Frozen Spin Target Manual
Document 3: Condensing Pure 4He in the Dilution Unit

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This documents describes the preferred method to condense 4He in the FROST dilution refrigerator.

Risk Assessment

No risk to personnel.

Hazard Control

Not applicable.

Overview

It is preferable to initially cool the FROST dilution unit with pure 4He rather than the 3He/4He mash. This document assumes that the 3He system is clean, meaning that a pump/purge of the system has been recently performed or that the system has been running cold with the 3He/4He mash and wishes to switch over to 4He running. In the latter event it is assumed that the 3He/4He mash has been properly removed and pumped into its storage tanks. It is further assumed that the 4He system is cold or that cooling of this system has commenced.

A. Circulating 4He through the 3He system

1. Confirm that all valves on the 3He gas panel are CLOSED except MV8361, MV8362A (or B), MV8363A (or B) and MV8374;
2. Confirm that the valves on the 3He and 4He storage tanks are CLOSED (MV8367B, MV8368B/C);
3. Confirm that MV8360V is OPEN. This is the vent valve between the L70 exhaust and check valve CV8360;
4. Confirm that the LN2 trap A (or B) is cold;
5. Set the 4He regulator PR8300 to about 5 psig;
6. CLOSE both the 3He run and bypass valves and then OPEN them 3 turns each;
7. Turn ON the 3He pumps in the manner specified in the 3He pump/purge procedure;
8. OPEN MV8371 and MV8371 until the condensation pressure PI8362 reads about 700 mbar, then close MV8372.
9. Closely monitor the circulation pressure (PI8362) and flow rate (FI8360). As the system cools from room temperature, it may be necessary to OPEN MV8372 in order to maintain this pressure. Likewise keep an eye on the still pressure (PI8360). If this approaches 1 torr, it will be necessary to remove some 4He from circulation. This can be accomplished using the auxiliary pump MP8374 and valves MV8371 and MV8374 (the butterfly valve);

10. Continue circulating in this manner until the mixing chamber indicates a temperature of about 10 – 20K, then slowly CLOSE the 3He bypass valve over the course of about 5 minutes;

At this point you may wish to condense 4He into the dilution unit (see below) or stop circulating in order to insert the target stick. For the latter, see *Document 9: How to Insert the Frozen Spin Target Stick.*

B. Condensing the 4He

1. Once the 3He valve has been closed (step 10 above) continue to open MV8372 to add more 4He to the system. Closely monitor the flow, condensation and still pressures;
2. When the still level probe indicates about 0%, close MV8372 (the still level ranges from -100% to +100%, so a 0% reading indicates about half full. The mixing chamber and still temperatures should be below 1K.