



Air Separation Unit Operations Course: Cryogenic Oxygen, Nitrogen and Argon Production



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Introduction:

Air separation unit operations covering cryogenic oxygen, nitrogen and argon production is a 5-day course for process engineers, panel and field operators and maintenance staff, ending with an ASU Performance and Safety Review for a case plant. Plants lose product and power, and face oxygen fires or reboiler incidents, when adsorber breakthrough goes unnoticed, column purity drifts, expanders trip or oxygen service cleanliness lapses. Nominees already run or maintain an air separation or gas-generation unit and work through inspection walkthroughs of cold box, adsorber and compressor data. CoreConcept Training Center delivers this air separation unit operations course.

Course Objectives:

- Trace air, product and refrigeration flows through an air separation unit and relate them to industrial gas demand and supply modes
- Operate main air compression and molecular sieve pre-purification so that water, carbon dioxide and hydrocarbons never reach the cold box
- Control double-column distillation, argon recovery and expander refrigeration to hold oxygen, nitrogen and argon purity and liquid output
- Apply oxygen service cleanliness, material compatibility and enrichment and deficiency controls to plant work and piping
- Execute cold start-up, planned shutdown and trip recovery while protecting compressors, expanders and the reboiler-condenser
- Prepare an ASU Performance and Safety Review that ranks power cost, purity, reliability and oxygen safety actions for a case plant

Target Audience:

- Process engineering staff responsible for air separation unit balances, product purity and specific power
 - Panel operating staff responsible for column, adsorber and expander control from the control room
 - Field operating staff responsible for rounds, sampling, liquid product transfers and equipment line-ups
 - Rotating equipment and maintenance staff responsible for air compressors, boosters and turbo-expanders
 - Shift supervision staff responsible for start-up, shutdown, trip response and safe work in oxygen areas
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Course Outline:

Day 1: Industrial Gases Landscape and ASU Process Basis

- Oxygen, Nitrogen and Argon Uses Across Steel, Chemicals and Electronics
- Pipeline, Bulk Liquid and Cylinder Supply Mode Comparison
- Air Composition, Boiling Points and ASU Block Flow Diagram
- Zeolite PSA and VPSA Units Versus Cryogenic Plant Selection
- Current-State Survey of Production, Purity and Downtime Records

Day 2: Main Air Compression, Pre-Purification and Cold Box Equipment

- Main Air Compressor Intercooling, Aftercooling and Direct Contact Cooler
- Molecular Sieve Adsorber Cycle With Heated Regeneration Gas
- Carbon Dioxide Breakthrough Detection and Adsorber Switchover Checks
- Brazen Aluminium Plate-Fin Main Heat Exchanger Temperature Profiles
- Cold Box Perlite Insulation, Casing Purge and Leak Signs

Day 3: Double-Column Distillation, Argon Recovery and Refrigeration Balance

- Column Purity Control Using Paramagnetic and Trace Impurity Analysers
- Reboiler-Condenser Liquid Level and Oxygen Bath Operation
- Crude Argon Side Column and Pure Argon Rectification
- Turbo-Expander Refrigeration Balance and Booster Brake Loading
- Liquid Product Rundown, Vacuum-Insulated Storage and Tanker Loading

Day 4: Oxygen Safety, Upsets, Trips and Machine Reliability

- Oxygen Service Cleaning, Material Compatibility and Gas Velocity Limits
- Hydrocarbon Accumulation Monitoring and Main Condenser Sump Purging
- Oxygen Enrichment and Oxygen Deficiency Atmosphere Hazard Controls
- Cold Start-Up, Planned Shutdown and Trip Recovery Sequences
- Air Compressor and Turbo-Expander Vibration and Seal Gas Monitoring

Day 5: Inspection Walkthrough and ASU Performance and Safety Review

- Case Plant Cold Box and Adsorber Data Walkthrough
 - Specific Power per Tonne Oxygen and Power Cost Benchmark
 - Oxygen Safety Inspection Checklist Applied to Case Plant Piping
 - Trip History Review and Rotating Machine Reliability Actions
 - ASU Performance and Safety Review Completion and Peer Defence
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Skills You Will Gain:

- Air Separation Process Mapping
- Adsorber Breakthrough Diagnosis
- Cryogenic Column Purity Control
- Expander Refrigeration Balancing
- Oxygen Service Cleanliness Checks
- Reboiler Hydrocarbon Surveillance
- ASU Specific Power Benchmarking
- Rotating Machine Condition Review

Why Attend This Course:

- Deliver an ASU Performance and Safety Review to the plant manager and technical services head as the basis for the next improvement budget
- Decide when to switch an adsorber, trim column reflux, unload an expander or purge the condenser sump by reading analyser and temperature trends
- Avoid oxygen fires, reboiler incidents, off-specification product and avoidable power cost caused by unnoticed upsets and lapsed cleanliness
- Brief shift crews and contractors on oxygen safety checks, start-up hold points and adsorber switchover steps using shared checklists

Conclusion:

Back at work, the participant presents the ASU Performance and Safety Review to the plant manager, technical services head and safety lead, who use it to rank power cost, purity, reliability and oxygen safety actions for the next operating period and turnaround scope. Shift supervisors can adopt its adsorber, condenser sump and oxygen cleanliness checks as routine controls. After the first month of use, the unit should review specific power, product purity excursions, trips and open safety actions against the review's targets.

Frequently Asked Questions FAQ:

What should participants know before the air separation unit operations course?

Participants should already operate, support or maintain an air separation or gas-generation unit and read process flow diagrams and trend displays. Bringing recent adsorber, column purity or compressor data helps them apply the walkthrough exercises to their own plant.

How does air separation unit operations differ from a general plant utilities course?

It concentrates on producing oxygen, nitrogen and argon: compression, pre-purification, the cold box, distillation columns, expanders, liquid products and oxygen safety. General utilities courses treat purchased or packaged nitrogen as one service among steam, water and fuel gas headers.

Why must hydrocarbons be watched in air separation unit operations?

Hydrocarbons that pass the adsorbers can concentrate in liquid oxygen at the reboiler-condenser, where they create a fire and explosion risk. Analysing the sump liquid, keeping adsorbers healthy and purging liquid as required keep that concentration well below hazardous levels.

What do participants take back from the air separation unit operations course?

Participants take back an ASU Performance and Safety Review for a case plant, with a specific power benchmark, purity and trip analysis, oxygen safety inspection checklist and ranked reliability actions they can adapt to their own unit.