
Gas Turbines and Centrifugal Compressors: Performance, Operation and Maintenance Training Course

28 June – 2 July 2027
Tokyo





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Programme Summary

Gas turbines and centrifugal compressors are the focus of this one-week training course for operations, maintenance and rotating equipment engineers and managers, ending in a performance and maintenance plan for one gas turbine and compressor train. These machines drive gas export, injection and pipeline duties, and a single trip can halt a facility. The programme moves from the Brayton cycle and compressor characteristics, through start-up and operating limits, to condition monitoring and maintenance planning, then applies them to one train. Mars Training Centre UK delivers this programme for mixed-organisation cohorts.

The Business Case

A gas turbine driving a centrifugal compressor is often the single largest production dependency on site. When teams read compressor performance data poorly, fouling goes unnoticed, surge events recur and overhauls are scheduled by calendar rather than by condition. Teams that understand how the driver and compressor behave together protect throughput, fuel and equipment life.

- Unplanned Trips: Fall as operating limits and protection logic are understood and tested.
- Fuel and Energy Use: Improve as performance drift is detected and corrected early.
- Maintenance Spend: Becomes better targeted as work follows condition rather than the calendar.

Principles and Evidence Base

- Brayton cycle: It explains gas turbine output, efficiency and the effect of ambient temperature in Session 1.
- API 617: It guides the discussion of axial and centrifugal compressor design, testing and documentation in Sessions 2 and 5.
- Compressor characteristic curves: They support the surge, stonewall and operating point work of Sessions 2 and 3.

Intended Participants

- Operations engineers and supervisors responsible for compressor trains.
- Maintenance and reliability engineers planning inspections and overhauls.
- Rotating equipment engineers who review vendor data and performance reports.
- Control and instrument engineers who support anti-surge and protection systems.
- Asset and plant managers accountable for availability and cost.

Typical sectors include oil and gas production, gas processing, pipelines, LNG and petrochemicals.



Learning Outcomes

1. Participants will be able to explain how a gas turbine converts fuel into shaft power using the Brayton cycle.
2. Participants will be able to read a centrifugal compressor characteristic curve and locate the operating point.
3. Participants will be able to describe how surge control and anti-surge control protect a compressor.
4. Participants will be able to apply start-up, loading and shutdown checks to a gas turbine and compressor train.
5. Participants will be able to interpret performance and condition monitoring data to detect fouling and wear.
6. Participants will be able to present a performance and maintenance plan for one gas turbine and compressor train.

Programme Structure

Day 1: Gas Turbine Principles and Performance

How does a gas turbine turn fuel into shaft power, and what changes its output?

- Brayton Cycle Walk-Through
- Compressor, Combustor and Turbine Section Review
- Ambient Temperature and Altitude Derating Estimate
- Fuel Gas Quality Checklist
- Performance Parameter Log Sheet

Day 2: Centrifugal Compressor Fundamentals

How does a centrifugal compressor build pressure and where are its limits?

- Impeller and Diffuser Flow Sketch
- Characteristic Curve Reading Exercise
- Surge and Stonewall Boundary Map
- Seal and Bearing Arrangement Review
- Vendor Data Sheet Review Against API 617

Day 3: Centrifugal Compressor Operation and Control

How is the driver and compressor started, loaded and kept inside safe limits?

- Start-Up Permissive Checklist
- Load Sharing and Speed Control Review
- Anti-Surge Control Loop Walk-Through
- Trip and Protection Logic Table
- Upset Response Drill Sheet



Day 4: Condition Monitoring and Gas Turbine Maintenance

How is wear found early and maintenance timed to condition?

- Compressor Wash and Fouling Assessment
- Vibration and Temperature Trend Review
- Borescope Findings Interpretation
- Hot Section Inspection Planning
- Overhaul Scope and Spares Table

Day 5: Applying the Programme to One Train

Does the plan hold when tested on a single gas turbine and compressor train?

- Applying the Session 1 Performance Log to Train Data
- Testing the Session 2 Operating Point on the Compressor Map
- Checking Session 3 Protection Logic Against Upset Scenarios
- Reviewing Session 4 Maintenance Scope with Peers
- Completing the Performance and Maintenance Plan

Methodology

The programme uses a structured exercise method built on anonymised compressor maps, trend plots, data sheets and short written cases from gas export and processing facilities. Participants work in small groups on one train, explain their reasoning to peers from other functions, and receive facilitator feedback on each work product, including every operating point and maintenance scope, so that centrifugal compressor operation and gas turbine maintenance are judged together.

- Suggested activity: Locating a drifting operating point on a compressor map.
- Suggested activity: Tracing the response of an anti-surge valve to a sudden flow drop.
- Suggested activity: Ranking inspection findings by consequence and urgency.

Capstone Output

Each participant completes a performance and maintenance plan for one gas turbine and compressor train. It holds a performance baseline, an operating envelope sketch, a protection logic summary and a condition-based maintenance schedule. The plan is used at work to guide operating decisions, challenge vendor advice and prepare the next outage.



Frequently Asked Questions

Who should attend training on gas turbines and centrifugal compressors?

Operations, maintenance, reliability and control engineers, and the managers who answer for compressor train availability, will benefit most.

How does surge control work on centrifugal compressors?

Surge control keeps the operating point away from the surge boundary, usually by opening a recycle valve when flow falls toward the limit, as explored in Session 3.

Which references support gas turbines and centrifugal compressors in this programme?

The programme draws on the Brayton cycle, compressor characteristic curves and API 617 for axial and centrifugal compressors.

How is the performance and maintenance plan for gas turbines and centrifugal compressors used at work?

You use it to guide operating decisions, challenge vendor advice and plan the next outage for your own train.