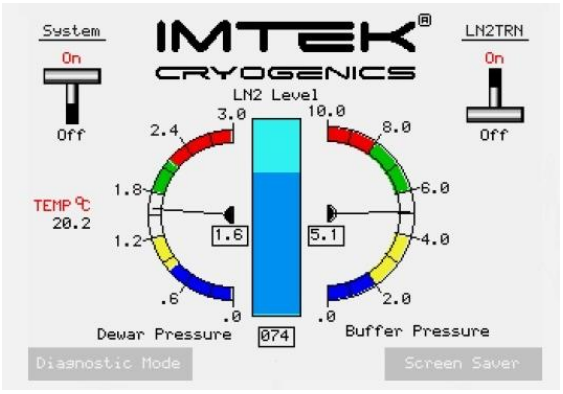
CNP ECO8

Liquid Nitrogen Production Reinvented by IMTEK Cryogenics

CNP ECO8 redefines liquid nitrogen production with its impressive 1920 L/day capacity and ultra-efficient performance. Engineered for speed, it delivers rapid startup and accelerated liquefaction, ensuring maximum productivity from the moment operations begin. With its intuitive, user-friendly interface and true one-button control, CNP ECO8 integrates effortlessly into any environment—bringing laboratory-grade precision, reliability, and simplicity together in one advanced system. At its core, ECO8 features a groundbreaking four-cylinder GM architecture, integrating four GM coolers within a single high-performance insulated housing. This GM4 technology enables exceptionally efficient liquefaction with ultra-low thermal losses, transferring liquid nitrogen into a 3000-liter storage tank with less than 1% loss. Developed exclusively by IMTEK Cryogenics, this multi-cooler system represents the first time such a configuration has been achieved at this capacity level, reaching the highest liquefaction efficiency attainable in any GM-based cryocooler and setting a new benchmark for performance in its class.

Intelligent Air Management Algorithm

Behind its compact form, CNP ECO8 incorporates the same high-end engineering that powers IMTEK's large-scale cryoplants. Its Intelligent Air Management Algorithm (IAMA) dynamically compensates for pressure fluctuations caused by PSA cycles, auto-drains, and varying air loads—delivering exceptional purity stability proven through long-term performance tests. Integrated condensate removal, multi-stage filtration and advanced dew-point control



IMTEK CRYOGENICS

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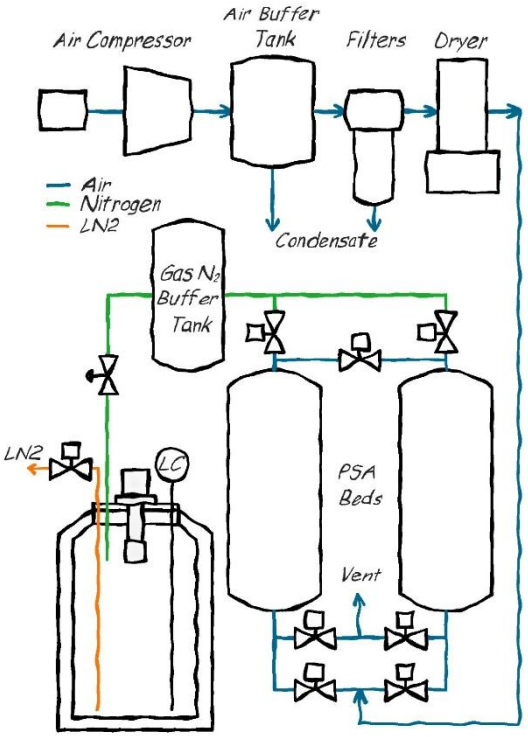
ensure clean, dry air enters the system, protecting internal components and extending service life. Meanwhile, the ECO PLC continuously analyzes system behavior, applying smart alarms, predictive diagnostics, and early warnings to eliminate downtime risks and maintain maximum productivity. Every operation is optimized automatically for efficiency, energy use, and consistent output, making CNP ECO8 one of the most reliable and performance-driven liquid nitrogen solutions in its class. Operator only needs to replace the filters and perform routine checks between maintenance intervals of **15,000 operating hours**, which is nearly twice that of comparable liquefiers.

Atmospheric air is first compressed and delivered to an Air Buffer Tank, where high-pressure air undergoes a comprehensive multi-stage purification process. Water droplets and particulates are removed through an auto-drain water separator and fine filtration system, while the integrated air dryer reduces the dew point to –40/–70 °C. This triple-layer moisture and particulate defense ensures that only clean, dry air reaches the purification stage, significantly extending adsorbent lifetime and enhancing long-term system stability. **IMTEK's Intelligent Air Management Algorithm** (IAMA) further stabilizes pressure variations caused by auto-drains and compressor cycling, maintaining a consistent and optimized airflow to the PSA module. This advanced control strategy forms the foundation of ECO8's superior purity stability—validated through long-duration performance testing that demonstrates exceptionally consistent nitrogen quality even under dynamic operating conditions.



The purified air then enters the Pressure Swing Adsorption (PSA) module, where carbon molecular sieves selectively adsorb oxygen, CO_2, and residual moisture to produce high-purity nitrogen. ECO8's dual-column PSA architecture operates in an alternating cycle: while one adsorption bed captures impurities, the other depressurizes and regenerates. This continuous cycling guarantees a steady, uninterrupted nitrogen flow. The PSA system is engineered with optimized adsorber volume and a highly efficient nitrogen/air ratio, minimizing air consumption while maximizing output. Combined with IMTEK's precision pressure-stabilization strategy—proven across large-scale CNP cryoplants—the result is exceptional purity consistency, reduced operational costs, and extended adsorbent longevity.

The high-purity nitrogen is then routed to a nitrogen buffer tank before entering the cryogenic stage, where the advanced GM4 Cryocooler and its integrated instrumentation enable highly efficient liquefaction. With minimal thermal losses and precise pressure control, ECO8 delivers stable liquid nitrogen production tailored to the stringent purity and performance requirements of laboratory and industrial environments alike.

Intelligent Reliability Architecture

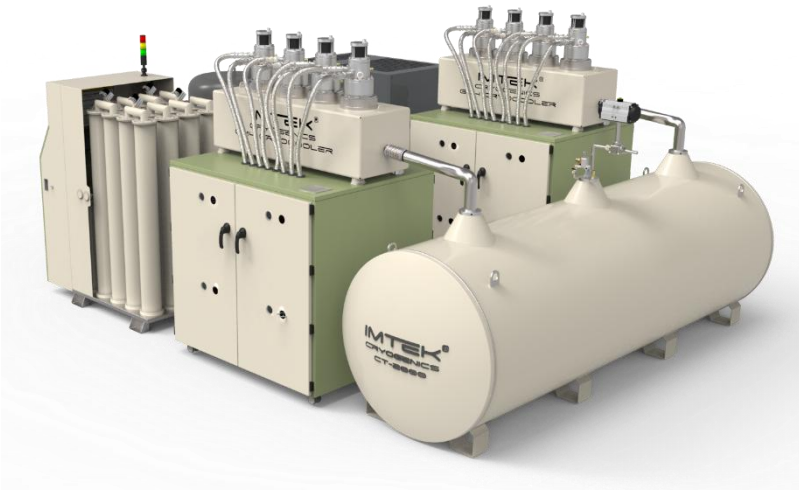
ECO8 incorporates the same advanced reliability framework that IMTEK Cryogenics applies to its large-scale TRL-9 cryoplants, combining real-time diagnostic intelligence with engineered operational resilience. The system continuously monitors all critical parameters, including pressure behavior across three independent pressure sensors, nitrogen level feedback, thermal conditions, airflow dynamics, and valve performance—allowing the PLC to interpret system health with exceptional precision. Time-based

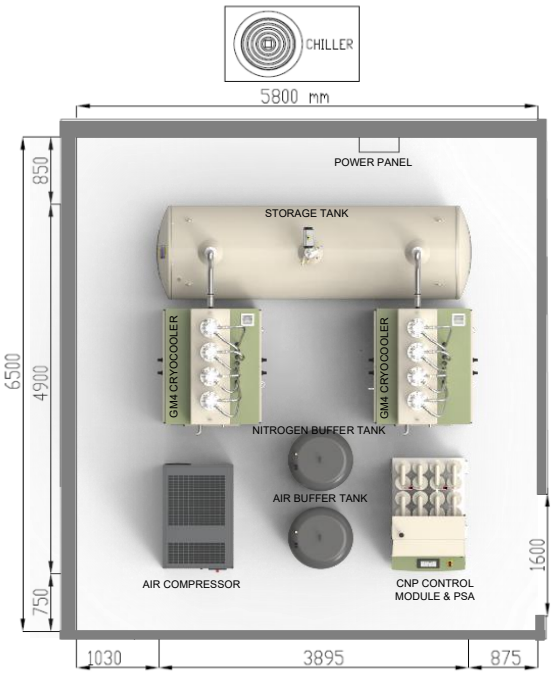
control scenarios and adaptive algorithms detect early deviations from normal operating patterns, generating smart alarms and predictive warnings long before they evolve into faults. This proactive diagnostic layer minimizes downtime, reduces service interventions, and ensures long-term operational stability.

In addition to software-based diagnostics, ECO8 features **a three-color visual alarm module** that provides clear, immediate status indication. A continuous green signal confirms normal operation, a steady yellow light indicates standby mode or non-critical transitions, and a flashing red alert—supported by an audible alarm—signals abnormal conditions requiring operator attention. This integrated visual-acoustic alert system brings a higher level of situational awareness to liquefier operation, allowing operators to assess system state briefly, even from a distance.

Instead of reacting to failures, ECO8 anticipates them. **IMTEK's predictive maintenance logic** evaluates compressor behavior, air-quality fluctuations, adsorbent performance, and system cycling patterns to prevent contamination risks, purity drift, or flow instability. The software continuously corrects transient disturbances—such as PSA pressure swings, auto-drain events, or compressor load changes—ensuring the liquefaction stage receives steady, high-quality nitrogen always. These intelligent corrections are derived from IMTEK's extensive field experience across more than 130 operational cryoplants, where real-world conditions shaped the algorithms used in ECO8's control architecture.

Beyond its diagnostic intelligence, ECO8 is engineered with intrinsic operational resilience. **IMTEK's GM4 Cryocooler** unit includes **4 independent GM cryocoolers**, each functioning as a self-contained cooling module. In the event of localized component disturbances—such as a solenoid valve malfunction or a cryocooler performance drop—the system automatically transitions into a stable reduced-capacity mode rather than shutting down. Because each GM cylinder operates autonomously, a fault in one cryocooler does not force the entire liquefaction system offline; the remaining units continue operating with only a proportional reduction in output. This stands in clear contrast to interconnected multi-cylinder cryocooler architectures, where a single-cylinder issue typically requires a full system shutdown.





By isolating irregularities and dynamically adapting cycle timing, pressure profiles, and liquefaction load, ECO8 preserves operational continuity and prevents mission interruptions. This engineered redundancy—combined with IMTEK's comprehensive alarm logic, three-color visual alert module, and defined safety scenarios—ensures that ECO8 remains operationally secure, predictable, and dependable under a wide range of environmental and usage conditions.

Together, ECO8's predictive diagnostics, intelligent alarm architecture, and engineered redundancy deliver a level of reliability rarely seen in compact liquefaction systems—an intelligence-driven platform capable of protecting itself, optimizing performance, and ensuring uninterrupted, high-quality liquid nitrogen production around the clock.

Features

High Performance Liquefaction

- 4-cylinder GM4 Cryocooler with independent architecture for industry-leading liquefaction efficiency
- More than 960 L/day liquid nitrogen production capacity
- Compatible with 2000 L, 3000L and 4000 L storage tanks for extended autonomous operation

Purity Stability & Air Management

- Intelligent Air Management Algorithm (IAMA) ensuring real-time pressure stabilization across PSA cycles
- Exceptional purity consistency validated through long-duration performance testing
- Triple-stage moisture & particulate defense (auto-drain water separator, filtration, air dryer)
- Dew point reduction to –40 / –70 °C for ultra-dry, contaminant-free inlet air

Optimized PSA Technology

- Dual-column PSA with continuous adsorption/regeneration operation
- Optimized adsorber volume for high output and reduced air consumption
- Low N_2/air ratio for increased efficiency and lower operating cost
- Stable nitrogen purity even under dynamic load and inlet fluctuations

Reliability & Smart Control

- Intelligent PLC platform with real-time diagnostics, event tracking, and trend analysis
- Predictive maintenance algorithms enabling early detection of performance deviations
- Three-color visual alarm module with audible alarm for instant system-state awareness
- Engineered redundancy ensuring continued operation under component-level disturbances
- Stable reduced-capacity mode during unexpected subsystem irregularities

User Experience & Maintenance

- True one-button operation with intuitive user interface
- Simple filter replacement and operator-level routine checks
- 15,000-hour maintenance interval—nearly twice that of comparable liquefiers

	CNP ECO8
Production Rate	≥ 1920 liters/day (≥80 liters/hour) @ 50 Hz
Electrical Rating	380/400/415VAC, 3Ph, 50Hz or 480VAC, 3 Ph, 60 Hz
Power Consumption (Steady State)*	122 kW@ 50Hz / 130 kW@ 60Hz
Water Consumption	8800 L/h @ 2 bar
Dimensions	4.3 m (W) x 4.7 m (L) x 2.1 m (H)
Suggested Installation Area	5.8m (W) x 6.5 m (L) x 3m (H)
Weight	4520 kg
Purity	≥ 99%
Dewar Volume	2000/3000/4000 liters
Maximum Altitude	4 500 meters
Noise Level	Low noise level < 65 dB @ 1 meter

* Power consumption is excl. chiller