

Standard Operating Procedure for Cryo-prober

We are starting this procedure to operate assuming that the main chamber of the cryo prober system is under vacuum.

Step-1: Evacuating the vacuum chamber

- i) First check from the temperature controller panel that the temperature for all stages (sample, radiation shield, second stage and 1st stage) is at 290K.



- ii) Ensure vacuum pump is switched off and the vacuum valve attached to main chamber is close by rotating it in clockwise direction gently.

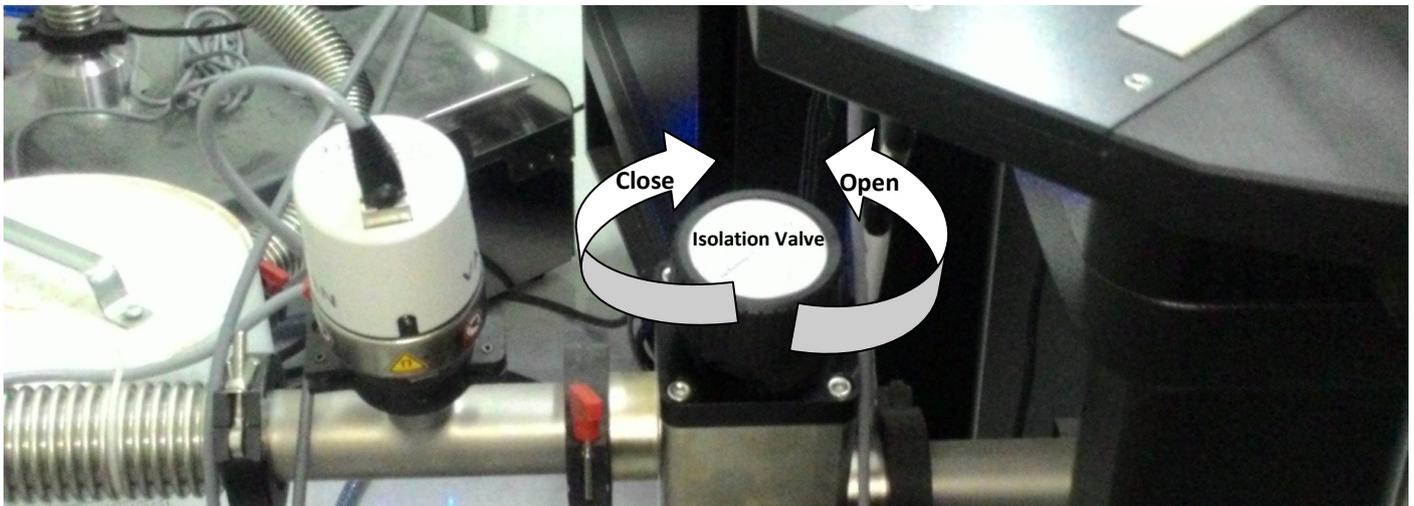


Fig. 1

- iii) Check the probes are well above (3 to 4 mm) from the sample holder. Also keep the probes away from each other.
- iv) Open the purge valve (Fig. 2a) and purge nitrogen gas with a line pressure of **2psi or less** and unscrew the main chamber lid. Let the gas flow until the chamber lid opens.

Step 2: Loading and unloading of sample

- i) Open main chamber lid and then open the inner shield attached to the radiation shield body.
- ii) Please ensure before loading or unloading process, that all the probes are out of the sample holder stage. Not doing that may damage the probes and these are very costly.

- iii) Sample is loaded and fixed with the sample holder using silver paste and make sure sample stuck properly with the holder.
- iv) At the time of unloading put acetone very carefully surrounding the sample on the sample holder. Acetone should not drop over the sample under test.
- v) Then gently unfix the sample from sample holder using twiser. Be very careful at this time, otherwise there is always a high chance that sample will go inside the vacuum chamber.
- vi) After loading the sample close the inner lid and main chamber lid properly.

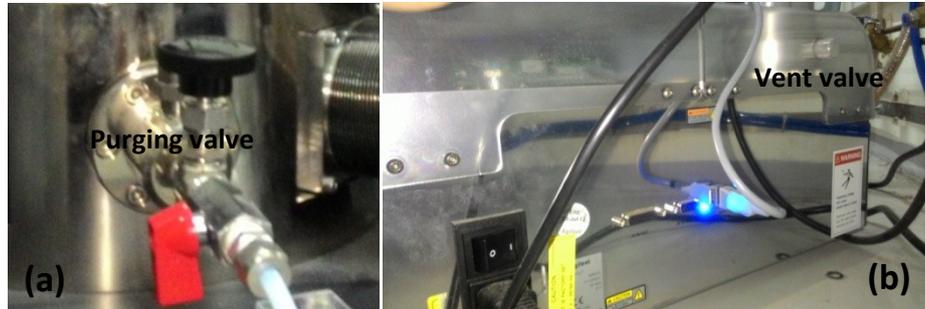


Fig. 2

Step 3: Switching on the vacuum pump

- i) Open the still colour turbo vent valve (Fig. 2b) in the back panel of vacuum pump by rotating it in anti-clockwise direction and keep it open until the hissing sound stop. Then close the valve again in clockwise direction.
- ii) Then open the isolation valve completely, shown in Fig. 1.
- iii) Then switch on the vacuum pump.

Step 4: Start cryo-cooler and set sample stage temperature

- i) After the vacuum reach to $1e-3$ Torr.
- ii) Then switch on chillier (a) main switch, (b) Pump on/off switch (rotating it 90^0 in clockwise direction) and (c) Comp. on/off switch (rotating it 90^0 in clockwise direction) [Fig. 3]. Chiller is situated outside the DC characterization lab.
- iii) Wait until the chiller temperature come down to 21^0 C.



Fig. 3: Chiller at switch on condition

- iv) Then switch on the cryo-cooler by pushing gently square shape black colour ON switch [Fig. 4].



Fig. 4: Cryo-cooler front panel

- v) Then switch on the temperature controller shown in Fig. 1. Set the sample stage temperature to required temperature for experiment and switch on sample heater. After completing the measurement at one temperature to move to other temperature, again set the temperature of the sample stage. Make sure, whenever temperature is changed, probes should be kept high from sample contact. Not following this will cause damage to the system.

How to set temperature: There are two Lakeshore 336 temperature controllers in the panel. Sample heater is connected to switch 'A' of the upper panel.

- a) Press 'A' from the upper panel, b) press 'Set point', c) set temperature from key board and d) press 'Enter'.

Then to fix heater range a) press 'A' from the upper panel, b) Press 'Heater range', c) set heater range using 'Upper or lower arrow' and d) press 'Enter'.

Set heater to 'Med' (medium) for the temperature range from 6K to 30K.

Set heater to 'High' for over 30K.

Step 5: Shut down procedure

- i) After all the measurements are done. 1st take all the probes up from the sample.
- ii) Switch off cryo-cooler by pressing 'OFF' on the front panel [Fig. 4].
- iii) Close the isolation valve by rotating it in clockwise direction and switch off vacuum pump main switch.
- iv) Switch off chiller by a) rotating 'Comp. on/off' switch by 90⁰ in anti-clockwise direction, b) rotating 'Pump on/off' switch by 90⁰ in anti-clockwise direction and c) pulling down the main lever [Fig. 3].