4.4 Bubble Chamber CF_3I Evacuation Procedure

This procedure covers the evacuation of residual CF_3I gas from the bubble chamber inner vessel *after* all CF_3I liquid has been transferred out of the chamber.

1) Review procedure 4 "CF3I Handling Procedure"

2) Ensure that the hydraulic system is appropriately initialized. It should be at ~30psia, with the inner vessel near bellows neutral.

3) Ensure that three CF_3I 10L sample bags are available, empty, and labeled with the date and "Residual CF_3I Gas 1", "Residual CF_3I Gas 2" and "Dissolved CF_3I Gas" respectively.

4) Assemble the CF_3I transfer lines, vacuum pump, and the CF_3I sample bag labeled "Residual CF_3I Gas 1". The plumbing consists of a flexible connection from the main Cartan valve (MV-22) to the CF_3I sample bag. No filter is required. The line is equipped with a tee to a vacuum gauge, an isolation valve and a vacuum pump.

5) Ensure MV-22 is closed. Turn on the vacuum pump, open the plumbing to the vacuum pump and evacuate the CF_3I transfer lines. Open the valve to the sample bag. Once they are evacuated, isolate and turn off the vacuum pump. Record the vacuum pressure, wait 5 minutes, and re-check the vacuum pressure. Ensure there are no leaks. Close the valve to the sample bag.

6) Ensure that you have the "Commissioning Tool" running. Initiate data logging every 5 seconds.

8) Follow the "Before Handling CF_3I" section of procedure 4.

9) Verify that the vacuum pump line is closed and the sample bag valve is open. Very slowly open MV-22. The sample bag should inflate by ~2L, bringing the chamber down to atmospheric pressure. If the bag inflates past 50%, there is still liquid CF_3I in the vessel, and you should halt this procedure and instead follow procedure 4.2 to drain the CF_3I.

10) Using the hydraulic ram control in the Commissioning Tool, move hydraulic ram down until the inner vessel bellows is fully compressed (on its stops). Be very careful not to over-compress the chamber, the glycol pressure should be no more than 20 psia.

11) Close MV-22 and the sample bag valve. Remove the sample bag (venting the transfer line).

12) Store the used sample bag with the MSDS for CF_3I in a light-tight container. Label the outside of the light-tight container. The same light-tight container may be used for all CF_3I sample bags.

12) Cap the line where the sample bag was. Ensure MV-22 is closed. Turn on the vacuum pump, open the plumbing to the vacuum pump and evacuate the CF_3I transfer lines. Open the valve to the sample bag. Once they are evacuated, isolate and turn off the vacuum pump. Record the vacuum pressure, wait 5 minutes, and re-check the vacuum pressure. Ensure there are no leaks.

13) Connect the 10L sample bag labeled "Residual CF_3I gas 2" to the pump exhaust. Ensure the gas ballast on the pump is closed (off).

14) Open the valve on the sample bag. Turn on the pump. The 10L bag should begin to inflate very slowly.

15) Very slowly open MV-22. The bag will inflate as CF_3I is removed from the chamber. Watch the chamber pressure and the bag volume. When chamber pressure stops dropping at ~1 psia and the bag stops inflating, close MV-22. The bag should inflate by ~2L (20% of its allowed volume).

16) Turn off the pump and close the sample bag valve.

17) Remove the sample bag and replace with the empty bag labeled "Dissolved CF_3I Gas".

18) Store the used sample bag with the MSDS for CF_3I in a light-tight container. Label the outside of the light-tight container. The same light-tight container may be used for all CF_3I sample bags.

19) Wait for 30 minutes as dissolved gas comes out of the water in the bubble chamber. Watch the pressure rise.

20) Repeat steps 14–16. The bag should inflate slightly.

21) Wait another 30 minutes and watch for further pressure rise. If the pressure rises by more than 2psia, repeat steps 14-16 and wait again. Continue iterating until the pressure rise over 30 minutes is <2psia. If after an iteration the volume in the sample bag exceeds 50% its allowed volume, replace the sample bag for the next iteration, following steps 17–18.

22) Remove the sample bag. Store the used sample bag with the MSDS for CF_3I in a light-tight container. Label the outside of the light-tight container. The same light-tight container may be used for all CF_3I sample bags.

23) Vent the transfer line and disconnect it from both the inner vessel and the pump. Cap the inner vessel port.

24) Ensure the "After Handling CF_3I" section of procedure 4 was followed.

25) Using the Commissioning Tool, pull the hydraulic ram up until the chamber pressure is the same as the room pressure.

26) Terminate data acquisition.