

CRX-EM-HF Probe Station (PS) Standard Operating Procedure

Startup

Step 0:

Release the vacuum, slowly open the purge valve by rotating the knob, in anticlockwise direction till a hissing sound is generated. Wait till the entire vacuum is released then remove the vacuum chamber lid.

Step 1:

Once the vacuum has been released, close the purge valve by rotating the knob in clockwise direction.

Step 2 :

Wear clean pair of gloves to handle the internal equipments.

Caution: Stay away from the vacuum tubes since its disturbance can lead to its stress.

Step 3 :

Unscrew the vacuum chamber lid followed by the radiation shield lid. The lids should be placed on a clean surface, say on a lint free cloths placed on a tabletop.

Step 4:

Lift the probes away from the sample holder using z-axis micrometer. Retract all the probe arms using x-axis hand dial.

Step 5:

Loading the sample

Apply thermal grease below the sample for thermal conductivity. Using a tweezer, place a sample onto the sample holder. Make sure that the sample can be probed by maneuvering the probe arms, and rotating the sample holder.



Fig. Z-direction movement caliper (Up and down movement of probe)

Step 6:

Once the positioning of the sample is adjusted and all connectivity's are ensured, close the radiation shield lid followed by the vacuum chamber lid.

Step 7:

Lift the probe tips away from the sample at some safe height and take them away from each other. **This step is crucial.**

Caution: This is done to prevent any damage caused by expansion of components due to subsequent low temperature processing.

Turning ON main supply:

Turn ON the main supply, switch is present behind the main power machine. It will show all the temperature readings.

Creation of Vacuum:

Step 8:

Power the vacuum pump, and open the vacuum isolation tube immediately. The ordering can also be interchanged. But make sure that there is not much delay between the two steps.

Caution: Long time lapse can lead to damage of the turbo fan blades of the vacuum pump.



Fig. Vacuum Pump.

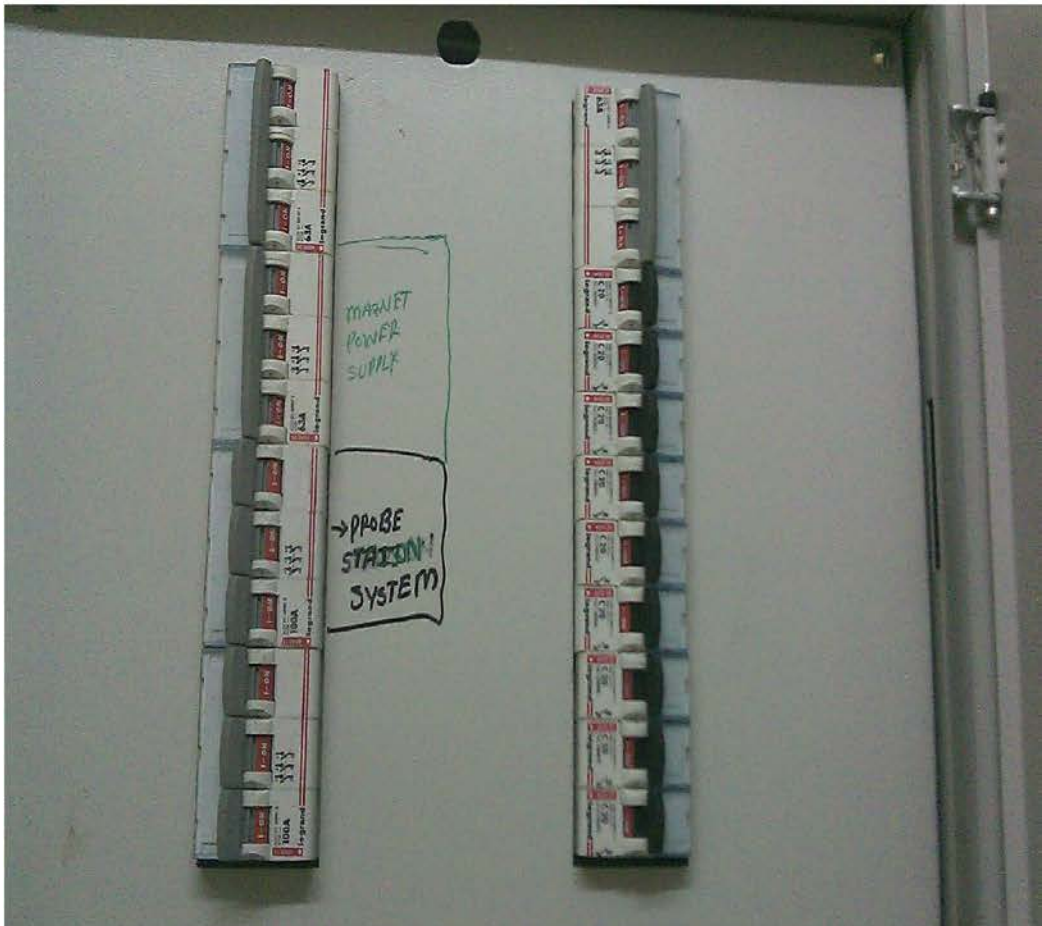
Step 9:

Wait till the pressure readings in the vacuum pump shows close to 10^{-4} torr. This will take slightly more than 30 minutes.

Step 10:

Turn on the water supply, Ensure all the three inlet and outlets for compressor, magnetic power supply and magnets; are on from inside the lab. By default, it is kept on.

Once 10^{-4} Torr pressure is attained, we should turn on the MCB for water supply and its circulation, in the same order as here present in DP1 and DP2. Ensure full water level in the tank. Switch on the chiller. Switch on both the new pumps. Note the temperature show on chiller. The temperature should be close to 22°C or less.



Step 11:

Circulation of water supply

Turn on the MCB switch for magnetic power supply followed by the compressor switch.

Step 12:

Turning Compressor ON

- a) Power on the MCB for compressor, which is inside the lab.
- b) Turn ON the knob present on the compressor.
- c) Push the “ON” button, also present on the compressor.



Fig. Compressor front diagram

The bottom most panel on main Supply machine is related to Magnet. It will show error if no water is flowing through magnet. To turn it ON, first make sure that water is flowing in the magnet and MCB inside the lab is ON, and then press the GREEN button present on main Supply Machine. On the bottom panel it will give the current and voltage value. It will show the temperature of magnet also, which should not cross 40 °C in any case.



Fig. Bottom screen showing reading related to magnet

Setup of Gauss meter:

Choose the magnetic field inside the vacuum chamber with the help of gauss meter which is the top most instruments present in main supply machine. Observe the following steps:

- a) Press “Control” on the panel.
- b) Select “Set the control”.
- c) Enter the value of field.
- d) Press “Enter” Press “Escape”.



Fig. Gauss meter

e) When you don't need any magnetic field, you can make magnetic field ZERO and switch OFF the magnet, first from the main Supply Machine and then MCB present in Lab.

Step 13:

Allow the temperature to drop to the required value. Also keep observing the drop in pressure. The minimum attained temperature of sample is 4 K. This might take about 2.5 hours.



Fig. Temperature controller module

Performance of experiment

During measurement, if you want to change the temperature of sample.

- a) Lift the probe tips from the substrate, it should not touch substrate.
- b) Change the temperature using the First Temperature controller. Select A (A is for Sample), then press **SETPOINT** and enter your required temperature and then hit ENTER and ESCAPE.
- c) Turn ON the heater of sample A. Press “A”, then press “Heater Range”, and enter select “High” (three options will be there, low-med-high. Med should be selected for temperatures less than 20 K, otherwise high), and then press “ENTER”. Make sure that red light is glowing below the number “1” place.
- d) P-I-D should be 50-20-0 as per Default.
- e) For other heaters (B= Radiation Shield, C= Probe arm on top temperature control per 336, A=CCR Second Stage, B= CCR First stage on lower temperature controller 336) Heater range option should be on “High”.
- f) You can switch off all the heaters by just pressing “ALL OFF” button once.



Fig. Temperature Controller Module

Switching off the system:

After the required characterization is performed, follow the steps below to switch-off the system.

Switch off Helium Compressor, press OFF button then turn knob to OFF state. Wait for at least one hour and observe the temperature, it should reach to 200 K. Close the vacuum isolation tube. Switch off the vacuum pump.

Caution:

In case of a power failure, just turn off the vacuum isolation tube asap.

Never close the vacuum valve and turn off the turbo pump, until the temperature become 200 K, otherwise probe station may get condensed inside, which make PS corroded after some duration.