CNP ECO1 & ECO1 Extendible

Reliable LN2 Production with Single Cold-Head Architecture

CNP ECO1 delivers reliable, continuous liquid nitrogen production in a compact, fully integrated plant for laboratories, research facilities, biological storage centers and industrial users. A single cryogenic cold head, driven by two helium compressors, liquefies nitrogen directly into a 500-liter vacuum-insulated storage tank.



CNP ECO1 Extendible (ECO1E) is the same plant, prepared for growth. When demand rises, its capacity can be expanded from 240 to 480 liters per day by adding one PSA module, one cryogenic cold head and two helium compressors, while the existing installation stays in service.

Powered by IMTEK Cryogenics' proven PSA technology and advanced control algorithms, ECO1 combines reliable nitrogen generation and intelligent process management in a single compact platform.

The integrated PSA system delivers 15 Nm^3/h of nitrogen gas to the liquefaction stage, supporting a liquid nitrogen production capacity of approximately 240 liters per day while maintaining stable purity and long-term operational reliability.

Its simple, proven refrigeration layout keeps maintenance straightforward and operating costs low.

Intelligent Air Management Algorithm (IAMA)

Despite its compact footprint, ECO1 incorporates the same advanced air management technologies used in IMTEK's larger cryogenic plants.

The Intelligent Air Management Algorithm (IAMA) continuously compensates for pressure fluctuations originating from PSA cycling, auto-drain operation, and varying air demand conditions.

By dynamically stabilizing the air supply to the PSA module, IAMA improves nitrogen purity consistency, enhances adsorbent lifetime, and contributes to stable liquefaction performance under varying operating conditions.

Integrated condensate removal, multi-stage filtration, and advanced dew-point control ensure that only clean and dry air enters the PSA system, protecting critical components and supporting long-term operational reliability.

The same architecture has been successfully validated in long-term operation across IMTEK's cryogenic plant installations worldwide.

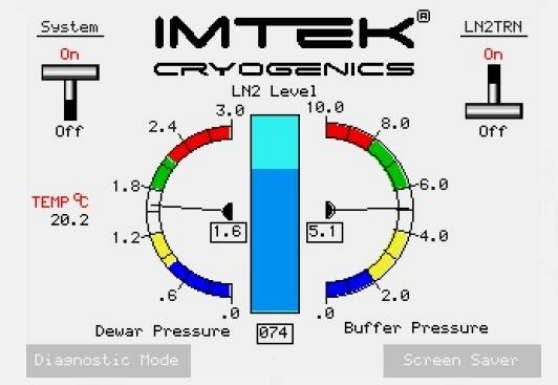
IMTEK CRYOGENICS

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Atmospheric air is compressed and delivered to an air buffer tank where it undergoes a multi-stage purification process.

Water droplets and particulates are removed through an automatic condensate separator and filtration system, while the integrated dryer reduces the dew point to as low as –40 °C or –70 °C depending on configuration.

The purified air is then processed by IMTEK's dual-column Pressure Swing Adsorption (PSA) system. Carbon molecular sieves selectively adsorb oxygen, carbon dioxide, and residual moisture, producing high-purity nitrogen suitable for cryogenic liquefaction.



The PSA system is optimized to achieve:

- High nitrogen production efficiency
- Reduced air consumption
- Long adsorbent lifetime
- Stable nitrogen purity
- Low operating cost

The generated nitrogen is accumulated in a nitrogen buffer tank before entering the liquefaction stage.

Intelligent Reliability Architecture

ECO1 combines intelligent diagnostics with continuous process monitoring.

The control system continuously monitors:

- Air pressure
- Nitrogen pressure
- LN_2 level
- Cryocooler performance
- Compressor status
- Process temperatures
- Valve operation
- PSA operating conditions

Advanced diagnostic algorithms identify deviations from normal operating behavior and generate predictive warnings before faults occur.

This proactive approach minimizes downtime, simplifies maintenance planning, and improves long-term operational reliability.

The PLC continuously records system data, operating trends, alarms, and service events, providing valuable information for maintenance and system optimization.

Refrigeration System

ECO1 uses one Gifford-McMahon cryogenic cold head served by two helium compressors operating in parallel in a closed, sealed helium circuit.

The refrigeration system consists of:

- Two F70 helium compressors
- One cryogenic cold head
- One 500-liter LN_2 storage tank

The helium circuit is delivered pre-charged, so no helium supply is needed on site. Cold head maintenance can be carried out on site.

This design provides:

- Proven refrigeration technology
- Low maintenance requirements
- Stable liquefaction performance
- Simplified maintenance planning
- Low operating cost

Automatic level control stops production when the tank is full and restarts it below the set point, so liquid nitrogen is always available.

Single Cold-Head Architecture

At the core of ECO1 is a single cold-head refrigeration system: one cryogenic cold head, two F70 helium compressors and one 500-liter LN_2 storage tank, all sharing a common nitrogen generation platform.

A closed-loop chiller supplies stable cooling water to the helium compressors, keeping liquefaction performance steady across a wide range of plant-room conditions. The compact layout gives direct access to the cold head and helium compressors for maintenance.

The result is a compact plant with consistent production and few moving parts to maintain.

Expandable Platform (ECO1 Extendible)

ECO1 Extendible is built for future growth. Its mechanical, electrical and control platform is prepared from the start for a second liquefaction line.

When additional liquid nitrogen demand arises, capacity can be expanded from 240 to 480 liters per day by adding one PSA module, one cryogenic cold head and two helium compressors. The existing system remains in use.

This scalable approach protects the user's investment while providing a simple and cost-effective path toward higher production capacities with minimal operational disruption.

User Experience and Maintenance

ECO1 is designed for simple and reliable daily operation.

Features include:

- One-button system start-up
- Fully automatic operation
- Automatic process optimization
- Intelligent alarm management
- Remote monitoring capability
- Operator-friendly HMI interface
- Simplified maintenance procedures

Routine maintenance primarily consists of filter replacement and periodic inspections.

The system is designed for long maintenance intervals and maximum operational availability.

Features

High Performance Liquefaction

- Up to 240 L/day LN_2 production
- Single cold-head architecture
- 2 × F70 compressors, 1 × cold head
- 500 L LN_2 storage tank
- Stable and efficient liquefaction

Purity Stability & Air Management

- Intelligent Air Management Algorithm (IAMA)
- Real-time pressure stabilization
- Multi-stage filtration and drying
- Dew point down to –40 / –70 °C
- Long-term purity stability

Optimized PSA Technology

- Dual-column PSA system
- 15 Nm^3/h nitrogen generation
- Optimized nitrogen-to-air ratio
- Reduced compressed air consumption
- Stable purity and long adsorbent life

Reliability & Smart Control

- Intelligent PLC platform
- Real-time diagnostics
- Predictive maintenance functions
- Smart alarm management
- Expandable to 480 L/day (ECO1E)

User Experience & Maintenance

- Fully automatic operation
- One-button start-up
- Remote monitoring capability
- Easy service access
- Simplified maintenance with long service intervals

Specifications

Parameter	ECO1	ECO1 Extendible
LN_2 Production Capacity	≥ 240 liters/day	
LN_2 Production Rate	≥ 10 liters/hour	
LN_2 Storage Capacity	500 liters	
Total Storage Volume	500 liters	
Nitrogen Generation Capacity	15 Nm^3/h	
Nitrogen Purity	≥ 99.9%	
Cryogenic Cold Heads	1	
Helium Compressors	2 × F70	
PSA Technology	Dual Column PSA	
Control System	PLC + HMI	
Operation Mode	Fully Automatic	
Remote Monitoring	Optional	
Dew Point	–40 °C / –70 °C	
Maximum Altitude	4,500 meters	
Noise Level	< 65 dB @ 1 meter	
Electrical Rating	380/400/415 VAC, 3Ph, 50 Hz or 480 VAC, 3Ph, 60 Hz	
Power Consumption*	Approx. 14kW	
Chiller Power Consumption*	Approx. 5 kW	
Air Compressor Power Consumption*	3 kW	
Total Installed Power*	Approx. 22 kW	
Maintenance Interval	Up to 15,000 operating hours	

* Values may vary depending on final configuration and site conditions. ECO1 Extendible: expandable to 480 L/day.

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