

How to transfer liquid Helium

Liquid Helium (LHe) is needed to operate our measurement systems and the magnets there should have a certain minimum level of LHe. The transfer is a bit more complex comparing to the handling of liq. Nitrogen. This has a number of reasons: First of all, LHe evaporates very fast when exposed to air and vacuum isolated transfer systems are needed. Second, LHe is expensive and losses must be avoided. And finally, for LHe the safety requirements are quite restrictive:

The contact with LHe and also with cold Helium gas immediately causes severe burns, comparable to a 3000 °C welding flame.

In the following the process is described step by step. However, unexperienced persons must seek assistance from trained lab stuff. Without personal training it is forbidden to transfer Helium.

1. The equipment:

Before starting a transfer, check that everything necessary is there:

- Protective gloves and face protection
- LHe level meter for the LHe vessel
- Transfer syphon that matches the LHe vessel and the cryostat port.
- A heat gun (max. 200 °C).



2. Next check the cryostat and the storage vessel:

- The pressure gauge at the storage vessel must show less than 50mbar.
- Check the LHe level in the vessel using the level meter. You may need 50-80%.
- The cryostat status vessel be judged from the boil off rate seen at a "ball". It must be resting in the low position.



3. Prepare cryostat and storage can:

- Make sure that the valves at the recovery line are both open.
- At the cryostat syphon entry, replace the plug with the recovery line.
- Connect the other recovery line to the storage vessel. Keep the connecting valve in the open position.
- Switch on the recovery line heater.



4. Insert the transfer syphon:

- **At this stage it is essential to wear protection!**
- Remove the blank at the storage vessel. Check that the O-ring size matches with the sliding seal on the transfer syphon.
- Fold the syphon so that you vessel keep it with one hand and insert it into the storage vessel. Insert only a short length - sufficient for the sliding seal. Close the O-ring clamp.
- Open the plug at the cryostat
- Insert now the other end of the syphon into the cryostat port so that it is tight, but do not yet push down.



5. Start the transfer:

- At the storage vessel, close the valve to the recovery line.
- Now slowly push the syphon down into the storage vessel. Observe the pressure gauge there, the pressure should go up to 100-200 mbar.
- Observe the ball. It should start to levitate, indicating that the syphon is cooled by LHe. When the rotation gets fast LHe is reaching the cryostat. At that point, the syphon must be fully pushed down into the cryostat. **During this process, safety valves can open for a short time releasing cold gas. Wear protective clothes.**



6. Transfer He:

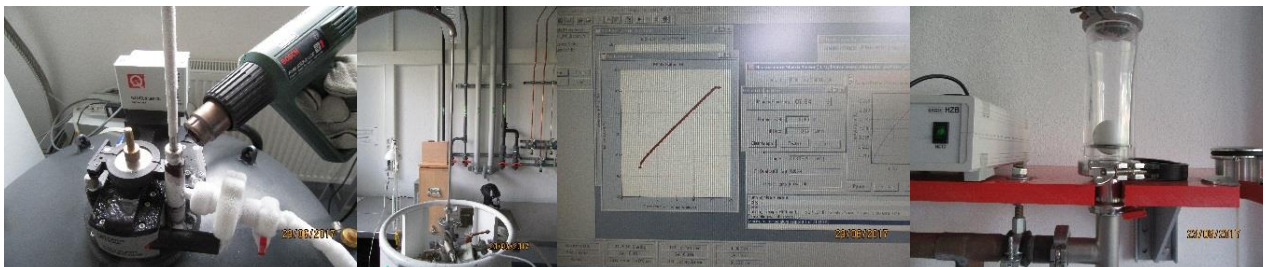
- Remove the recovery line from the storage vessel and replace it with the He gas line.
- Open the main valve at the He gas bottle. You need ~ 0.3 bar overpressure at the gas bottle.
- Open the valve at the storage vessel to pressurize it slightly from the line.
- Observe the pressure at the storage vessel and the filling rate. The ball will stay in a lower position for some time. At a certain filling level, it will levitate again.
- Observe the He level in the cryostat and the storage vessel.



7. Stop the transfer:

The transfer must be stopped when the storage vessel has less than 10% filling left. Also, when the cryostat reaches 90%, it makes little sense to continue filling because everything above that level will evaporate very fast.

- Disconnect the pressuring gas line.
- **CLOSE the gas bottle at the central valve.**
- Connect the recovery line to the storage vessel. This will reduce the pressure a bit and stops the transfer.
- Pull up the transfer syphon in the storage vessel and the cryostat, but **DO NOT PULL IT OUT! At this stage it is essential to wear protection! The ends will be cold.** It is possible that the syphon gets frozen to the O-ring seal. Use the heat gun to gently warm up. Tighten the sliding seals so that the syphon cannot drop back.
- The ball indicates the boil off from the system. Wait until it stops boiling, i.e. until the ball comes back to the resting position. This may take 10 min.



8. Remove the syphon:

When the pressure on the storage vessel is down and the boil off from the cryostat low you may remove the transfer syphon.

- Remove first the cryostat side of the syphon. **Wear protection clothes. Cold gas likely will come out.** Eventually use the heat gun ($T < 200^{\circ}\text{C}$).
- Then remove the syphon from the storage vessel. Put it aside.
- Immediately close the cryostat filling entry and also the storage vessel.



9. Finalize:

- Remove the recovery connection from the cryostat. **Wear protection clothes. Cold gas likely will come out.**
- Close the cryostat with the cap.
- Return the storage vessel to the parking position. Connect it to the recovery there.
- Close the unused recovery lines on the board.
- Switch of the recovery line heater.
- Shut down the "Helium fill" application, else it will continuously boil a lot of He.

