Quantum Design

Service Note 1070-315

Recommendations for Avoiding Blocked Helium Impedances

(Systems: MPMS, PPMS, SQUID VSM)

Introduction

If you have difficulty in setting temperatures below 10K or are experiencing reduced performance when cooling the sample space from high temperatures, this behaviour is most likely caused by a blockage in the secondary and/or primary helium impedance tube. This blockage can be caused by frozen air or other contaminants that can enter the impedance. The impedances are at the bottom of the probe and pump helium liquid from the dewar. The blockage will reduce the flow of helium and lead to the symptoms mentioned above.

For diagnosing and clearing a blocked impedance on the PPMS please follow the procedure in the PPMS service note 1070-306 on the website www.qdusa.com.

Possible Sources of the Blockage

A blockage can occur for diverse reasons and we will discuss in this note the most common.

I. Blockage during liquid helium transfer

A full description of the procedure for cooling down your system is at the section “Initial Helium Transfer/ Consecutive Transfer” of the relevant system manual.

In addition to the instructions presented in the manual, there are some recommendations to prevent blockages during the transfers:

1. Avoid lowering the transfer line to the bottom of the storage dewar. Keep the end of transfer line at least 5 cm above it. This will avoid collecting all the frozen particles accumulated on the bottom of the dewar.
2. If the system already contains helium, minimize the time between removing the dewar pop-off valve and inserting the transfer line. This reduces the amount of air that is cryopumped into the liquid helium space.
3. If the system already contains helium, do not insert the transfer line inside the system until you observe the helium “flame” coming out of the extension. This will prevent the presence of air inside the transfer line, which will then enter the dewar.
4. In case you need to use more than one storage dewar to cool down your system, warm up and dry the transfer line before inserting it in the second dewar and resuming the transfer. To dry the transfer line faster it is useful to flow warm helium gas through it.

5. Do not wait until the helium level is below 40% before refilling the system. Below this level the helium liquid may fall below the impedance inlet. This increases the risk that air enters and blocks the impedance when one opens the dewar for inserting the transfer line.

II. Blockage related to the vacuum pump

The vacuum pumps are a basic element of the temperature control and gas handling system and if not properly maintained can cause problems in reaching low temperatures.

1. The oil of the oil pumps will need a periodic refilling to ensure it is inside the operational limits. Failure in this basic maintenance will produce gas backflow that can produce a blockage over time.
2. Perform maintenance on the pumps without previously taking the required steps to isolate the system will allow air to enter the system and block the impedances. If you have questions about the pump maintenance, please contact your Quantum Design representative in order to receive the proper instructions.
3. In the case of scroll pump maintenance for systems with EverCool or Reliquifier option, it is very important to contact your Quantum Design representative to receive the appropriate instructions.

III. Blockage because of poor quality of the liquid helium or gas used during the transfer

Some commercial suppliers do not make a regular cleaning and warm-up of their storage dewars. Consequently the dewars accumulate frozen contaminants in the liquid helium. During the helium transfers these contaminants can be pushed inside the system dewar and block the impedances. **We recommend you to contact your local Quantum Sales/Service Representative in order to receive information about the recommended suppliers in your region.** The recommended suppliers will be chosen relying exclusively on the positive experience of regular users of this supplier in the region. Quantum Design will not take responsibility in the malfunction of the system caused by helium bought from suppliers that are not specifically recommended. This recommendation is subject to change, therefore we recommend contacting your Quantum Service Representative as soon as you suspect poor quality helium. The feedback of our customers is very important to select the right supplier.

The helium gas used to pressurize the storage dewar has to have a purity of at least 99,996%. Do not use helium of lower quality or unspecified quality, such as the one from a recovery system, to perform the transfers.

One way to recognize blockages produced by dirty helium is when one or more QD systems block simultaneously right after a helium transfer. Please inform your supplier in case this happens in order to prevent this incident in the future.

The use of a filter at the transfer line inlet in the storage dewar might reduce the amount of contaminants, however since nitrogen tends to form a slush it seems to be difficult to filter 100% of contaminants when you use helium with frozen impurities. A filter made of a sintered block of fine metal particles, such as the 1 micron sinters used at the inlet of the QD impedance assembly, may be a good candidate for such an inlet to the transfer line. Contact Quantum Design if you would like more information about such filter designs.

IV. Blockage produced by a leak in the system

When, despite taking the above precautions, an impedance blockage reappears during cooldown or after some time of system operation then it is necessary to look for a possible leak in the dewar or gas handling system. To locate such a leak may require you to contact your Quantum Design representative for further assistance.