CRYO

Operation Instructions

LN7 & LN32

LN2 Generator/Liquefier

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CLOSED CYCLE
LN_2 Generator

Introduction

CRYO's liquid nitrogen generators (LN7 & LN32) are easy-to-use performance by design systems. Just input nitrogen gas and out the nozzle comes liquid nitrogen.

A flexible vacuum insulated transfer line allows the liquid nitrogen to be directed where needed.

A 'closed cycle cryogenic refrigerator' cools nitrogen gas and liquefies it.

CRYO's closed cycle Cryocooler LN7 & LN32 provide a continuous supply of liquid nitrogen, which can be collected in a portable storage dewar or delivered to cool a cryostat or your sample/device.

The LN7 produces more than 7 liters/day and LN32 more than 32 liters. Both systems are similar in design and vary only by the size of the cryogenic refrigerator.

After cooldown, the system is self regulating and provides reliable long term generation of liquid nitrogen.

CLOSED CYCLE REFRIGERATOR

A GM (Gifford McMahon) refrigerator is the cooling source. CRYO's LN2 generator uses the highly reliable Sumitomo brand refrigerator, known for its reliability. The result is reliable generation of liquid nitrogen at cryogenic temperatures for long continuous periods.

UNPACKING

Unpack the consignment and inspect for any possible damage. If damage is suspected, report this immediately to the freight carrier and to CRYO. Check the packing list for all listed items, and if any are missing, report this immediately to CRYO.

Main Component Parts:

- Universal Cryocooler (Closed Cycle Refrigerator) with attached stainless steel flexible transfer line
- Refrigerator Compressor
- Temperature readout
- Manuals on disk (pdf files)

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****Customer Supplied Items****

a.) Dry and Clean nitrogen gas supply (Optionally available from CRYO)
b.) Two stage Pressure regulator with low pressure adjust
c.) Water Hoses for Compressor (Water cooled only)
e.) Vacuum pump and pumping hose.
(VACUUM PUMPING OF THE INSULATING VACUUM IS REQUIRED.)

Make sure that the nitrogen gas supplied to the cryocool is free of contaminants and condensable gases. Contaminants can freeze and plug the flow of the system.

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SET-UP/INSTALLATION

1. Read all manuals supplied and follow all standard vacuum and cryogenic safety practices

Read and understand all manuals supplied with system.

2. Refrigerator/Compressor Set-Up

CONSULT THE SEPARATE REFRIGERATOR MANUAL ENCLOSED FOR THE REQUIRED CLOSED CYCLE REFRIGERATOR COLDHEAD AND COMPRESSOR SETUP AND CONNECTIONS.

Summary of coldhead/compressor connections are as follows:

a.) Have a licensed electrician connect proper connector on end of power cord and connect to proper power source

b.) Connect the high pressure flex hose labeled ‘supply’ to the matching connections on the compressor and cryocooler coldhead

c.) Connect the high pressure flex hose labeled ‘return’ to the matching connections on the compressor and cryocooler coldhead

d.) Connect compressor control cable to cryocooler coldhead

e.) Connect water hoses (water cooled compressor only)

Coldhead flex hose connections

F-70 Compressor flex hose connections

Cryocooler Coldhead connected to compressor

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3. Set-up the device to be cooled or the storage dewar that will collect the LN2

Connect the nozzle to storage dewar of device to be cooled. For optimum performance the liquid nitrogen flow should exit at and elevation below the transfer lines 90 degree elbow on the bottom of Cryocooler. i.e: Transfer line flex section from Cryocooler should continually angle downward toward cryostat, not upward. Cold liquid nitrogen work best if flowing downward.

If filling a portable storage dewar or flask, insert the Cryocooler transfer line nozzle (downstream leg) into the storage dewar transfer line inlet port.ts require use of a compression knob to keep with cryocooler transfer line fully seated in the cryostat. If your transfer line leg has a knurled compression knob on it then it has the optional compression knob. In this case you must tighten the compression knob after inserting the Cryocooler transfer line (downstream leg) into cryostat transfer line inlet port

Basically, liquid nitrogen will flow out the nozzle. Insert the transfer line nozzle into or above that to be cooled; or, insert into a storage dewar to collect the liquid nitrogen.

4. Set-up the Temperature Monitor and Temperature monitor Cable Connections

CONSULT THE SEPARATE TEMPERATURE MONITOR FOR PROPER SETUP AND OPERATION.

5. Set-up the flow adjust control

The flow control needle valve will control the flow of nitrogen gas into the refrigerator. The 'floating ball' will indicate the flow rate.

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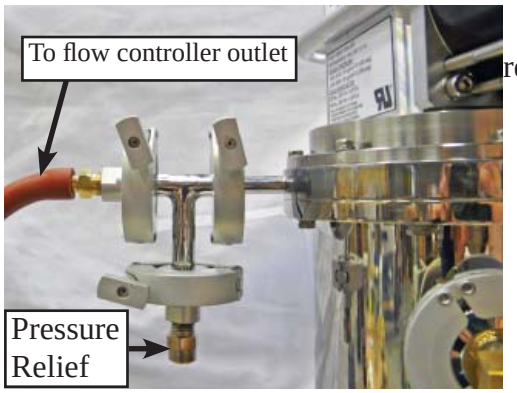
6. Make Gas Flow Circuit Connections

The two stage regulator range should allow the nitrogen gas pressure to be adjustable between 0 - 15. A regulator with a 0 - 30 psig low pressure side will work.

Connect the nitrogen gas supply to the refrigerator. Check the flow controller for indication of flow. Initially, the flow may be low and it will naturally increase as the flow conductance increases due to the cold temperatures.

Make sure the inlet pressure relief mounted on a Tee is installed on the cryocooler refrigerator gas flow inlet.

Connect Gas Flow Controller outlet to tube adapter on Tee installed on the cryocooler refrigerator gas flow inlet with system compatible rubber or stainless steel hose.



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PERIODIC PUMPING OF THE VACUUM SPACE IS REQUIRED

The Cryocool incorporates a charcoal based cryopump that helps maintain the insulating vacuum for long term operation. However, if the outer vacuum tube of either the cryocooler or transfer line feels 'cold to the touch' or if moisture condenses (sweating) on outer surfaces, or efficiency of liquefication decreases substantially, these symptoms may indicate that vacuum pumping is required. Maintaining the highest generation rate requires maintaining the vacuum.

The cryocooler and the transfer line are \vacuum insulated and the vacuum is common to each other (i.e.: Pumping on the cryocooler vacuum space also pumps the transfer line vacuum space at the same time). A good vacuum is the key to continued low temperature performance.

The system should be pumped with a turbo pump (preferred) or two stage rotary.
To pump a system:
The system should be at room temperature before pumping vacuum spaces. (Unless you have a turbo pump)
Attach the vacuum pump to the vacuum evacuation valve flange which is a NW25.
Evacuate the pumping line before opening the vacuum valve to the vacuum space.
When done, close the vacuum valve and put back the blank flange.

Pumping with a high vacuum type pump (turbo) is preferred. Pumping with a turbo pump can be done whether the system is warm or cold, best vacuum pumping is obtained when the system is warm.
If a turbo pump is not available, use a two-stage rotary pump (not a single stage type) which is capable of an ultimate pressure of 10-3 Torr.

*Important Note: A two-stage rotary pump can be used but requires that the system be warm (not cold, not operating) when pumping vacuum spaces. Pumping while cold pumping space with a two-stage rotary pump will result in oil contamination from pump in vacuum space. Therefore it is best to only pump vacuum spaces when warm and close vacuum valve to pump when making system cold.

Note: New cryostat systems require more pumping then cryostats which have been used often. As time passes and systems are used outgassing is reduced and pumped away each time the system is re-evacuated. Of course, the refrigerator/cold nitrogen temperature surfaces inside the cryostats will also cryopump the vacuum space when it gets cold.

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SYSTEM OPERATION

1.) Set an initial flow rate of approximately 3.4 liter gas/min (LN7) or 15.5 lg/min (LN32). Turn the needle valve control knob to adjust the flow rate.

2.) Turn on the water flow, if the compressor is water cooled. Assure that the water flow is sufficient and cold enough as noted in the separate compressor/refrigerator manual.

3.) Monitor the cooldown using the readout on the temperature monitor. Wait until the sensor stops getting colder, when it should display approximately 77 K - a short time later liquid nitrogen will begin to exit the nozzle.

4.) Find the optimized flow rate. If the temperature drops below 76 K, increase the flow rate. Monitor and repeat if necessary. Keep adjusting until the temperature settles to a steady value between 76.5 K and 77.4 K. Once the system reaches a steady equilibrium, it will be near self regulating and no adjustments are necessary.

Note: Optimized nitrogen gas flow can be done observation when filling a small container/dewar. If the generator is filling a small storage container (dewar) and the dewar has sufficient liquid nitrogen in it to assure the dewar is fully cold; then, observe the exiting vapor. Adjust the flow rate so the exiting vapor is just visible.

Assure the supply of nitrogen gas is continuous and sufficient.

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NOTES

Periodically check the following:

The temperature and flow are proper.

The insulating vacuum is sufficient. The outside surfaces of the generator should never have condensation on the sufraces..

The nitrogen gas supply is operating properly.

Liquid nitrogen is being manufactured as expected.

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