CONCEPT

Ammonia and Propane Refrigeration Systems: Operation, Maintenance and Safety

8 – 12 August 2027
Dammam - Eastern Province five-star



Ammonia and Propane Refrigeration Systems: Operation, Maintenance and Safety

Ref: 523_17003 **Date:** 8 – 12 August 2027 **Location:** Dammam - Eastern Province five-star **Fees:** 19500 SAR

Introduction:

Industrial ammonia and propane refrigeration systems in gas plants, petrochemical units, food processing plants and cold stores often lose capacity long before anyone notices: suction pressure drifts, non-condensable gases lift head pressure, oil collects in evaporators and gaps in detection or relief protection go unchecked. With toxic ammonia and flammable hydrocarbon charges, each of these faults is also a safety exposure. This Core Concept course takes plant teams through the refrigeration loop on the pressure-enthalpy diagram, the equipment, the controls and the refrigerant hazards. Each participant completes a Refrigeration Troubleshooting and Safety Audit Report.

Course Objectives:

- Plot an operating refrigeration cycle on a pressure-enthalpy diagram and read superheat, subcooling and refrigerating effect from plant data
- Compare ammonia, propane, propylene and carbon dioxide as refrigerants by boiling point, latent heat, toxicity and flammability
- Operate screw and reciprocating compressors, condensers, evaporators, economisers, receivers and accumulators within their design limits
- Adjust capacity control, expansion devices and staging in multi-stage and cascade systems to hold suction conditions and process temperatures
- Apply leak detection, relief protection, machinery room ventilation and emergency response measures to ammonia and hydrocarbon refrigerant hazards
- Diagnose performance losses and recurring faults from log sheets and record corrective and safety actions in an audit report

Target Audience:

- Refrigeration plant operators responsible for compressor rooms, daily rounds and log sheets
- Mechanical maintenance technicians responsible for compressors, vessels, valves and heat exchangers in refrigeration circuits
- Process engineers responsible for refrigeration duty in chilling, liquefaction and product cooling units
- Shift supervisors responsible for start-up, shutdown and alarm response on refrigeration systems
- Plant safety and inspection staff responsible for gas detection, relief devices and emergency plans around refrigerant inventories

Course Outline:

Day 1: Refrigeration Cycle Fundamentals and Refrigerant Properties

- Vapour-Compression Cycle Stages: Compression, Condensation, Expansion and Evaporation
- Pressure-Enthalpy Diagram Plotting: Superheat, Subcooling and Refrigerating Effect
- Ammonia R-717 Properties: Latent Heat, Boiling Point, Toxicity and Flammability Range
- Propane R-290 and Propylene as Process Refrigerants for Low-Temperature Duty
- Carbon Dioxide R-744 Overview and Plant Baseline Survey of Charge, Duty and Operating Logs

Day 2: Compressors, Heat Exchangers and Vessels in the Refrigeration Plant

- Oil-Injected Screw Compressors: Slide Valve, Volume Ratio and Oil Separator Arrangement
- Reciprocating Compressors: Cylinder Unloaders, Valve Plates and Crankcase Oil Return
- Evaporative, Shell-and-Tube and Air-Cooled Condensers: Heat Rejection and Fouling Effects
- Flooded, Direct-Expansion and Liquid Overfeed Evaporators with Recirculation Pump Packages
- High-Pressure Receivers, Suction Accumulators and Surge Drums: Level Control and Carryover Protection

Day 3: Multi-Stage and Cascade Systems, Controls and Daily Operation

- Two-Stage Compression with Intercoolers and Screw Compressor Economiser Ports
- Ammonia-Carbon Dioxide and Propane-Ethylene Cascade Arrangements and Cascade Condenser Duty
- Expansion Devices: Float Valves, Hand Expansion Valves and Electronic Expansion Valve Loops
- Capacity Control Methods: Slide Valve Modulation, Variable Speed Drives and Compressor Sequencing
- Operator Rounds Checklist: Suction and Discharge Pressures, Temperatures and Oil Levels

Day 4: Refrigerant Hazards, Safety Systems and Fault Diagnosis

- Ammonia Toxicity and Hydrocarbon Fire and Explosion Hazards in Machinery Rooms
- Fixed Gas Detection, Leak Search Methods and Alarm Response Philosophy
- Pressure Relief Valves, Relief Headers and Machinery Room Ventilation Under IIAR-Type Guidance
- Oil Draining, Non-Condensable Gas Purging and Water Contamination Control in Ammonia Circuits
- Fault Diagnosis Matrix: High Head Pressure, Low Suction, Liquid Slugging and Compressor Overheating

Day 5: Troubleshooting and Safety Audit Case Work

- Case Data Pack: Plant Log Sheets, Cycle Diagram and Compressor Performance Records
- Inspection Walkthrough: Machinery Room, Vessels, Valves and Detector Coverage Against Audit Criteria
- Performance Deviation Analysis: Coefficient of Performance and Specific Power Trends
- Emergency Response Review: Ammonia Release Isolation, Evacuation and Communication Steps
- Refrigeration Troubleshooting and Safety Audit Report Presentation and Peer Review

Skills You Will Gain:

- Pressure-Enthalpy Cycle Analysis
- Refrigerant Hazard Assessment
- Screw Compressor Operation
- Cascade System Operation
- Refrigerant Leak Detection
- Non-Condensable Gas Purging
- Relief Protection Inspection
- Refrigeration Plant Troubleshooting

Why Attend This Course:

- Return with a Refrigeration Troubleshooting and Safety Audit Report built on readings and inspection criteria your own plant can use
- Trace high power use and lost cooling capacity to specific causes in compressors, heat exchangers, oil or trapped gases
- Recognise the different release behaviour of toxic ammonia and flammable hydrocarbon refrigerants and the safeguards each needs
- Compare refrigeration practice with operators, technicians and engineers from gas, petrochemical, food and cold storage plants

Conclusion:

Safe and efficient industrial refrigeration depends on crews who read the cycle, know their refrigerant and keep the plant inside its limits. The course moves from the vapour-compression cycle and refrigerant properties, through compressors, heat exchangers and vessels, to multi-stage and cascade systems and their controls. It then covers ammonia and hydrocarbon hazards, detection, relief, ventilation, purging and fault diagnosis, before the final day applies them in an inspection walkthrough and a troubleshooting and safety audit report.