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| TITLE: GAS CLEAN UP AND FINAL LEAK CHECK OF CRYOMODULE | DATE: DEC. 14, 1992 |
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| BY:  | CHK: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
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| REV. | ECO# | DESCRIPTION  | BY  | CHK. | APP. | APP. | DATE  |
| SUMMARY OF CHANGES FROM PREVIOUS REVISION:  |

1.0 PURPOSE

 The purpose of this procedure is to provide detailed instructions to be followed during gas clean-up and final leak check prior to shipment of cryomodules to the accelerator. This procedure is performed with safety in mind by qualified technicians, setting up good communications and documenting results in the Cryomodule Traveller.

2.0 SCOPE

 To provide a procedure for gas clean-up and final leak check of cryomodule helium gas circuits before installation into the accelerator.

3.0 APPLICABLE DOCUMENTS

 Cryomodule Procedure No. 3.7.1

 Leak Test Procedure No. 2.10.1

 Cryomodule Staging System Schematic 11149-D-0067, Rev. ??

4.0 EQUIPMENT REQUIRED

 Turbo Pump Station - 500 l/s Balzer Turbo and Mechanical Pump

 Cascade Pump Station - Roots Blower and Mechanical Pump

 Du Pont Leak Detector

 Panametrics Hydrometer Moisture Sensor

 Gaseous Nitrogen/Helium Source

 Primary System Gauges: 0-100 torr Baratron, 30-0-60 psi Gauge

 Secondary System Gauges: 0-160 psi Gauge

 Insulating Vacuum Gauges: Cold Cathode/ DV6 Thermocouple Gauge

5.0 PRECAUTIONS

 Personnel operating pressurized gaseous systems must be informed of the safety procedures required to operate such systems and to guard against contaminating the CTF.

6.0 PROCEDURE

 Note: The helium vessels and the shield circuit have been pumped out numerous times for preliminary leak-checking purposes and consequently will have an inert atmosphere.

 1. The Gryomodule is brought out to the staging area. A nitrogen supply (MV291 boil- off from LN2 dewar) is connected to the supply end can. A special fixture is employed that ties the shield and the primary circuits together (as indicated in Detail B on Schematic).

 2. The return end can primary and shield circuits are joined together and connected to vent inside the building as indicated on Detail A.

 3. Boil-off nitrogen (MV291) is started; the EVJT valve is opened fully and the shield is throttled with MV190 so as to maximize the flow through the primary circuit.

 4. The purge gas is heated to 112F (+/- 5 F) and circulated for a minimum duration of forty-eight (48) hours.

 5. The insulating vacuum is established with the 500 l/s Balzer Turbo and mechanical pump equipped with a du Pont leak detector. This is employed to ensure that the insulating vacuum is leak-tight and then to monitor the following operations.

 6. The purge is then isolated by closing off the supply MV193 and the return MV691. Pressure remains trapped at atmosphere. The nitrogen is disconnected and a clean helium supply is reconnected.

 7. The primary and the shield circuits are then pumped down using the Cascade pumping station connected on the return MV692 as indicated on Detail A. Continue pumping on the primary circuit and isolate the shield and the shield circuit by closing MV64 and MV16. The shield circuit is pressurized to 145 psig (160 psia) with helium via MV192 and left on for ten (10) minutes. The du Pont leak detector which is monitoring the insulation vacuum will sense any rise in helium background at this time. The acceptance chart is appended to the traveller.

 8. The vacuum pump on the primary circuit is isolated by closing MV692. The pressure in the shield circuit is bled into the primary circuit via MV16. The primary is then pressurized using the gas bottle and MV92 to 15 psig (30 psia) while being monitored on the leak detector connected to the insulating vacuum for ten (10) minutes. The acceptance chart is appended to the traveller.

 9. The 15-psig is then vented through MV65, MV692 and the vacuum pump to the exhaust manifold.

 10. Both circuits are then pumped and purged four (4) times, pumping to 1 torr and then backfilling to atmosphere with clean GTF helium. Pressure is then increased to 12 psig in both circuits and secured.

 11. The helium return side U-tube has been cleaning up to thirty (30) minutes with nitrogen venting through the relief RV691 to the building. The nitrogen purge is stopped and the U-tube to the return end can is connected to the helium return manifold at MV691.

 12. As the U-tube is stabbed, the 12 psig in the module vents through the 10 psig relief RV691. The helium supply is opened and one continues to purge through the same relief for thirty (30) minutes.

 13. Ensure that the hydrometer is isolated with MV694 and MV696 closed. Open the vent MV695 on the hydrometer manifold and route the gas to the return end can U-tube and vent through the 2 psig relief until the pressure burst subsides and the flow meter indicates.

 14. Open the hydrometer MV696 to vent into the building. When hydrometer comes on scale, about 2-1/2 hours, the vent MV696 is closed and the gas is returned via MV697 to the CTF return.

 15. After flowing overnight, the hydrometer usually reads 2-6 ppm. Continue circulating gas until the gauge reaches its asymptote. Glose the return vent at the end can MV691. Allow the module to pressurize to 2 psig. Isolate the supply by closing the supply MV15 and return valves MV65 and the JT valve. At this point 12 psig is locked in.

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 NOTE : A Change Request to install a permanent 30-0--60 gage PI61 on the module return to monitor the primary circuit was approved. This benefits operations aas there is now a means to monitor the primary pressure after it exceeds the Baratron PI60 maximum pressure of 100 Torr.

 16. The shield circuit is then pressurized to 10 psig and both inlet Mv16 and outlet MV64 valves are secured. A 0-160 gauge PI11 has been installed to monitor the trapped shield gas pressure at MV11 for the same purpose.

 17. After transport to the accelerator and before the gas circuits are connected to the refrigerator, monitor weekly the pressure in both the primary circuit and the secondary circuit. Record the pressures on the traveller (see attached) appended to the permanent logbook attached to the module. Loss of pressure on any circuit is to be reported immediately to W. Chronis ( 7615 / 881-7615 ) and

 W. Schneider ( 7173 / 881-7131 ).

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|   CEBAF CRYOMODULE # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ INSTALLED IN SLOT # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ TEST LAB FINAL HYDROMETER READING # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CIRCUITS CHARGED TO : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PI 61 ( 30-0-60 psi ) PI 11 (0-160 psi )  |
| INITIALS | DATE | PRIMARY PRESSURE | SECONDARY PRESSURE | TIME |
|  |  |  |  | start |
|  |  |  |  | wk 1 |
|  |  |  |  | wk 2 |
|  |  |  |  | wk 3 |
|  |  |  |  | wk 4 |
|  |  |  |  | wk 5 |
|  |  |  |  | wk 6 |
|  |  |  |  | wk 7 |
|  |  |  |  | etc. |