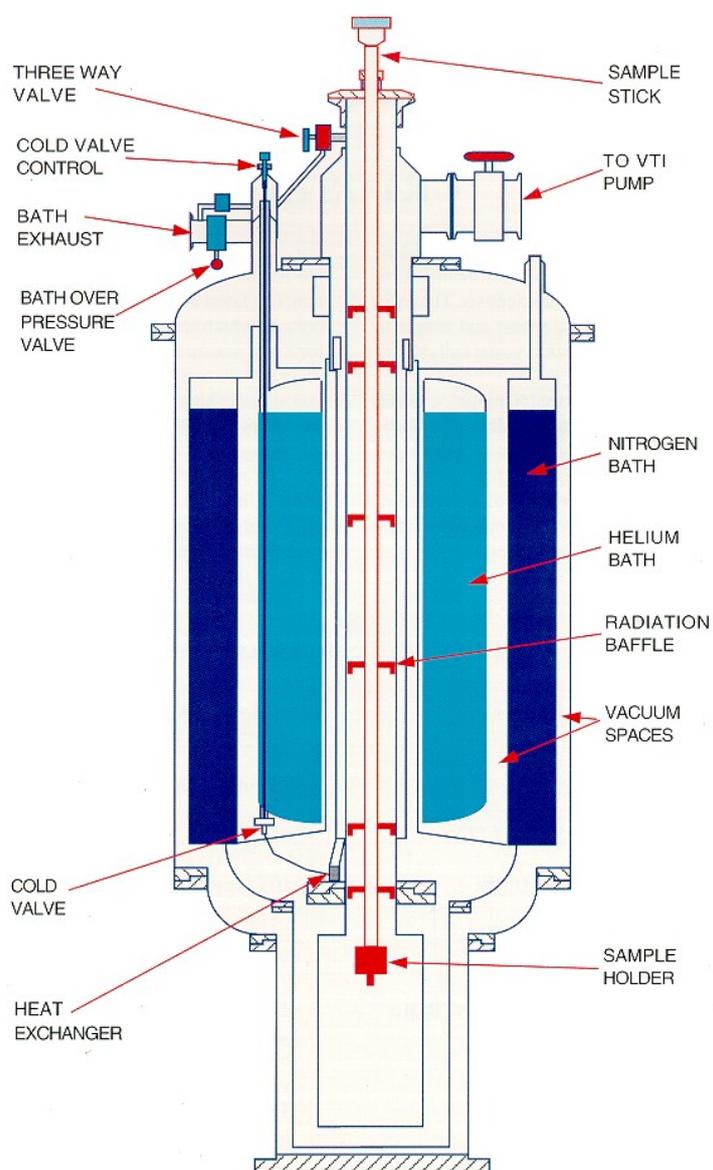


Orange Cryostat Operating Instructions

Principle of Operation

An orange Cryostat consists of five concentric volumes.

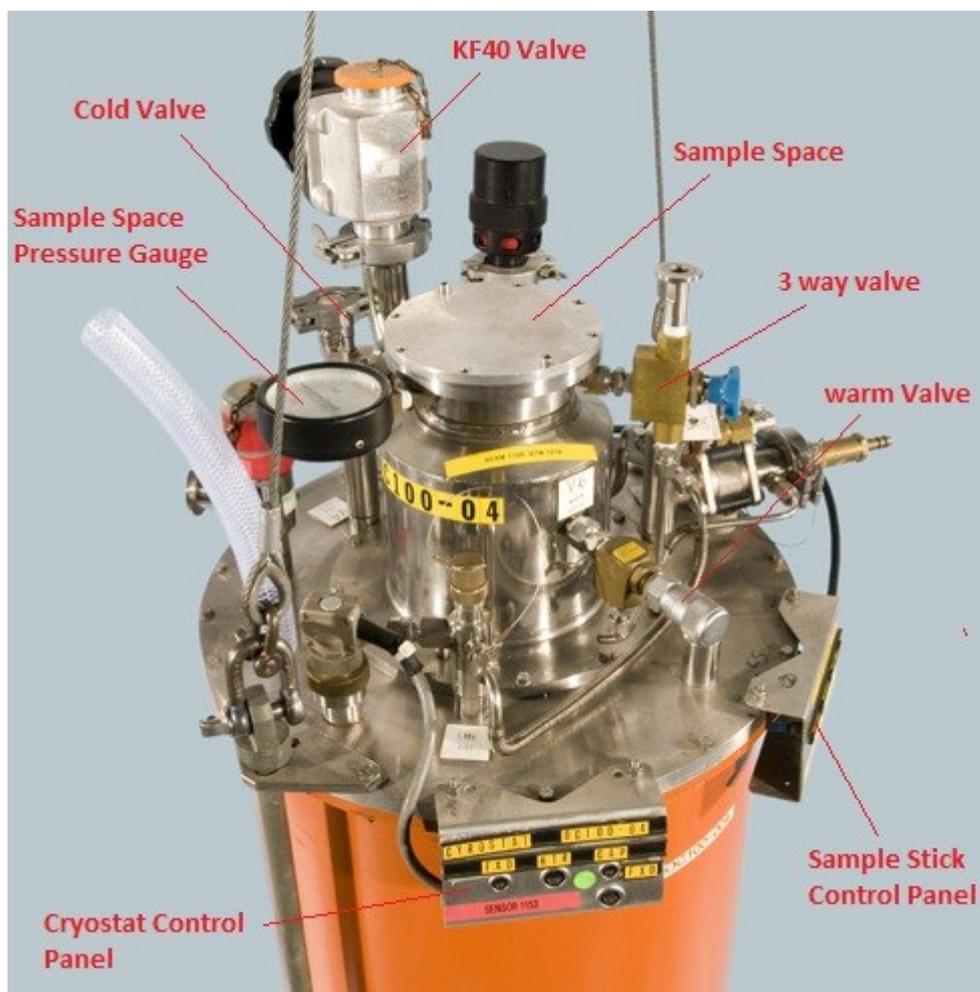
1. Main vacuum insulation jacket
2. Liquid Nitrogen bin and insulation jacket
3. Liquid Helium bin
4. Annulus
5. Sample volume



STANDARD L.L.L. "ORANGE" CRYOSTAT

Liquid He is fed under pressure at 2 psi (0.13 bar) from the Liquid He bin through a cold valve via a capillary to the heat exchanger. The Helium is also drawn from the heat exchanger by a vacuum pump. The drawn gas cools the sample volume which in turn cools the sample by conduction through an amount of exchange gas which has been added to the sample volume.

A 50Ω (100W max) heater is provided at the heat exchanger to control the sample temperature between 350K and 1.5K.



To cool the sample to 4.2K using the warm valve.

1. Open the cold valve $\frac{1}{2}$ a turn
2. Open the warm valve and maintain a flow of 10l/min on the flow meter. The sample will start to cool.

Note! A typical cool down time for a sample from room temperature using a 100mm (50mm) cryostat is approximately 3½ to 4 hrs (1½ to 2 hrs). Cooling is slow to start with but will accelerate once the sample has reached 50K. Once the sample has reached a temperature of 4.2K reduce the gas flow to 4 l/min (2 l/min) using the warm valve.

To cool the sample to 4.2K using the cold valve.

1. Connect roots pump to KF40 valve on the cryostat.
2. Ensure cryostat warm valve **and** cold valve are closed.
3. Start pump, when pressure gauge reads zero, open KF40 valve on the cryostat.
4. Open the cold valve $\frac{1}{2}$ a turn; maintain a flow of 10mBar on the pump gauge or 10 l/min on the pump flow meter. The sample will start to cool.

Note! A typical cool down time for a sample from room temperature using a 100mm (50mm) cryostat is approximately 3 $\frac{1}{2}$ to 4 hrs (1 $\frac{1}{2}$ to 2 hrs). Cooling is slow to start with but will accelerate once the sample has reached 50K.

Once the sample has reached a temperature of 20K reduce the gas flow to 2mBar or 4 l/min (1mBar or 2 l/min) by adjusting the cold valve.

To control sample at intermediate temperatures

If you wish to control the sample by direct heating via the cryostat heater and the cryostat sensor or alternatively if you have a sample heater then try the following values.

Temperature (K)	Voltage (V)	P(%)	I(s)	D(s)	Flow (l/min)
1-5	8	3	1	0.2	4
5-10	12	3	10	2	3
10-20	16	1	10	2	2
20-300	16-52	1	50	10	2

If you wish to control the cryostat heater using the sample sensor then try the following values.

Temperature (K)	Voltage (V)	P(%)	I(s)	D(s)	Flow (l/min)
1 - 20	8-12	2	40	8	0 - 4
20 - 50	16-24	2	100	20	3
50 - 150	24-40	2	200	40	2
150 - 300	40-52	2	1000	200	1

It should be noted that the given values serve only as a rough guide and slight changes may be needed to best suit your experiment.

Alternatively an autotune facility is available and can be used in 'single shot' mode (*to control at one particular temperature*) or 'adaptive' tune mode "not recommended" (*to control at a range of temperatures*).

To cool the sample below 4.2K

1. Connect roots pump to KF40 valve on the cryostat.
2. Follow steps 2 - 4 ([To cool the sample to 4.2K.](#))
3. When the cryostat reaches a temperature of $>4\text{K}$ close the cold valve.
4. Wait until roots pump pressure gauge reads zero again, then adjust the cryostat's cold valve until the pressure and flow begin to rise, then wait until the pressure and flow readings stabilise.
5. Adjust the cold valve so that a steady pressure of about 2mbar is reached and the flowmeter reads between 4-6l/min. Alternatively for a 50mm cryostat 1mbar and 1-3l/min respectively.

Note!

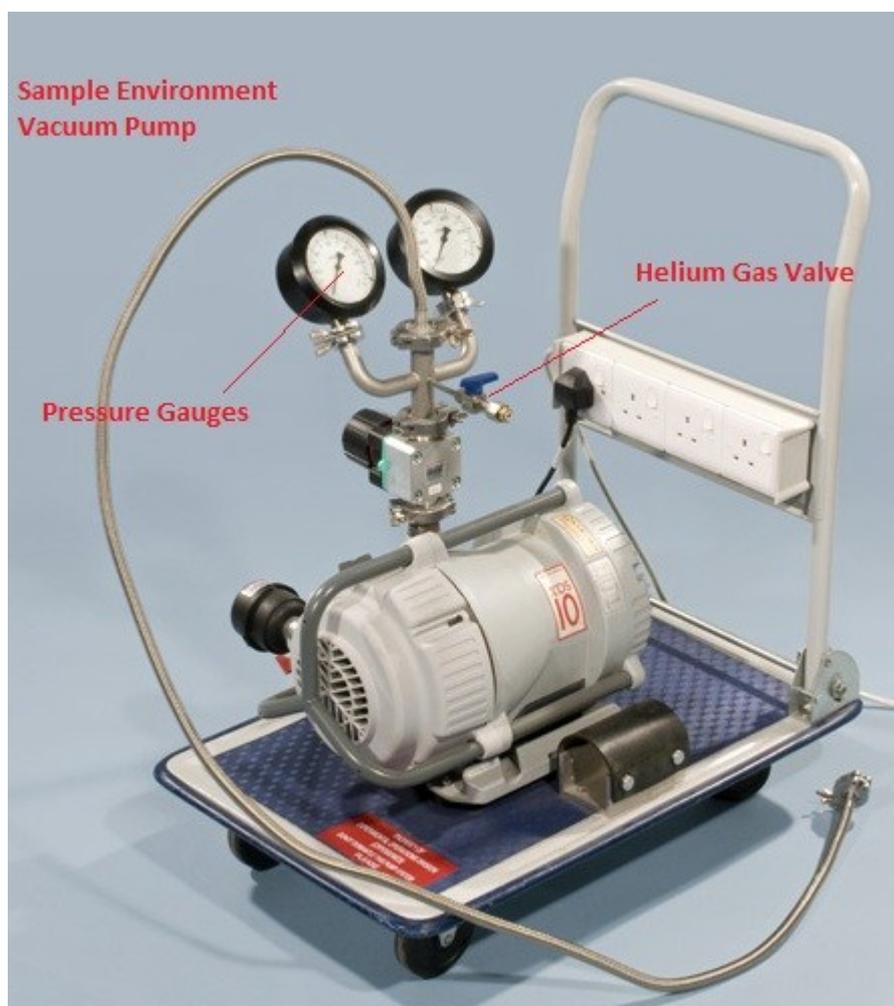
Sample and 100mm cryostat will take about 10-15 mins to reach 1.5K, less for a 50mm cryostat. (*Depending upon sample mass*)

Changing Sample in a Cryostat

Inserting the sample stick

Before commencing the procedure ensure the following:

The cryostat and centrestick are at 80 K and the cryostat is connected to the Helium recovery panel.



1. Connect Sample Environment vacuum pump to top of blue 3 way valve and start the pump to evacuate the line, ensure that a helium gas supply is connected to the pumps gas valve.
2. Turn the 3 way valve vertically *UP* to open the sample volume to the pump close the vacuum valve and open the gas valve to fill the sample volume with Helium exchange gas.
3. Ensure that the centrestick is fully prepared.
4. Remove blanking flange from top of cryostat and insert centrestick carefully.
5. Re-insert flange screws and tighten.
6. Close gas valve and open vacuum valve on pump to evacuate the sample space of Helium exchange gas.
7. When pressure gauge on the rotary pump reaches zero, re-introduce Helium exchange gas by closing the vacuum valve and opening the gas valve.

8. Close the gas valve and open the vacuum valve and throttle the valve until the pressure gauge on the rotary pump reads 30-40mbar.
9. Turn the 3 way valve *HORIZONTAL*.
10. Connect Jaeger plug to the top of the centrestick.
11. Begin cooling of the sample. (See *Cryostat Operating Instructions*)

Removing the sample stick

Before commencing the procedure ensure the following:

The cryostat and centrestick are at 80 K, the cryostat is connected to the Helium recovery panel and the cryostat blanking flange is to hand.

1. Disconnect the Jaeger plug from the top of the centrestick.
2. If not already connected, connect Sample Environment vacuum pump to top of blue Hoke valve and start the pump to evacuate the line, ensure that a helium gas supply is connected to the pumps gas valve.
3. Turn the 3 way valve vertically UP to open the sample volume to the pump then close the vacuum valve and open the gas valve to fill the sample volume with Helium exchange gas.
4. When the sample volume is at atmosphere, remove securing screws from centrestick flange and carefully withdraw the centrestick and then replace with the blanking flange, replace the securing screws.
5. Close the gas valve and open the vacuum valve until the pressure gauge on the rotary pump reads 0mbar, turn the 3 way valve *HORIZONTAL*.

Note!

Before re-using the Centrestick ensure that any moisture is removed by using a hot air blower and wipes.

To insert another sample follow the inserting a sample stick instructions

Checklist of equipment required for your Orange Cryostat

Sample stick

Sample Environment vacuum pump (fitted with Pressure gauge 0-1000 Mbar and gas valve).

XDS35 pump for $T > 4K$ or Roots pump for $T < 4K$ (fitted with analogue Vapour Pressure gauge and flow meter).

Liquid Helium level Indicator + cable

If you are unsure about any aspect of cryostat operation consult your local contact or contact ISIS Experimental Operations Division Cryogenics Team.