



Service Note 1091-208

Dilution Refrigerator Option Unpacking Inspection

It is necessary to inspect the DR immediately after unpacking. This document describes the inspection process. This procedure **MUST** be followed prior to running the DR every time the DR is shipped to ensure all of the shipping fixtures are removed and the system is free of damage.

I. Visual Inspection and Removal of Shipping Fixtures

1.1. Check: DR Probe

- Inspect the DR probe for any damage (See *Image 1*). The probe should be straight and the tubes should be free of dents.

1.2. Remove Shipping Screws

- Use a 5/64" Allen key to remove the two shipping screws. (See *Image 1*)

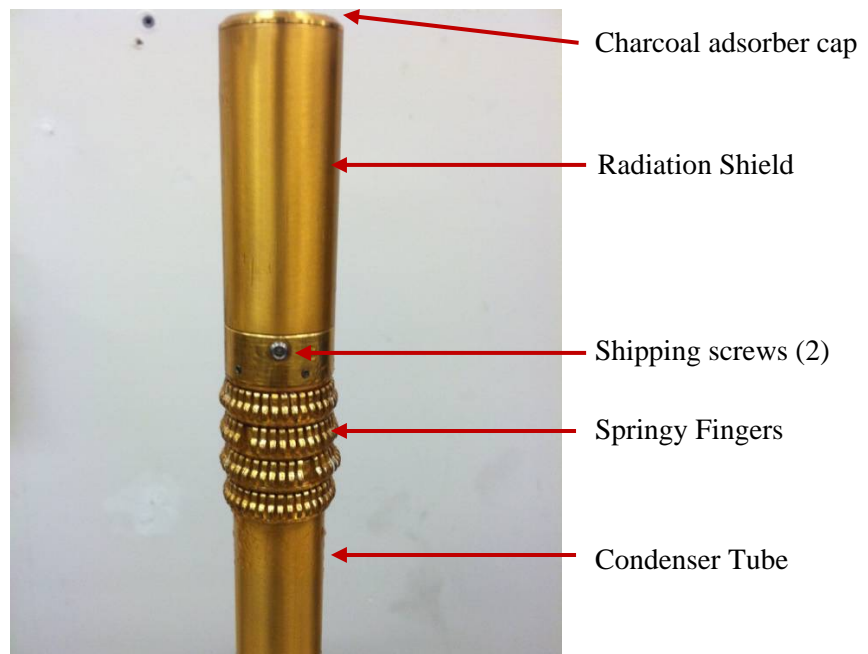


Image 1

1.3. Check: Sample Stage

- Remove the adsorber cap and look down into the radiation shield with a flash light. The sample stage should be roughly centered and should not touch the radiation shield. (See *Image 2*)

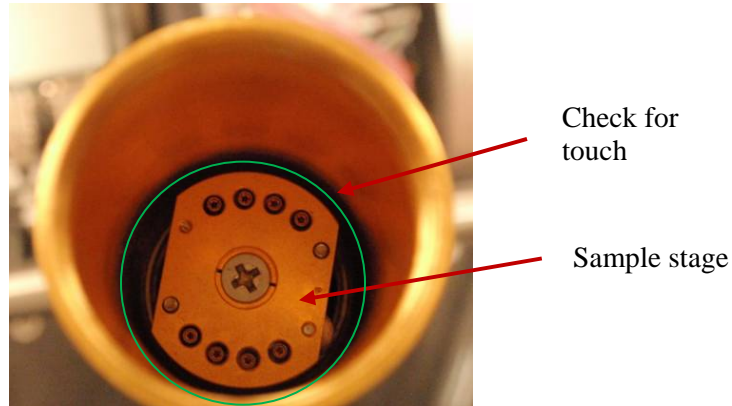


Image 2

1.4. Check: Dilution Unit

- Unscrew the radiation shield from the condenser tube and carefully lift straight up to remove. It is important to hold the condenser tube while unscrewing the radiation shield.
- Install the sample mounting pins in both threaded holes of the condenser tube where the shipping screws had been. Thread them gently in until they brace the fridge (Sample Mounting Pins are shipped with DR accessory kit).

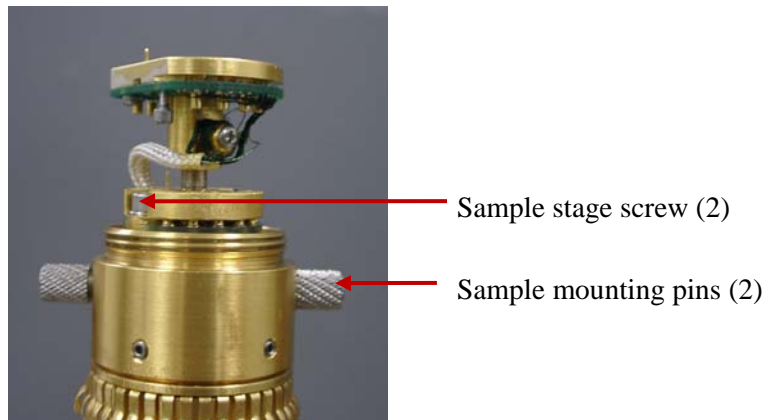


Image 3

- Carefully remove the sample stage: Use the modified 5/64" Allen key found in the user kit to unscrew the two sample stage screws. Lift the sample stage straight up. You will feel some resistance since there are electronics pins engaged in sockets.
- Unscrew the sample mounting pins, which you have installed in the previous step.

- Look into the top of the DR with a flashlight to see if anything touches the sides of the condenser tube (See image 4).

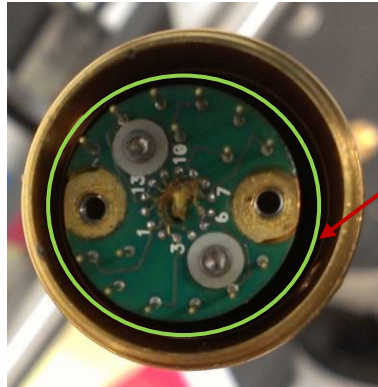


Image 4

1.5. Reassemble

- Apply N-grease to the threads on the condenser tube, radiation shield and adsorber cap.
- Reinstall the condenser tube. Make sure it is screwed tight to the condenser.
- Reinstall the sample mounting pins as mentioned before.
- Reinstall the sample stage, noting to carefully align the pins with the sockets and engage them carefully.
- Reinstall the radiation shield.
- Reinstall the adsorber cap.
- Remove the sample mounting pins.

II. Cryo Clean DR Mixture Gas

- Open tank Valve by several turns (refer to Gas-handling System section 2.4 in DR user manual).
- Refer to DR User Manual appendix section A.2.6-A.2.7 for cryo cleaning setup, and section 5.2.1 for detailed instructions on cryo cleaning.
- Start Cryo Clean wizard from MultiVu (Utilities>DR>Wizards>Cryo Clean Mixture Using LN2 Trap) and follow the on screen directions.
- Cryo clean for 125 cycles.
- If the pressure difference before and after cryo cleaning is >15 Torr or if the metered gas pressure at end of wizard is below 600 Torr then contact your Quantum Design service representative. After the cryoclean wizard, warm the LN2 trap, look at the resulting pressure and give this information to the rep.

III. Greasing Sample Chamber and DR Insert

Use N-grease to grease the DR insert (Note: Do not use any other grease).

- Apply N-grease to the eleven sets of springy fingers found on the DR insert. Refer Image 5.



Image 5

- Use *Image 6* to judge how much grease to apply to the condenser tube springy fingers. The grease is only useful on the outside of the fingers so avoid squishing the grease between the fingers. The best technique is to apply grease to your gloved finger tips and gently pat the surfaces of all of the spring fingers.



Image 6

- Insert probe into sample chamber (Refer to DR User Manual section 4.4.2).
- Try to avoid rotating the probe as it slides in as this will tend to break the springy fingers.
- Take care to go straight in as it is easy to bend the DR insert.
- Pull the DR probe out and re-grease, repeat these steps three times to coat the sample chamber with N-grease, leaving the probe in the sample chamber the final time.

IV. DR Cool Down

Now that DR insert is greased and inside the sample chamber, the DR is ready to cool down.

- Open MultiVu, and start logging both MultiVu and DR log with 20 sec interval.
- If DR system is using a diaphragm pump, this design enables one to perform a flow test at 20 K. Go to Sec. 4.1 and return once test is passed.
- Set the temperature in MultiVu to 0.050K. The DR state engine will go through the following states in the process of condensing the gas mixture in DR and establishing a stable base temperature: *Condensing for Dilution Cooling, Dilution Cooling*.
- Typically it will take from 400 to 500 minutes for the DR to reach the base temp (50mK) from 20K.

4.1 Flow Test at 20K

If you have DR with a Diaphragm pump in the gas handling system (how to recognize?), perform the 20K flow test to check the DR impedance flow, before you cool down the DR.

- Start 20 K flow test wizard (Utilities>DR>Wizards> Check DR Impedance Flow at 20 K), refer DR User Manual section 5.2.6.
- It should take 60 to 120 minutes to cool the DR from 300K to 20K as seen in *Image 7*.

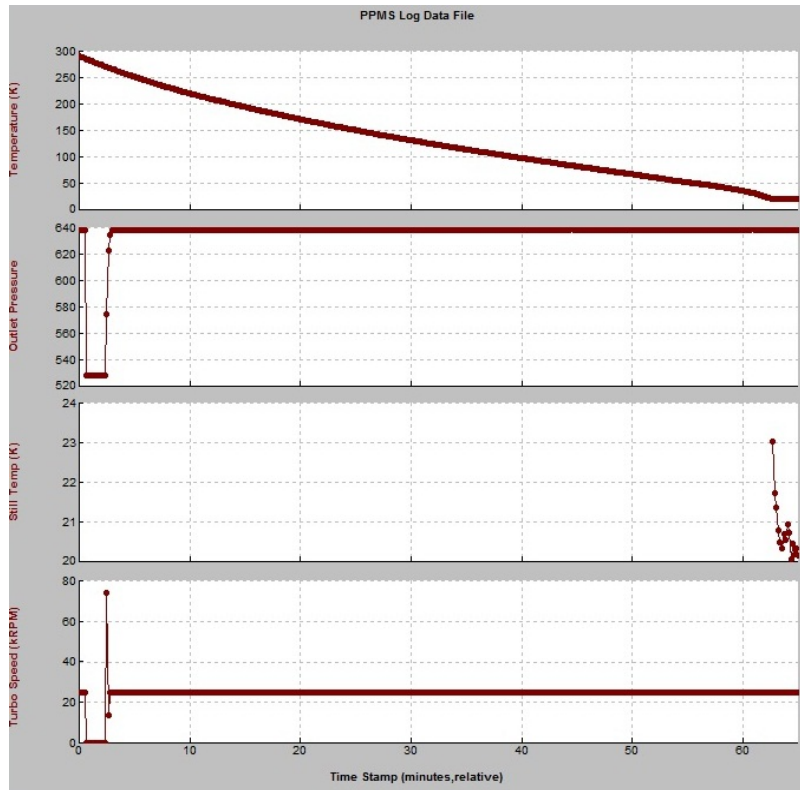


Image 7

- When prompted select “Flow Test”
- Enter the pressure data from three minutes and the pressure at eight minutes into the appropriate dialog boxes.
- The flow rate should be >1.60 sccm.
- Image 8 shows a good flow test. The condensing rate should be at least 5 Torr/min. If it is condensing slower there may be poor thermal contact between the DR and the sample chamber.

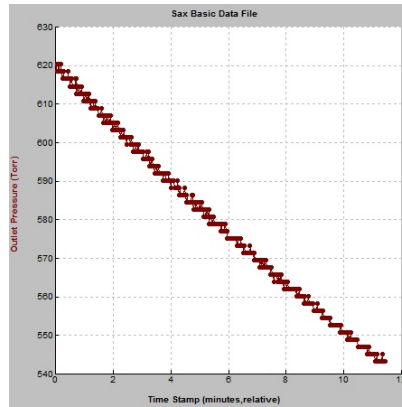


Image 8

- Now that we verified that the DR impedance has a good flow, the DR is ready to be cooled down.

4.2 Check: Vespel Plates

If the 20K flow test looks good and the DR doesn't reach the base temp (50mK), check the Vespel plates in the DR insert.

- **Warm the DR to 300K by setting the temperature in MultiVu.**
- **Remove the DR insert from PPMS and place the DR in its chart.**
- **Remove the sample stage from the DR insert as mentioned in section 1.4.**
- Remove the Condenser tube. It should be threaded tightly onto the condenser so it will require a firm grip to get loose. Do not grip the springy fingers in this process.
- Check the 6 screws attaching the Vespel plates are snug. These screws should not be loose, however over tightening the screws can damage the Vespel plates. Refer image 5. Do NOT over tighten!



Image 9

- Reassemble the sample stage back to DR insert as mentioned in section 1.5.
- Follow the section 4 to cool down the Dilution refrigerator.