

**Procedure:** Impedance Tube Blockage Test and Repair

**System:** MPMS

## Introduction

If you are having difficulty setting low temperatures (below 10K) a likely cause is a blocked impedance tube. Air that is inadvertently admitted into the dewar will freeze and form ice. This ice can easily enter the impedance. The impedance is a small capillary tube at the bottom of the probe that pulls helium gas from the dewar. If the impedance becomes partially plugged, the system may have difficulty cooling below 4.5K. The system may also be slow to stabilize at temperatures below 10K.

## Diagnosing a Blocked Impedance

The following instructions explain how to check for a blocked impedance.

1. Connect (or verify) the 5-liter flowmeter is on the pump output, the exhaust line from the Oil Mist Filter.
2. Access the **Diagnostic Gas Controls** menu.
  - a. Press **F7** to enter the **Diagnostic** menu.
  - b. Move the cursor to select **Gas Controls**.
  - c. Press **ENTER** to access the **Diagnostic Gas Controls** menu.
3. Permit the maximum flow through the impedance valve.
  - a. Turn the **Impedance Heater** OFF from the **Diagnostic Gas Controls** menu.
    - 1) Place the cursor by the **Impedance Heater** field.
    - 2) Press **ENTER**, then select OFF.
  - b. Set the **Cooling Valve** to OPEN from the **Diagnostic Gas Controls** menu.
    - 1) Place the cursor by the **Cooling Valve** field.
    - 2) Press **ENTER**, then select OPEN.

4. Check the helium gas flow rate and annulus pressure.
  - a. When the temperature is stable, check the annulus pressure to ensure there is no negative pressure. The annulus pressure gauge should be 0 (+/- 1)
  - b. Check that the helium gas flow rate is between 2.0 and 2.5 liters per minute.
5. Verify the results.
  - a. If your results are within the values of step 4, the problem you are experiencing may be due to other parts of the sample chamber system, a leak in your vacuum sleeve, or other malfunctioning components. Contact your Quantum Design service representative for further assistance.
  - b. If your flow rate is below this range and if there is negative pressure, the impedance is either fully or partially blocked. You will need to complete the following procedure, Clearing a Blocked Impedance, to remove the plug.

Quantum Design  
Customer Service  
11578 Sorrento Valley Road  
San Diego, CA 92121

TEL: (800) 289-6996 within U.S.  
(858) 481-4400 outside U.S.

FAX: (858) 481-7410

EMAIL: [service@qdusa.com](mailto:service@qdusa.com)

## Clearing a Blocked Impedance

The following instructions should be performed if a plug has been detected in your impedance valve.

1. Transfer helium from the MPMS dewar back into your storage dewar. (Nitrogen-jacketed dewars should be emptied of Nitrogen as well.)
2. Allow the system to warm to room temperature.
3. With the system at 300K, remove the probe carefully lifting it straight up and out of the dewar.

### Caution

Use extreme care to prevent damage to the probe. At least two people are required to safely remove and install the probe into the dewar. Do not attempt to perform this procedure alone. A step ladder is also needed to safely remove and install the probe. As the probe is being removed and installed, support it by the top plate and base (magnet). Never support the probe by the wiring tubes that run along the length of the probe.

4. Store the removed probe vertically and supported at the head, or rested horizontally with supports along the length of the probe.
5. Insert a long-necked vacuum cleaner into the dewar to remove any debris that may have accumulated at the bottom of the dewar.
6. Allow the dewar and probe to remain at room temperature for a least 12 hours to ensure that all components are fully dried. (In humid climates this may take 24 to 36 hours.)
7. Carefully return the probe to the dewar.

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8. Refill the dewar using the procedure, Initial Helium Transfers, provided in the MPMS manual.

The system is now ready for normal use.