Usage Policies Notebook for Tousimis 815B, Series C Critical-Point Dryer

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INRF UCIrvine

Emergency Plan for Tousimis 815B Critical-Point Dryer

Standard Operating Procedures for Emergencies

Contact information

Person	Phone number
Lab Manager	Jake Hes, 949-824-8239 (day), 562-522-8328 (alternate)
Director	G.P. Li: 949-824-4194 (day), 949-824-2047 (alternate)
Staff	Mo Kebaili: 949-824-8239 (day), 949-494-5892 (alternate)
Super User	Carlos Ruiz (818) 527-6349 (Anytime, voicemail or text only)

Hazardous chemicals, gases, and conditions

Hazard name	Description of hazard
N_2 (nitrogen) gas	Asphyxiant
High temperature	Burn or ignition source
Electrical Hazards	Electrical shock, ignition source
Lamp Explosion	Mercury Vapors
Fingers could be jammed	DO NOT Take any action during Operation
Radiation Hazards	High energy of UV light from exposure lamp

Emergency shutdown plan #1

In the event of an emergency, when there is very little time, *press the large red emergency shut-off button at the front of the Tool*. This action will shutdown the system, and will stop and turn off the exposure lamp. Leave the facility at once, and contact the lab manager or the staff.

Emergency shutdown plan #2

In the event of an emergency, when there are a few minutes available, place the tool in the stand-by mode. Leave the facility at once, and then contact the staff and the lab manager.

Usage Policies for Tousimis 815B Critical-Point Dryer

Standard policies for usage

The Tousimis815B, Series C Critical-Point Dryer is a fully automatic carbon dioxide (CO_2) critical point drying system. The tool is used for the MEMS CO_2 dry release typically after wet etching. Critical point drying is an efficient method of drying delicate substrate without damaging its structure by surface tension that occurs when changing from the liquid to the gaseous phase. Critical point drying is usually performed release of bulk or surface micromachined devices. The CPD achieves a phase change from liquid to dry gas without the effects of surface tension. The critical constants for CO_2 are 31.1°C and 1070 psi.

Contact information

The INRF staff or the lab manager may be reached at 824-8239 or 824-9831.

Authorized users

Only INRF registered users who have completed the training and passed the certification may use this equipment. Users may only use the portion of the system for which they have been trained.

Training

Users must have received direct training from the staff in order to use this equipment. Users are expected to understand the nature of the system. Training varies slightly, depending on the process to be performed. Contact the staff for details and to arrange for a training session.

Usage logs

Users are required to log all activity in the log sheets provided. All users must log in when they used the Tousimis 815B Critical-Point Dryer (date and time), when they completed their process in the user log sheets. If users notice anything unusual, they should record it in the user log sheets, and add details in the maintenance log sheets. Any maintenance to the system must be logged in the maintenance log sheets (maintenance staff only).

Safety equipment

There is no specific safety equipment for use on this tool, however cleanroom gloves and tweezers should be used when handling and placing substrates on the chuck, care should be taken.

The Tousimis 815B Critical-Point Dryer normally operates under very high chamber pressures. Do not deviate from the correct procedure for loading the sample and securing the chamber lid, personal injury is quite possible otherwise.

An uncontrolled release of CO_2 can cause personal injury due to frostbite. Again, do not deviate from the correct procedures. Make very sure that persons near the system are always wearing protective eyewear.

Standard equipment and materials

The laboratory provides the following: Liquid CO_2 (LCO_2), and alcohol solvents.

User maintenance

Users are requested to clean and wipe off the chuck after use. Spray the isopropanol into a lint-free cloth and wipe the chuck clean. Dispose of the cloth in a waste container marked for flammable solid waste.

Pollution Control

Dispose of the alcohol soaked wipes in a waste container marked for flammable solid waste.

Scheduling

Reservations can be done online, also, the system can be used on a first come, first served usage if no reservation was made.

Other issues

Users should remain physically present in the cleanroom facility during the entire use of the Tousimis 815B, Series C Critical-Point Dryer.

At no time should a user adjust a pressure regulator on a gas line. Gas control should be “on” or “off” only, using only the valves appropriate. For most gases, this is usually the valve at the cylinder head.

Non-standard use

Users may not modify any hardware on this equipment. For use of non-standard processes, gases or materials, contact the staff or the lab manager.

Usage Notes for Tousimis 815B Critical-Point Dryer

Guide for using the Tousimis 815B Critical-Point Dryer correctly

1. Turn the power switch "ON". The "ON/OFF" power switch is located on the right side panel. The green LED on the VENT button will illuminate. This indicates that the power is ON, and that the unit is in the VENT stand by mode.

2. Let the dryer stand for 3-5 minutes. This initial wait period will allow all internally heated plumbing components to "warm-up".

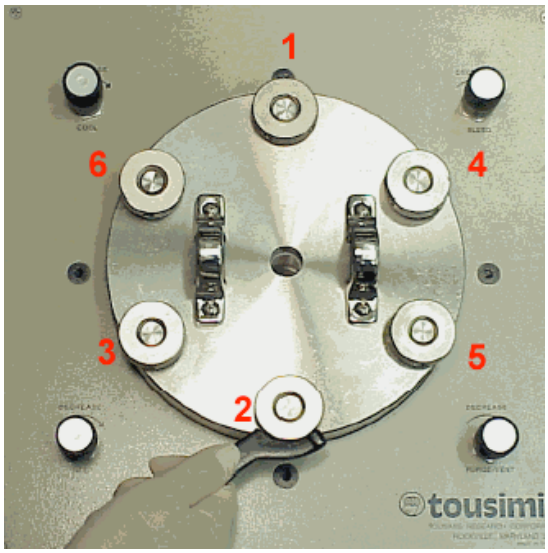
3. Now, press the VENT button once. The VENT LED will begin to blink. This indicates that the VENT solenoid is closed and you may now introduce ultra-pure alcohol into the chamber.

4. At this point, you can fill the chamber with enough alcohol (IPA, Methanol, or Ethanol) to cover your wafer(s) or die.

   NEVER EXPOSE THE CHAMBER TO ANY ACIDS!

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

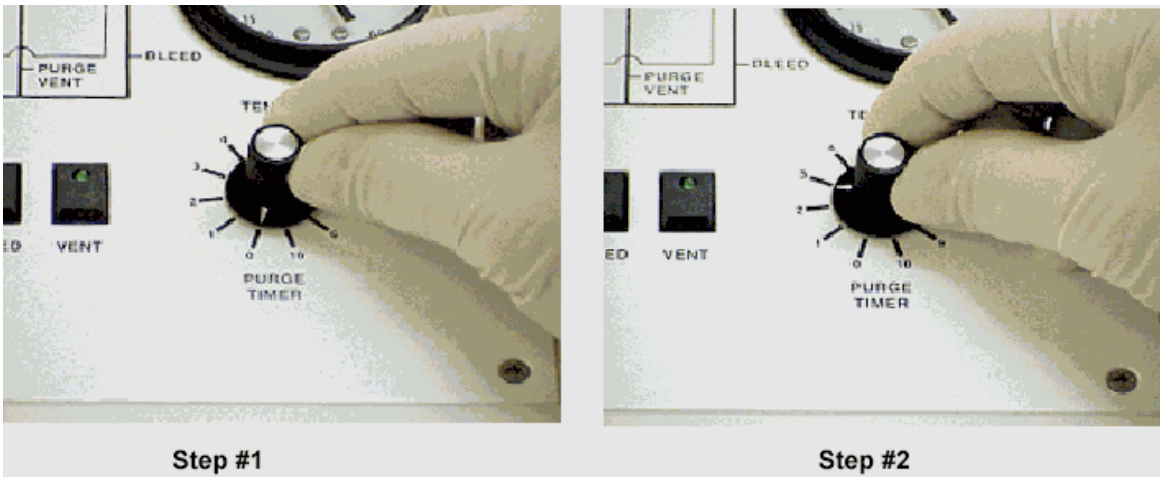
6. Carefully place the chamber lid on top of the chamber. Use your hand to evenly tighten the 6-knurled nuts around the circumference of the chamber lid. Then, use the spanning Wrench provided, and uniformly tighten each knurl nut in a "Star Pattern". Tighten the knurl nuts in the numbered sequence as shown in the following photo. Repeat this rotation "Star Pattern" sequence until the knurl nuts are unable to tighten further.



7. 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. The #2 position will give you a 10-minute purge time… Correspondingly, the #9 position will give you the max purge time capable of 45 minutes. The "purge time" setting is best determined by the individual investigator. A general "rule-of-thumb" to follow is the following:

   To purge ¼ chamber full of alcohol = 15 minute purge time.

   - ½ chamber = 20 minute purge time.
   - ¾ chamber = 25 minute purge time.



Step #1 Step #2

Note that the actual purge time can vary greatly depending on your sample type in combination with the FILL and PURGE metering value set positions.

8. 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 chamber temperature slowly begins to drop, you will hear the LCO_2 circulating through the unit. The 815B will continue cooling by itself until the chamber temperature reaches 0°C (±5°C). At this point, the cooling will automatically stop.

9. Press the FILL button and the 815B will begin to fill the chamber with LCO_2 for 8 minutes. From this point forward, the 815B will automatically cycle through all the drying sequence steps until the process terminates. During the FILL mode, the COOL function may periodically energize as necessary to maintain the chamber temperature between 0°C - 10°C.

10. After the 8 minutes FILL mode expires, the 815B will automatically advance into the PURGE mode. This will be indicated by the illumination of the PURGE LED.

11. At this point of the cycle, the 815B will remain in the PURGE mode for the duration of the time preset by the operator via the PURGE TIMER. The alcohol coming out of the 815B Chamber Exhaust connect hose will be collected directly into the SOTER™ condenser.

12. Upon Completion of the PURGE mode, the 815B will automatically advance into a POST-PURGE-FILL mode in which the chamber fills with LCO_2 for an additional 4 minutes. This mode is indicated by both the FILL and PURGE LED's illumination.

13. Upon completion of the POST-PURGE-FILL mode, the PURGE and FILL LEDs will turn off and the HEAT LED will illuminate. The HEAT mode is the stage in which the samples are carried through the "*Critical Point*". Both the pressure and temperature will steadily rise.

14. When the 815B chamber pressure reaches and goes beyond 1072 psi, it will stabilize in the neighborhood of 1350 psi (± 5% @ 20°C). As the temperature achieves 31°C, the unit has achieved the "critical point" and this is where the Tousimis equilibrium 4-minute cycle starts. The HEAT LED will begin to blink for the next 4 minutes indicating your 815B is in the Tousimis equilibrium.

15. At the end of the 4-minute Tousimis equilibrium period, the 815B will automatically advance into the BLEED mode. The HEAT LED will stop blinking and the BLEED LED will illuminate.

16. At this point, you can measure the BLEED rate via the Flow Meter supplied, by attaching the Flow Meter to the outlet of the COOL EXHAUST (if desired).

17. The flow rate should read 45-50 SCFH at the beginning of the BLEED cycle. This setting should yield on average of approximately 100-150 psi/min reduction in pressure. This pressure reduction flow rate is the desired decompression rate between 1300-400 psi.

18. Between 360-400 psi, the 815B will automatically advance from the BLEED mode into the VENT mode. The BLEED LED will turn off, while the VENT LED will illuminate.

19. It is not necessary to readjust the PURGE-VENT metering valve flow rate. The chamber should then come to atmospheric pressure in approximately 10 minutes.

20. At this point, the chamber lid may be removed by alternatively and evenly loosening all of the knurl nuts using the spanning wrench in a "reverse star pattern".

21. The wafer(s) or chip(s) can then be removed from the chamber for further processing. Seal the chamber with the lid to help keep it clean and moisture free.

22. Turn the 815B power off using the ON/OFF SWITCH located on the panel right-hand side. You will notice that it will take a few seconds for the VENT LED to turn of.

Note:

You will need at least 25 lbs of LCO_2, if not enough LCO_2 is available the process will abort (all lights flashing).