshooting case studies.

Day 4: Turbines – Operation, Control, Protection, and Troubleshooting

- Turbine applications in refinery operations.
- Fundamentals of steam turbine operation.
- Fundamentals of gas turbine operation.
- Major turbine components and their functions.
- Energy conversion principles in turbine operation.
- Steam conditions and their influence on turbine performance.
- Turbine speed and load control.
- Governor systems and control concepts.
- Turbine lubrication systems.
- Bearings and thrust control.
- Sealing and gland systems.
- Condensing and non-condensing steam turbine applications.
- Turbine startup and warm-up requirements.
- Thermal expansion and differential expansion considerations.
- Critical speed and vibration considerations.
- Normal shutdown and emergency shutdown procedures.
- Overspeed protection.
- Turbine trips and protective systems.
- Common causes of turbine performance deterioration.
- Steam leakage and efficiency losses.
- Bearing temperature and lubrication problems.
- Vibration and rotor-related problems.
- Practical turbine troubleshooting scenarios.

Day 5: Integrated Troubleshooting, Condition Monitoring, and Operational Excellence

- Integrated approach to rotating equipment troubleshooting.
- Distinguishing process problems from mechanical problems.
- Structured fault diagnosis methodology.
- Using operating trends for early problem detection.
- Pressure, temperature, flow, speed, and power analysis.
- Fundamentals of vibration monitoring.
- Understanding common vibration patterns.
- Bearing condition monitoring.
- Lubricant condition monitoring.
- Seal performance monitoring.
- Performance degradation and efficiency assessment.
- Root cause thinking for recurring equipment problems.
- Identifying operational contributors to equipment failure.
- Improving communication between operations and maintenance.
- Developing effective operator inspection routines.
- Critical equipment rounds and condition checks.
- Alarm response and abnormal situation management.
- Emergency response considerations for rotating equipment.
- Reducing unplanned shutdowns and equipment trips.
- Improving equipment availability and reliability.
- Energy efficiency opportunities in pumps, compressors, and turbines.
- Practical integrated troubleshooting workshop.
- Case study involving multiple equipment symptoms and operational decisions.

Target Audience

The Refinery Critical Equipment Operation (Compressors, Turbines & Pumps) course is suitable for professionals responsible for refinery operations, rotating equipment, maintenance, reliability, mechanical integrity, and process performance, including:

- Refinery operations engineers.
- Mechanical engineers.
- Rotating equipment engineers.
- Reliability engineers.
- Maintenance engineers.
- Process engineers.
- Production engineers.
- Operations supervisors.
- Shift supervisors.
- Maintenance supervisors.
- Refinery operators and senior operators.
- Machinery specialists.
- Condition monitoring professionals.
- Mechanical technicians.
- Maintenance planners.
- Asset integrity professionals.
- Technical support engineers.
- Professionals working in refineries, petrochemical facilities, oil and gas processing plants, terminals, power facilities, and other process industries.

Course Requirements

Participants should preferably have a basic understanding of refinery operations, mechanical equipment, process systems, maintenance, or industrial engineering. Advanced rotating equipment experience is not required, as the course progressively develops knowledge from fundamental operating principles to equipment

troubleshooting and performance analysis.

Participants with practical exposure to pumps, compressors, turbines, refinery process units, maintenance activities, or control room operations will gain additional value from the practical exercises and troubleshooting scenarios.

Training Methodology

The course applies a practical, interactive, and operations-focused methodology designed to convert rotating equipment principles into actionable workplace capabilities. The learning process combines technical explanation with equipment analysis, operating scenarios, troubleshooting exercises, and refinery-based case studies.

The methodology includes:

- Expert-led technical presentations.
- Real-world refinery equipment examples.
- Equipment diagrams and operating scenarios.
- Pump performance analysis exercises.
- Compressor operating map interpretation.
- Turbine operating case discussions.
- Startup and shutdown scenario analysis.
- Abnormal operating condition exercises.
- Troubleshooting workshops.
- Failure case studies.
- Performance trend interpretation.
- Condition monitoring examples.
- Individual and group problem-solving activities.
- Integrated rotating equipment case studies.

The methodology emphasizes the connection between equipment behavior and process conditions, enabling participants to identify emerging problems earlier, make better operational decisions, and communicate

technical findings more effectively across operations, maintenance, reliability, and engineering functions.

Learning Outcomes

Upon successful completion of the Refinery Critical Equipment Operation (Compressors, Turbines & Pumps) course, participants will be able to:

- Explain the operating principles of pumps, compressors, and turbines used in refinery service.
- Interpret key rotating equipment operating and performance parameters.
- Understand the relationship between process conditions and machinery performance.
- Apply appropriate startup, operating, shutdown, and monitoring practices.
- Interpret pump performance curves and identify abnormal operating conditions.
- Recognize cavitation, recirculation, seal problems, bearing issues, and performance deterioration.
- Understand centrifugal and reciprocating compressor operation.
- Recognize compressor surge and understand anti-surge protection principles.
- Evaluate common causes of compressor performance deterioration.
- Understand steam and gas turbine operating principles and protection requirements.
- Recognize abnormal turbine operating conditions and common failure indicators.
- Monitor lubrication, bearing, sealing, and auxiliary systems effectively.
- Use operating trends and condition indicators to support early fault detection.
- Apply structured troubleshooting techniques to rotating equipment problems.
- Distinguish between process-related and mechanical equipment problems.
- Contribute to reducing unplanned equipment shutdowns and recurring failures.
- Support improved rotating equipment reliability, availability, and energy efficiency.
- Strengthen coordination between operations, maintenance, reliability, and engineering teams.

Instructor Profile

The course is delivered by “An internationally certified expert with extensive practical and consulting experience.”

The instructor brings extensive professional expertise in refinery operations, rotating equipment, pumps,

compressors, turbines, machinery reliability, troubleshooting, condition monitoring, maintenance optimization, and industrial asset performance.

The training approach combines internationally recognized engineering practices with practical refinery experience, enabling participants to understand not only how critical equipment operates, but also how operating decisions influence process safety, mechanical reliability, energy consumption, maintenance requirements, production continuity, and long-term asset performance.

Contact Us

For registration inquiries, upcoming dates, or group pricing, please contact us:

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