

General procedures for transferring liquid helium

Richard A. Chamberlin
Caltech Submillimeter Observatory
Last update: April 15, 2009

1. Use an inexpensive vacuum grease (e.g. Dow) to grease the transfer tube so it seals well and slides easily on its o-ring seal. If the transfer tube has an extension on the intake side make sure it is tight.
2. Put on good gloves. Special cryo gloves are available and some people prefer the heavy welding gloves. Do not wear light gloves or use a piece of fabric such as shirt sleeve as a substitute! Eye protection is mandatory.
3. Insert the transfer tube in the storage dewar and tighten the o-rings to make a good seal.
4. Close off the bleed valves on the storage dewar.
5. Insert the transfer tube all the way to the bottom dewar and then raise it about 1 cm from the bottom. This raising is done to prevent debris that may be on the bottom of the dewar from obstructing the intake tube.
6. After you have a jet of LHe coming out of the transfer tube put it in the receiving cryostat.
7. If the pressure in the storage dewar drops below 2 psi then pressurize the dewar with an external source of helium gas. A transfer at about 3 PSI in the storage dewar is about right. A transfer at too high a pressure, such as 6psi will cause too much flash loss. A transfer at a lower pressure is too slow and the LHe sits in the transfer tube too long and may heat up too much and vaporize.
8. On the receiving side, periodically move the transfer tube up and down ~ 1 cm so that you are sure no ice is forming. If there is difficulty moving the tube because you think ice is forming then stop the transfer and put a copper rod down the fill tube in the cryostat to melt the ice and open up the fill tube. Do not have your face or any body part in the

way of the copper rod in case there is an explosive release of evolved helium gas and the rod is forcibly ejected. This problem has never happened at the CSO that we know of, but it has happened at other sites when clearing an ice plug. After the ice is cleared then resume the transfer. In the usually dry summit environment ice blocking the fill tube is not usually a problem. Hilo, of course, may be a different story.

9. When the receiving cryostat is full, as evidenced by a big change in the vapor plume coming out of the fill port, then:

- (a) If open, close the port on the storage dewar which is connected to the Helium gas cylinder.
- (b) Remove the transfer tube from the receiving cryostat.
- (c) Use one !GLOVED! hand on the brass O-ring fitting on the top of the storage dewar to hold the fitting down while pulling the transfer tube out. Do not pull the transfer tube out all the way. Rather, pull it out far of enough so that the end of the tube is above the liquid surface and only gas is coming out of the tube. Allow other end of the tube to rest somewhere safe and stress free while the dewar pressure SLOWLY bleeds down. If connected, shut off the external source of helium gas, replace the one way valve, disconnect the hose, and open the port on the storage dewar it was connected to. Open any other pressure valve relief ports that may have been shut during the transfer (usually there is one.) This procedure of slowly bleeding down the pressure in the storage dewar is for your safety and to prevent flash loss.

Note, that the technique of pulling out the transfer tube so it is above the liquid surface and only gas is coming out is also useful for pausing the transfer in case something (such as ice formation) needs to be checked.

10. When the pressure in the storage dewar is almost totally bled down, then, and only then remove the transfer tube. Close the valve on the top of the dewar.

11. The amount of helium withdrawn from the storage dewar should be consistent with the amount required to fill the cryostat. Table 1 of

Table 1: Cryostat capacities

Cryostat	capacity (liters)	fill depth (cm)	comments
Sidecab	5	12	
Barney	~7	9.5	
Frank's Rx	~7	13.5	
SharcII	12	17	
Z-spec	~30	19.5	
Zeus	~25	unknown	~25 liters total from 2 transfers of ~10 liters and ~15 liters.
Bolocam	~20	27.3	When pumping on the LHe bath, do 2 LHe transfers, ~15 liters after a night of observing/before cycling then a second fill of ~10 liters after the cycle/before pumping on the instrument again. The long dipstick used for dipping transfer dewars is needed for dipping Bolocam

the capacities and fill depths of various common cryostats used at the CSO.

- If you have any questions about these procedures or suggestions for improving them please see Richard or Ed.