University of Minnesota Nano Fabrication Center
Standard Operating Procedure

Equipment Name: Critical Point Dryer

Coral Name:	cpdryer	**Revision Number:**	4
Model:	915 B	**Revisionist**:	S. Miller
Location:	Bay 4	**Date:**	2/8/2006

1 Description

The Critical Point Dryer is capable of drying various size wafers (maximum of 6 inches) down to 1 square cm pieces. Liquid carbon dioxide replaces the solvent used in the last rinse process. The pressure and heat are then increased to change the liquid carbon dioxide to a gas. The pressure is slowly decreased to atmosphere thereby not allowing carbon dioxide to condense. The lack of the liquid/vapor stage allows for the minimizing of stiction in beam release.

2 Safety

a Safety glasses are mandatory when using this system.

3 Restrictions/Requirements

a Must be a qualified user on critical point dryer.

b **No acid, acetone, or water can go into the cpdryer**. Wafers need to be rinsed 3-4 times in water (if possible) then 3-4 times in Ethanol, Methanol, or IPA before loading into the cpdryer. **Acid, water, and acetone will DAMAGE the chamber**..

c DO NOT use in Vacuum Grease in the critical point dryer.

d DO NOT adjust the metering valves.

e Complete log book and enable/disable the equipment in CORAL with each use.

f Clean up all rinse dishes when finished.

4 Required Facilities

a 120 Volt Power

b LCO_2: 2 tanks

5 Definitions

a LCO_2: Liquid Carbon Dioxide

6 Setup

a Check the initial verses current tank weight for both LCO_2 tanks. If the difference between the initial verses current weight is **30 lbs** or greater for either tanks contact staff. A staff member will have to change the tank out before the cpdryer can be used.

b Verify metering valve setting are set for the default values given below:

Cool: 0.55
Fill: 1.00
Vent: 0.26
Bleed: 0.15

Other values can be set if approved by an NFC staff member. Note: The metering valves need to be set back to the default values when the non standard run is finished.

c Wafers need to be rinsed 3-4 times in water (if possible) then 3-4 times in Ethanol, Methanol, or IPA before loading into the cpdryer. Acid, water, and acetone will DAMAGE the chamber. The rinses will minimize the chance of any of the above getting into the cpdryer.

d Turn power switch to "**ON**". "**ON/OFF**" power switch is located on right side of panel. Green LED on **VENT** button will illuminate. This indicates that the power is **ON** and the machine is in the standby **VENT** mode. Let the machine stand for 3-5 minutes. This will allow all internally heated components to "warm-up".

7 Operating Instructions

a Enable the cpdryer in CORAL prior to starting work and fill out the log book.

b Press the **VENT** button once. The **VENT LED** will begin to blink. This indicates that the **VENT** solenoid is closed.

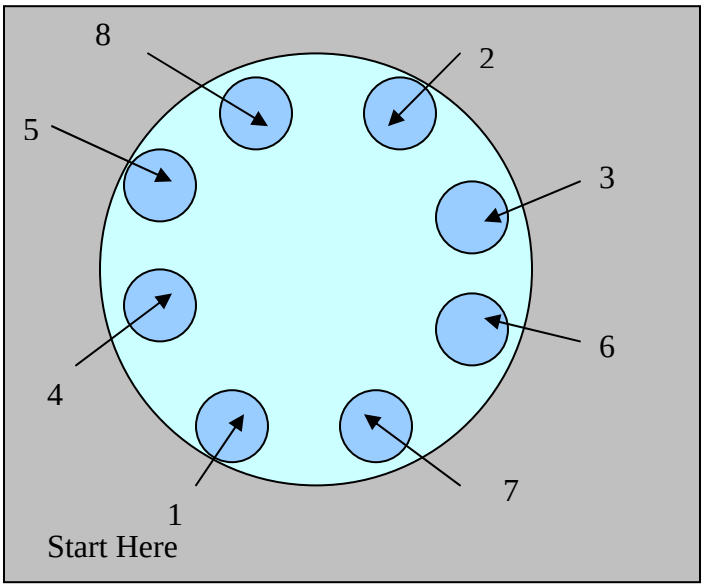
c Loosen the knurl nuts on the top of the machine and remove the lid. Place the lid and knurl nuts on top of clean towels next to the machine.

d Put the correct number of inserts into the chamber that will minimize any wafer or piece movement. Load sample into the correct size wafer or piece holders.

e At this point, you can fill the chamber with enough alcohol (IPA, Methanol, or Ethanol) to cover your wafer(s) or die. **NEVER EXPOSE CHAMBER TO ANY ACIDS, ACETONE, or WATER!**

f Carefully and quickly transfer your wafer(s) from your wafer container into the machine process chamber. For best results, minimize any exposure time to air.

g Carefully place the chamber lid on top of the chamber. Use your hand to evenly tighten the 8-knurled nuts around the circumference of the chamber lid. Then, use the wrench and uniformly tighten each knurl nut in a "Star Pattern". Tighten no more than 15˚ at a time. Do this at least twice.



h Once the chamber lid is secured, it is time to set the **PURGE** timer located to the right of the push button switches. Positions on the purge timer are calibrated at 5-minute intervals. Setting the "purge timer" indicator arrow to the #1 position will give you a 5-minute purge time. General rule of thumb:

To purge ¼ chamber full of alcohol = 15 minute purge time
½ chamber = 20 minute purge time
¾ chamber = 25 minute purge time

i After the initial warm up, press the **COOL** button. The **COOL LED** light will go on, and the **VENT** light will turn off. As the temperature slowly begins to drop, you will hear the LCO_2 circulating through the machine. The machine will continue to cool itself until the chamber temperature reaches 0-10^{o}C. At this point the cooling will automatically stop

j Press the **FILL** button and the machine will begin to fill the chamber with LCO_2. **From this point forward, the machine will automatically cycle through all the drying sequence steps until the process terminates.** During the **FILL** mode, the LCO_2 will enter the chamber for 8 minutes. You may hear the **COOL** cycle on / off during the **FILL** mode as the chamber temperature is automatically maintained between 0-10^{o}C.

k Once all of the above mentioned cycles have been completed, the chamber will then vent itself. Once the **VENT** LED is illuminated, wait 15 minutes for the chamber to come to atmospheric pressure.

l Loosen the knurl nuts in the reverse order from the way that they were tightened.

m Remove the samples from the chamber.

n Close the chamber lid and tighten the knurl nuts with your hand.

o Turn the power off by using the **ON/OFF** switch on the right side of the machine.

p Complete log book. Empty out the condenser. Put all beakers used during the rinse process away. Leave the area clean and tidy.

q Enable out of the critical point dryer in CORAL.

8 Problems/Troubleshooting

a If there is a leak during any time during the run contact a staff member.

b If there is liquid left in the chamber, the purge time may need to be increased.