Service Manual

Millrock REVO™ Series Freeze-Dryer PC/PLC

CE

Rev. 1.2

MILLROCK TECHNOLOGY
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Copyright Information

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Warranty

Millrock provides a warranty on all parts and factory workmanship. The warranty includes areas of defective material and workmanship, provided such defects result from normal and proper use of the equipment.

The warranty for all Millrock products will expire one year from date of installation, except when otherwise stated.

This limited warranty covers parts and manufacturer's factory labor, but not transportation, travel expenses and insurance charges. Under no circumstances shall seller, any subsidiary or any division thereof, have any liability whatsoever for loss of use or for any indirect or consequential damages. The warranty shall be void should the purchaser fail to adhere to maintenance programs prescribed by the seller, if replacement or spare parts not compatible with the machine are installed or if any alterations or repairs detrimental to the machine are performed. The warranty is limited to the first purchaser and is not transferable. No warranty shall apply in the event purchaser makes any change or modification to any part of the items ordered without the express written consent of seller.

Lamps and filters are not covered by this warranty.

Limitation of Liability

The disposal and/or emission of substances used in connection with this equipment may be governed by various federal, state, or local regulations. Millrock Technology is held harmless with respect to user's compliance with such regulations.

IP Rating
This equipment is rated IP20 when assessed to EN 60529.

For Immediate Service Contact:

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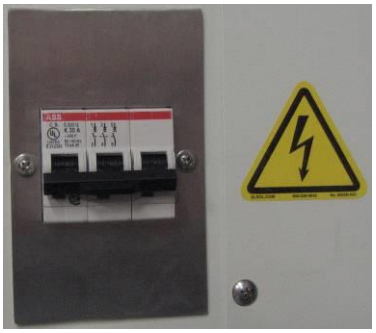
Warning Labels	
	This is the electrical hazard symbol. It indicates that there are DANGEROUS HIGH VOLTAGES PRESENT inside the enclosure of this product. TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, do not attempt to open the enclosure or gain access to areas where you are not instructed to do so. REFER SERVICING TO QUALIFIED SERVICE PERSONEL ONLY. Do not operate this equipment from any power source that does not match the voltage rating stamped on the equipment. Refer to the Manufacturer's Identification Label for operational requirements.
	VENTILATION – slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the product. To protect the unit from overheating, those openings must not be blocked or covered. This product should not placed in a built-in installation, such as a wall cutout unless proper ventilation is provided. hot temperatures will result
	WARNING! EXTREME COLD! surface temperature of this equipment operates below 0°C (32°F). Use appropriate Personal Protective Equipment (PPE) when performing maintenance operations.
	CRUSH HAZARD! Keep hands away from moving parts.
	CAUTION! Replace fuse with same type and rating: F1: 250v, 5a, type "f" 5 x 20 mm I/R 10kA F2: 250v, 3A, type "t" 5 x 20 mm I/R 10kA

Electrical

Refrigeration systems are generally intolerant of low voltage conditions. Make sure that the voltage supply and wiring is designed to carry the required current at the required voltage. Compressors have a high starting current draw, which if the wiring is not proper, can result in a voltage drop that will prevent the compressor from starting.

- Voltage must operate between +/- 10% of nominal rating.
- A circuit breaker should be provided with a rating of 20% above the running amps of the system.
- Verify voltage at the source.
- Verify wiring size is sufficient to carry the in-rush current at compressor start-up.
- 208V/230V units are not supplied with a plug.

The main breaker/Disconnect acts as a Category 0 Stop for the equipment and the equipment must be installed in a manner that allows unfettered access to the D/C.



The primary service entrance ground bears the marking "PE". (Protective Earthing)

Line Cord Replacement

"If the cordage for this equipment is damaged and requires replacement, it is the responsibility of the Installer to supply a suitable length of medium heavy duty flexible supply cordage.

It should meet the following requirements:

- It must be approved for use in the country in which this equipment is installed or bear the <HAR> Mark.
- The maximum length of the cordage should not exceed the values established by the National Code of the country in which it is installed.
- The outer jacketing of the cordage should be rated for exposure to water, oil and other similar substances.
- The Voltage and Ampere rating of this equipment, as noted on the Manufacturer's Identification Label, should be consulted when selecting the proper size (mm^2) of the cordage
- A suitable industrial style attachment plug should be selected for connecting to the branch circuit. As an alternative, the end that terminates at the building supply source may be permanently connected in accordance with local wiring rules.
- The supply cordage should be routed to the Lyophilizer in a manner that does not allow it to be stepped on, pinched, subject to abrasion, excessive bending, or other physical abuse."


Caution – Replace Fuses With Same Type and Rating


Fuse No.	Voltage	Amperage	SC I/R	Type	Size
F1	250V	2.5A	200 kA	T	.25" x 1.25"
F2	250V	2.5A	200 kA	T	.25" x 1.25"
F3	250V	20A	1.5 kA	T	.25" x 1.25"
F4	250V	20A	1.5 kA	T	.25" x 1.25"
F5	250V	2.5A	200 kA	T	.25" x 1.25"
F6	250V	2.5A	200 kA	T	.25" x 1.25"
F7	250V	4A	0.2 kA	T	.25" x 1.25"
F8	250V	8A	0.2 kA	T	.25" x 1.25"

Fuse Type operating designations are as follows:

F = Quick acting

FF = Very Quick Acting

M = Medium Time Lag

T = Time Lag

TT = Long Time Lag

Cleaning

If it should become necessary to clean this equipment, disconnect the unit from its power source first. Do not use, aerosols, abrasive pads, scouring powders or corrosives. Use a soft cloth lightly moistened with a mild detergent solution or rubbing alcohol. Ensure the surface cleaned is fully dry before reconnecting power.

Cleaning Gaskets

Remove the gasket(s) from the chamber(s). Rinse the gasket(s) with warm water. Use dish detergent to remove residue/dirt. Rinse the gasket(s) with warm water to remove any residual detergent. Make sure to dry the gasket completely with a dry, lint free towel. Re-Install gasket(s) on the freeze dryer.
Note Gasket must be completely dry before starting a run.

Operational Clearances/ Maintenance Clearances

<table>
<tr><th>Volts to Ground</th><th colspan="3">Minimum Clearance Distance</th></tr>
<tr><td rowspan="4">0-150
151-600</td><td>Condition 1</td><td>Condition 2</td><td>Condition 3</td></tr>
<tr><td>900 mm (3 ft)</td><td>900 mm (3 ft)</td><td>900 mm (3 ft)</td></tr>
<tr><td>900 mm (3 ft)</td><td>1 m (3.5 ft)</td><td>1.2 m (4 ft)</td></tr>
<tr><td>Exposed live parts are on one side and no live or grounded parts are on the other side of the working space. Or, exposed live parts on both sides are effectively guarded by wood or other suitable insulating materials. Insulated wire or insulated busbars operating at not over 300 V to ground shall not be considered as live parts.</td><td>Exposed live parts on one side and grounded live parts on the other side. Concrete, brick or tile walls shall be considered as grounded.</td><td>Exposed live parts on both sides of the work space (not guarded as in Condition 1) with the operator in between.</td></tr>
<tr><td colspan="3">Dead Front Assemblies – Working space shall not be required in the back or sides of assemblies, such as dead-front switchboards or motor control centers where all connections or all renewable or adjustable parts such as fuses or switches are accessible from locations other than the back and sides. Where rear access is required to work on non-electrical parts on the back of enclosed equipment, a minimum horizontal working space of 762 mm (30 in) shall be provided.</td></tr>
</table>

IMPORTANT:

An important point to ensure before operation:

1- If using the gas backfill, make sure that the gas source is connected and is turned ON. If the source is connected, but not turned on the system will not release the vacuum.

Equipment Options:

LN2 Trap:

CAUTION: Oxygen Depletion when using Liquid Nitrogen

H2O2 sterilization:

WARNING: DO NOT open any Chamber Doors while unit is in process of H2O2 sterilization!

Stoppering Option

A momentary button is provided for stoppering. The toggle switch allows for raising and lowering the shelves.

Stoppering Pressure is 10 PSI

Periodic Maintenance: General

Maintenance Item	Comment	Frequency	Requirements
Run a System Test. Make sure to run the same system test so the results can be compared to previous runs.	Verify results against the last saved System Test. Make sure to save the new results in a new file for comparison later.	3 months	
Visually inspect the Lyophilizer for any fluid leaks.	Look at the base of the unit on insulation for wet spots. If found, wipe with towel and verify fluid type.	3 Months	
Visually inspect the safety valves and safety switches (Emergency stop switches, door lock switch, pressure relief valves	Look for wear or breakage.	Annual	
Visually inspect the condition of the insulation.	Look for wet spots, cracks and delaminating seams.	Annual	
Calibration of the Critical Sensors and Instruments		As required by QA Dept.	Thermocouple Simulator or ice bath
Inspect manual operating valves and replace seals as required.		3 Years	
Inspect and touch up machine frame paint work.	Look for bare spots or rusting. Sand and repaint as required.	3 Years	

Periodical Maintenance: Vacuum System

Maintenance Item	Comment	Frequency	Requirements
Check the Vacuum Pull down time.	Use System Test Results or Run the system in Manual mode with the condenser on. When condenser reaches -40°C, turn on the vacuum with a setpoint of 0mT. Note the time is takes to reach 100mT.	6 Months	
Check the system Leak Rate.	Run the automatic Leak Rate function in the machine's software. Test at 100mT for 60 minutes.	6 Months	
Visually inspect door gaskets.	Remove the gasket. Look for cracks and rips that may cause leaks or failure.	3 Months	
Visually inspect all sanitary gaskets on the sanitary fittings and replace as needed.	Look for cracks, nicks, or splits. Only replace with similar material.	6 Months	

Periodical Maintenance: Fluid Circulation System

Maintenance Item	Comment	Frequency	Requirements
Check the fluid level in the Expansion Tank by looking at the sight glass on the side of the tank.	Expansion tank is located at the highest point in the system. A site glass is located at one end and may be covered with insulation. The site glass should be ½ full or more with the shelf at 25C.	Monthly	For -70C shelf - Syltherm XLT For -45C shelf - Lexsol
Inspect all shelf hoses inside the Product Chamber to check for leaks.	First visually inspect, then wipe the hoses with a clean white cloth. Look for any residue.	Monthly	
Inspect the two (2) Swagelok fittings inside the Product Chamber to check for leaks.	First visually inspect and then wipe the fittings with a clean dry cloth. Look for any residue.	Yearly	
Check the working of the Thermostat.	Set the thermostat's temperature at 40^0C. In Maintenance Mode on the control computer, turn on FLUID PUMP and HEATER and allow the system to heat up. The Solid State Relay for the heater (SSR) should turn off at 40^0C. After the test is completed, reset the thermostat to 65^0C.	Yearly	
Check and calibrate the thermocouples for the shelf.	The shelf thermocouple is attached to the shelf inlet fluid line.	As required by QA Dept.	Thermocouple Simulator or Controlled temperature ice bath

Periodical Maintenance: Hydraulic System

Maintenance Item	Comment	Frequency	Requirements
Check the oil level in the reservoir of the hydraulic pumping system and top off if required.	The reservoir should be no less than ½ full with the shelves in the open position.	6 Months	HE-200 oil
Check and adjust Hydraulic pressure relief Valve if necessary or if all the vials are not getting stoppered properly		Yearly	
Check the Hydraulic cylinder gasket and replace if necessary.	If tightening the cylinder bolts on the outside of the chamber doesn't remedy any leaks, then remove the cylinder and replace the gasket.	3 Years	

Periodical Maintenance: Refrigeration System

Maintenance Item	Comment	Frequency	Requirements
Check refrigerant static pressure by inspecting the refrigeration pressure gauges.	In a 25C room: First stage: Greater than 135 PSI Second stage: greater than 175 psi	Monthly	R-507 first stage R-508 second stage
Check for refrigerant leaks during the standby hours with Halogen leak detection system	Allow the system to stabilize for 4 or more hours after operation before leak checking. Check all joints and fitting.	Yearly	
Visually inspect the condition of the insulation on the piping.	Look for cracks and separation. Fix as required.	Yearly	
Visually inspect the condition of all exposed copper piping.	Look for cracks and corrosion. Fix as required.	Yearly	
Check the functionality of the solenoid	Using Maintenance Mode Check each valve by turning each valve on and off Shelf, Control, Interstage (if any), Bypass, and Condenser. Listen for valve actuation or use a magnetic current tester to verify each solenoid is receiving power.	Yearly	
Inspect each refrigeration system pressure gauge to ensure proper operation.		6 Months	
Air Cooled Systems: Check the air cooled condenser for build up of lint.	Vacuum the air cooled condenser to remove any lint or dust build up.	6 months	
Water Cooled Systems Only: Check the High Pressure Cut-out setting and adjust if required.	To test the High pressure cut-out, close the cooling water supply line. The compressor pressure will rise above the hi/low cut-out setpoint and turn off the compressor.	Yearly	270 psi max.

Periodical Maintenance: Product Chamber/Condenser

Maintenance Item	Comment	Frequency	Requirements
Clean the Door and Door Gasket with alcohol and apply a thin film of Silicon Vacuum grease.		2 Weeks	
Check the cleanliness of the chamber and clean as required.	Wipe clean using alcohol.	Weekly	
Isolation Valve Option Only: Check for proper functionality of the Isolation Valve and lubricate as required.	In Manual Mode: Turn the isolation valve on and off and verify operation.	6 Months	
Visually inspect all sanitary gaskets, and replace as needed.		6 months	
Systems with Drain on the Chamber: Check the drain valve for debris and clean as required.		Monthly	

Periodic Maintenance: Control Panel

Warning: Disconnect all power before accessing the Control Panel.

Maintenance Item	Comment	Frequency	Requirements
Check and replace the PLC battery.		3 Years	
Check for any loose connections in the electrical panel and tighten as required.		6 Months	
Check for functionality of the Control Transformer by measuring the output voltage with a voltmeter.	60Hz : Acceptable voltage is from 208V to 245V. 50Hz : Acceptable voltage is from 190V to 200V.	6 Months	
Clean the Interior of all electrical boxes with Vacuum Cleaner.		6 Months	
UPS Option: Check the operation of the UPS system installed for computer by removing the power to the UPS and verifying the output remains on.		6 Months	
UPS Option: Check the operation of the UPS system installed for PLC and chart recorder by removing the power to the UPS and verifying the output remains on.		6 Months	

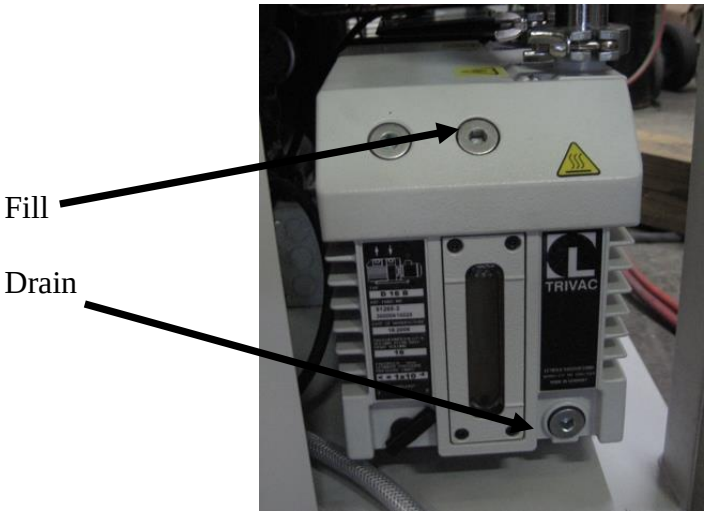
Changing Vacuum pump oil
(Oil Type – Double Distilled VPO, contact Millrock Technology)

The oil in the vacuum pump should be changed between 500 and 1000 hours of operation, or sooner if the oil in the pump is milky or dark in color.

Drain - Move the pump so it sticks over the edge. Place a drain pan beneath the pump drain. Drain the oil by removing the bottom plug. Replace the plug.

Add oil by removing the top plug. Add to the fill line toward the top of the sight glass. Replace the plug.

When the pump is first started the oil level will drop slightly. This is normal and not a concern.



Reset the counter in the software on the machine. On the main screen click on the vacuum pump icon. Press “resent vacuum pump timer”. The time will reset to (0) hours.

Troubleshooting

Symptom	Problem	Solution
System will not start	Low voltage Contactor or fuse open	Verify voltage and correct if necessary Check relays and contactors for proper operation
System will not get to maximum low temperature	Ambient temperature too high (air cooled systems) Water flow insufficient (water cooled systems) Source voltage is too low causing the second stage compressor to cycle on/off Condenser is blocked Outlets of cabinet are blocked Loss of refrigerant	Make sure room temperature is below 80°F Verify proper water flow. Check hoses for kinks and valves for proper orientation. Verify voltage during operation and correct Check for dust or that the system is too close to the wall Check for dust or that the system is too close to other objects If the first stage loses refrigerant the second stage will not start If the second stage loses refrigerant, the first stage will operate properly, but the second stage will turn on/off
System will not cool	The cool solenoid is not working	Check voltage Check the coil
System will not pull vacuum	Verify vacuum pump connect	Is vacuum pump turning on? Check all hoses and fittings.
(Start at the vacuum pump and work your way out)	Vacuum pump switch is ON Verify pump has proper oil fill Verify proper condition of oil Check vacuum sensors Check vacuum sensor wiring Verify that all doors are closed Verify all fittings are tight Check tubing for cracks Check that vacuum valves are not open (if included with system)	Verify switch on pump motor. Oil should be between Min and Max lines Make sure the oil is not cloudy or milky, indicating water or corrosive contamination. If necessary flush pump and add new oil. Change the sensor to eliminate the sensor as an issue

Spare Parts – REVO Series

Part#	Description
5300010	Oil Mist Eliminator for 400lpm vacuum pump (D16B)
8010002	Vacuum Pump Oil for use in Leybold vacuum pumps
5240002	Vacuum Grease
7030037A	Chamber Gasket RV
7030016	Condenser Gasket RD/RV
3160003	Product probes, 72”
6110006	Refrigeration Solenoid Valve Coil
3040002	Vacuum Release Solenoid Coil
3040001	Vacuum Control Solenoid Coil
3070016	PLC Digital Output module
3070018	PLC Thermocouple Input module
3140002	Fan Motor 16W 220v