

Zero Global Warming Potential Freeze-Dryer

The **REVO NitroLyo** Freeze Dryer uses liquid nitrogen (LN2) for cooling, a method that meets the Zero Global Warming Potential (GWP) criteria. LN2 has minimal to zero GWP values and does not deplete the ozone layer, positioning it as eco-friendly substitutes for synthetic refrigerants.

LN2 (liquid nitrogen) ensures the highest performance and reliability available. The REVO NitroLyo system is designed to minimize moving parts, dramatically improving system reliability and reducing maintenance and repair costs. In addition, the NitroLyo provides more robust system performance, enabling protocol transfer without modification.

Millrock equipment continues to be the standard by which other freeze dryer companies aspire. Decades of intelligent engineering have created the most robust and sophisticated freeze dryers on the market today. Paired with our world class customer and applications support teams, we are the "rock" of the lyophilization industry.



SYSTEM PERFORMANCE

- 6 Shelf pull down from +20 to -40°C in less than 30 minutes
- Vacuum pull down to 100 mT in less than 20 minutes
- Vacuum leak rate less than 30 mT per hour
- Vacuum level 10 mT in clean dry system

Advantages of LN2 Cooling

- Zero GWP cooling system
- Non-flammable gas
- No proprietary technology
- Known and trusted method of cooling
- Quiet operation
- High system reliability
- Reduced maintenance expenses
- Easy to implement without changing existing protocols
- No additional room air conditioning or water cooling needed
- Similar cost of operation compared to mechanical refrigeration

REVO NitroLyo Features



SYSTEM COOLING

- Liquid Nitrogen (LN2)
- Zero GWP



SHELF SYSTEM

- Up to 12 sq ft of shelf area
- 12" x 24" shelf size
- Bulk or hydraulic stoppering option
- 12 PSI stoppering pressure for 2ml vials
- 316L stainless Steel on all wetted parts



CONDENSER

- 20L/24 hr, 30L capacity
- Choke free design
- External condenser with 6" vapor port
- Exposed coil condensing surface to eliminate vapor bypass
- Hot gas defrost



VACUUM

- Pirani vacuum sensor with optional Capacitance Manometer
- Solenoid control with optional proportional control
- Gas backfill
- Corrosion resistant vacuum pump



FITTINGS

- Sanitary and KF fittings on all chamber access ports



CONTROL SYSTEM: Opti-Dry Genz®

- PC/PLC with ethernet and remote connectivity
- Cycle Assist Protocol Generator
- Manual and automatic operating modes
- Automatic system and leak rate testing
- Predictive maintenance
- User definable batch reporting – date, operator, recipe, data, graphic, and alarms graphic and numeric data collection

See page 2 for options.

REVO® NitroLyo™ Freeze Dryer

SPECIFICATIONS

REVO NITROLYO SPECIFICATIONS	
SHELF AREA	2 to 12 sq ft (0.186 to 1.115 sqM)
SHELF ASSEMBLY	Bulk or Hydraulic Stoppering
SHELF TEMPERATURE RANGE	-70°C to +65°C -60°C to +65°C
SHELF HEAT TRANSFER	Hollow Fluid Filled
SHELF DIMENSIONS	12" x 24", 316L SS, 20Ra or better (305mm x 610mm)
CONDENSER TEMPERATURE	-100°C
CONDENSER CAPACITY	30L
CONDENSER RATE	20L in 24 hours
CONDENSER STYLE	Exposed Coil, 6" Vapor Port
PRODUCT SENSORS	4 Type T Thermocouples
VACUUM PUMP	Corrosion Resistant
VACUUM CONTROL	Pirani w/ Solenoid & Needle Valve Option: Capacitance manometer with proportional control
GAS BACKFILL	Included
CONTROL SYSTEM	Opti-Dry® Gen2: PC/PLC Control
TRAYS	One per Shelf Included
CABINET	35" w x 46" d x 75" h
ELECTRICAL	230V, 50/60Hz, 1ph, 20A
LN ₂ SOURCE	25 LPH, 20 PSI

* Vacuum specifications are based on a Leybold D16b vacuum pump or similar.
Please note that units operated at 50Hz have heat removal de-rated by 17%.

AVAILABLE OPTIONS

MECHANICAL

- Clean room configuration
- Butterfly isolation valve on condenser
- Shelf latching kit to change shelf inter-distance
- Isolator interface for connection to an isolator
- Stainless steel door when using solvents
- LN₂ trap to protect your vacuum pump from solvents
- **Clean in Place** to wash between different products
- **H₂O₂ integration** for sterilization
- **Controlled Nucleation - FreezeBooster**

INSTRUMENTATION AND CONTROLS

- Auto-Dry Protocol Development
- Up to 16 thermocouples
- Resistivity probe
- 21 CFR Part 11 capable software

VACUUM

- Capacitance manometer to control the same as production systems
- Proportional vacuum control (+/-2mT control)
- Dry vacuum pump for use when processing solvents

SERVICES

- Startup and training
- Software Validation
- Electro-Mechanical Validation documentation
- IQOQ, FAT and SAT documentation and execution

VIAL CAPACITY

VIAL (ml)	DIA (mm)	HGT (mm)	NUMBER OF SHELVES				
			1	2	3	4	5
2	16	41	774	1548	2322	3096	3870
5	22	48	403	806	1209	1612	2015
10	24	58	322	644	966	1288	-
20	29	71	218	436	654	-	-
50	43	81	96	192	-	-	-
100	52	92	65	130	-	-	-

SHELF CONFIGURATION

SHELVES	SPACING (in/MM)	AREA (sq ft/sq M)
1	14.5/368	2/0.186
2	7.0/177	4/0.373
3	4.5/114	6/0.599
4	3.25/82	8/0.746
5	2.5/63	10/0.929
6"	2.0/50	12/1.115

* 6 shelf units are bulk only

BULK FILL (LITERS)

DEPTH (mm)	NUMBER OF TRAYS					
	1	2	3	4	5	6"
10mm	1.8	3.6	5.4	7.2	9.0	10.8
15mm	2.7	5.4	8.1	10.8	13.5	16.2
20mm	3.6	7.2	10.8	14.4	18.0	21.6

* 6 shelf units are bulk only



OPTI-DRY GEN2: PC/PLC CONTROL

Our new Opti-Dry Gen2 software provides sophisticated and intelligent tools to easily develop and execute both simple and advanced freeze-drying cycles. Millrock Reporter is included with every system, providing full batch reporting, including recipe, graphs, data, and alarms in a single report. Predictive maintenance with advanced system monitoring delivers cost-savings and enables maximum uptime by tracking and monitoring the condition and performance of equipment during normal operation. This same control system is used on industrial freeze dryers, allowing scaling to production. All systems are remotely accessible, with customer approval, for troubleshooting process issues.

Popular Features:

- Simple and easy to use for both the novice and experienced operator
- Better graphics and more meaningful data
- Ability to perform basic and intelligent protocols, standard features
 - Pre-freeze loading step
 - End of primary drying determination— requires a capacitance manometer
- **Cycle assist** automatically generates a protocol based on your product critical temperature
- **Full batch reporting**—reports include recipe, run data, run graphs, alarms in a PDF format
- **Predictive maintenance**—Component life tracking
- **System self-testing** with reporting
- Internet ready for remote support from the factory



Maximum Ice Condensing Rate (24hrs) is based on freeze drying water as aggressively as possible. The actual ability to condense ice at a specific rate over time is application dependent.

Specifications subject to change without notification. All specifications based on 20C ambient and 60 Hz. Trademarks registered to Millrock Technology, Inc. MA61016

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