4 Operation

Overview

This chapter provides complete operation directions for the Brooks Automation Product.

Chapter Contents

4.1 What the Cryopump Does in STANDBY, COOL, and DEFROST

The cryopump operates in three different modes: STANDBY, COOL, and DEFROST.

What the cryopump does in STANDBY

When the unit is in STANDBY, the COOL and DEFROST solenoid valves are closed. The unit circulates (and cools) the mixture of refrigerants in the "Polycold stack." The refrigerant is coldest when the unit is operating in this mode because it has the least heat load.

What the cryopump does in COOL

When the unit is in COOL, the COOL solenoid valve is open and the DEFROST solenoid valve is closed. Cold refrigerant is pumped into the feed line. The cold refrigerant cools the cryosurface and comes back through the return line. The refrigerant then goes through the "Polycold stack" to the suction side of the compressor.

What the cryopump does in DEFROST

When the unit is in DEFROST, the COOL solenoid valve is closed and the DEFROST solenoid valve is open. Hot refrigerant is pumped from the "Polycold stack" into the feed line. The hot refrigerant warms the cryosurface and comes back through the return line. The unit will automatically switch to STANDBY when the cryosurface is defrosted.

4.1.1 Special notes for PFC/PFC or PFC/P

The PFC / PFC and PFC / P function in the same way as the PFC. However, the refrigerant is split into two separate feed and return lines so that it services two cryosurfaces. Also, the second circuit of a PFC / P cannot be defrosted rapidly. (It does not have a DEFROST mode.)

When one circuit is defrosted while the other circuit is in cool, the circuit in cool will warm up by up to 20°C. Therefore, the timing of defrost must be coordinated so as to maintain your process requirements. If the second circuit is a baffle for a diffusion pump, this is normally not a problem. However, when both circuits cool cryocoils, you must evaluate the impact on your process when you defrost one circuit while the other circuit is in cool during your deposition process.

If the refrigerant circuits are operated in different modes, the following will happen.

STANDBY versus COOL

The cryosurface being cooled will get several degrees colder than when both cryosurfaces are cooled simultaneously. This is because there is less total heat load on the system. It is not possible, however, to get 100% of the cooling capacity into one circuit simply by not using the other circuit.

DEFROST versus COOL

The cryosurface being cooled will warm up by up to 20° C while the other cryosurface is defrosted. This is because refrigerant from both cryosurfaces is combined in the common return line. Contact the Polycold service department for an evaluation if this warm up will cause a problem.

DEFROST versus STANDBY (PFC / PFC only).

The cryosurface being defrosted will defrost slightly faster than when both cryosurfaces are defrosted simultaneously.

4.2 How to Use the Cryopump

4.2.1 If the Cryosurface is a Coil

Select STANDBY to precool the unit.

When the refrigeration unit is in STANDBY, it cools the refrigerant mixture and "Polycold stack." Complete precooling may take 60 minutes if the unit was off for more than 12 hours.

The COLDEST LIQUID (TC #9) temperature may be used to monitor the internal temperature of the unit. For quick cooling when switching to COOL, this temperature should be 5-10°C colder than your desired cryocoil temperature. See Table 3-8.

NOTE: *The unit may be operated indefinitely in STANDBY.*

Select COOL to capture water on the cryocoil.

Once the unit is precooled, the unit may be switched to COOL any time after the vacuum chamber is under vacuum. Most users switch to COOL at crossover (when opening the high vacuum valve). The cryocoil will start capturing water within 60 seconds.

Experimentation can be done with the cryopump to determine the shortest pumpdown time for a particular application. The sooner the unit is switched to COOL, the faster the vacuum chamber's pumpdown time. However, if the cryocoil captures too much water, the cryocoil's apparent surface temperature will rise and limit the ultimate attainable base pressure.

Select DEFROST to remove the captured water from the cryocoil.

DEFROST allows the "regeneration" of a cryocoil in preparation for the next vacuum cycle. Start DEFROST so that the cryocoil is warm before the vacuum chamber reaches atmospheric pressure. A typical DEFROST takes 4 minutes or less. The unit will terminate DEFROST when the return temperature of the refrigerant reaches 20°C. This assures that no additional moisture will condense on the cryocoil from the atmosphere.

The unit will automatically go into STANDBY when DEFROST is complete. Allow the unit to remain in STANDBY for at least 5 minutes before selecting COOL.

NOTE: *To shorten the DEFROST cycle, terminate DEFROST early by putting the unit in STANDBY.*

⚠ CAUTION

GENERAL HAZARD

If large amounts of water are collected during the vacuum cycle, liquid or ice may drop from the cryocoil during DEFROST. This could cause minor or moderate injury.

You may need to provide a drip pan or similar device to prevent liquid water from accumulating in an undesirable location.

⚠ CAUTION

GENERAL HAZARD
For PFC/PFC and PFC/P users:
Be aware that when defrosting one circuit while the other circuit is in cool, the temperature of the coil being cooled will increase by up to 20° C. Review the required temperatures for the affected process to make sure this warming will not affect your process. If such a temperature is not acceptable, wait until the completion of this process before performing defrost. Both circuits may be defrosted at once.

4.2.2 If the Cryosurface is a Baffle

To cool the cryobaffle

1. Evacuate the location of the cryobaffle to at least 0.01 torr (1.33 Pa).

2. Turn on the refrigeration unit and select COOL. A typical cryobaffle may take more than 60 minutes to cool down.

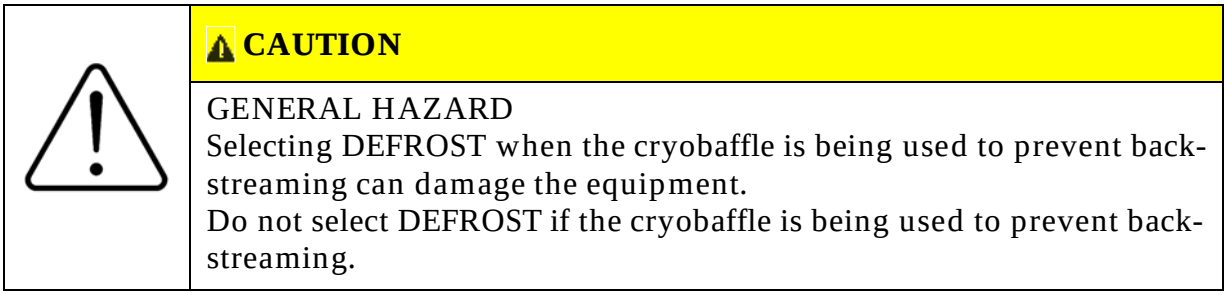
3. Turn on the high vacuum pump. It is not necessary to wait until the cryobaffle has cooled down.

To defrost the cryobaffle

If the cryobaffle captures too much water, the cryobaffle's apparent surface temperature will rise and limit the ultimate attainable base pressure. Regular defrosting is suggested to "regenerate" the cryobaffle. Complete defrosting can take 8 hours or more depending upon the amount of moisture captured, the mass of the cold surface, and the vacuum level.

1. Turn off your high vacuum pump.

2. Turn off the refrigeration unit or select STANDBY.



NOTE: *Backstreaming will contaminate the system because it is the process of hot vapor migrating and condensing on cold surfaces. When the vacuum pump is used, the pump oil heats up and travels opposite of the pumping direction and condenses the system resulting in system contamination.*