



We make freeze drying easy.

The **REVO** R&D Freeze Dryer offers up to 12 sq ft (1.115 sq M) of lyophilization shelf area with a condensing rate of 20 liters in 24 hours and a capacity of 30 liters. Millrock provides the most advanced PC/PLC controls with an intuitive user interface, as a standard feature, simplifying equipment operation and reporting.

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.

The REVO is designed to eliminate the nuisance issues often experienced with our competitor's freeze dryers and provide the highest reliability components to ensure that your product is processed properly each and every run. Using more robust refrigeration components, such as scroll compressors, ensures the highest performance and reliability available.

Our new Opti-Dry® G2 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.

Advanced system options include Auto-Dry™ Protocol Optimization and FreezeBooster® Controlled Nucleation. The combination provides the ideal platform for simplified and optimized protocol development. Require more control of your process? Check out our REVO Pro with LyoPAT® technology.

SYSTEM PERFORMANCE

- 6 Shelf pull down from +20 to -40C 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 (-85C)

REVO Features



CONTROL SYSTEM: Opti-Dry G2

- 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



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

- Choke free design
- External condenser with 6" vapor port
- Exposed coil condensing surface to eliminate vapor bypass
- Hot gas defrost



REFRIGERATION

- Oversized and highly reliable scroll compressors
- CFC-free non-proprietary refrigerants



VACUUM

- Pirani vacuum sensor with solenoid control
- Gas backfill
- Corrosion resistant vacuum pump
- Option: Capacitance manometer with proportional control



FITTINGS

- Sanitary and KF fittings on all chamber access ports

See page 2 for options.

REVO® R&D Freeze Dryer

SPECIFICATIONS

REVO STANDARD SPECIFICATIONS

SHELF AREA	2 to 12 sq ft (0.186 to 1.115 sqM)
SHELF ASSEMBLY	Bulk or Hydraulic Stoppering
SHELF TEMPERATURE RANGE	-45C to +65C (-53C Condenser) -70C to +65C (-85C Condenser)
SHELF HEAT TRANSFER	Hollow Fluid Filled
SHELF SIZE/FINISH	12" x 24", 316L SS, 20Ra or better (305mm x 610mm)
CONDENSER TEMPERATURE	-53C or -85C
CONDENSER CAPACITY	30L
CONDENSER RATE	20L in 24 hours
CONDENSER STYLE	Exposed Coil, 6" Vapor Port
DEFROST	Hot Gas
COMPRESSORS (SCROLL)	(-53C) 3.5 HP (-85C) 3.5 HP 1st stage 2HP 2nd stage
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® G2: PC/PLC Control
TRAYS	One per Shelf Included
CABINET	35" w x 46" d x 75" h
ELECTRICAL FOR -53C UNITS	230V/60Hz, 1ph, 30A 220V/50Hz, 1ph, 30A
ELECTRICAL FOR -85C UNITS	230V/60Hz, 1ph, 40A 220V/50Hz, 1ph, 40A 380V/50Hz, 3ph, 25A

* 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
- Water Cooled Condenser
- 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

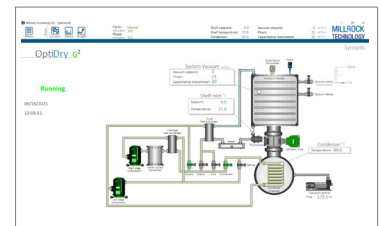


OPTI-DRY G2: PC/PLC CONTROL

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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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