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C-A OPERATIONS PROCEDURES MANUAL

7.1.13 25 kW Helium Refrigerator Scrub

Text Pages 2 through 8

Hand Processed Changes

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Approved: \_\_\_\_\_ *Signature on File* \_\_\_\_\_  
Collider-Accelerator Department Chairman Date

D. Lederle

### 7.1.13 25 kW Helium Refrigerator Scrub

#### 1. Purpose

This procedure provides instructions for scrubbing the RHIC 25 kW helium refrigerator. The purpose of scrubbing is to remove contaminants such as air and water from the refrigerator prior to cooldown and operation of the refrigerator.

#### 2. Responsibilities

- 2.1 The Shift Supervisor, or an Operator designated by the Shift Supervisor, is responsible for conducting the procedure and providing documentation in the Cryogenic Control Room Log.
- 2.2 Should a problem arise during the completion of this procedure, the Shift Supervisor shall contact the Technical Supervisor for instructions before continuing.

#### 3. Prerequisites

- 3.1 Prior to scrubbing, the refrigerator must be pumped and purged.
- 3.2 Operator shall be familiar with the following drawings:
  - Drawing 3A995009 25 KW Helium Refrigerator P & ID
  - Drawing 3A995032 HCS Block Diagram
  - Drawing 3A995078 RHIC Helium Gas Storage Refrigerator Valve Reference Guide
- 3.3 Operator shall be familiar with the physical location of components on the drawings listed under 3.2.
- 3.4 Purifier initialized per [C-A-OPM 7.1.28, "Compressor Room Cryogenic Purifier Operation"](#).
- 3.5 Operator shall be familiar with the control pages found on the CRISP control system.
- 3.6 Water cooling tower system operating.

#### 4. Precautions

- 4.1 All personnel entering the compressor building (1005H) should wear hearing protection if compressors are operating.

#### 5. Procedure

- \_\_\_\_\_ 1. Verify valve positions as specified in prerequisites [C-A-OPM-ATT 7.1.13.a](#). (Valve configuration may deviate from [C-A-OPM-ATT 7.1.13.a](#) if required by current operational conditions, i.e. 80K cooler operation).
- \_\_\_\_\_ 2. Set H3044A to maintain the suction pressure of the utility compressor at 1.8 – 2.2 atm.
- \_\_\_\_\_ 3. On the CRISP compressor control page, ensure valve H3025A is closed.
- \_\_\_\_\_ 4. On the CRISP compressor control page, ensure valve H3007A is closed.
- \_\_\_\_\_ 5. On the CRISP compressor control page, open H3019A manually to 50%.
- \_\_\_\_\_ 6. Start the utility compressor.
- \_\_\_\_\_ 7. Set H3045A to maintain the discharge of the utility compressor at approximately 15 atmospheres.
- \_\_\_\_\_ 8. Circulate helium in the refrigerator with the valve configuration specified in [C-A-OPM-ATT 7.1.13.a](#) while monitoring the gas purity levels to the inlet of the purifier. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
- \_\_\_\_\_ 9. OPEN the following valves:
  - H714A (at HX1B/2B)
  - H771A (at adsorber B)
  - H822M (at HX1B/2B)
- \_\_\_\_\_ 10. CLOSE the following valves:
  - H314A (at HX1A/2A)
  - H371A (at adsorber A)
  - H422M (at HX1A/2A)
- \_\_\_\_\_ 11. Circulate helium in the refrigerator with this valve configuration while monitoring the gas purity levels to the inlet of the purifier. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor

shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.

**Caution:**

Steps 12 –17 Concern scrubbing turbines 1A/2A and HX3A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 12. To scrub turbines 1A/2A, close the following valves:
  - H346M
  - H9168M
  - H9171M
  
- \_\_\_\_\_ 13. Open the following valves:
  - H407M
  - H266M
  - H9169M
  
- \_\_\_\_\_ 14. Regulate flow through the turbine string by adjusting pressure regulator PR9169M.
  
- \_\_\_\_\_ 15. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
  
- \_\_\_\_\_ 16. Close the following valves:
  - H266M
  - H9169M
  - H9170M

**Caution:**

Steps 17-21 Concern scrubbing turbines 1B/2B and HX3B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 17. To scrub turbines 1B/2B, close valves H746M and H9168M.
  
- \_\_\_\_\_ 18. Open the following valves:
  - H703M
  - H9166M
  
- \_\_\_\_\_ 19. Regulate flow through the turbine string by adjusting pressure regulator PR9166M.

- \_\_\_\_\_ 20. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
- \_\_\_\_\_ 21. Close the following valves:  
H407M  
H703M  
H9166M

**Caution:**

Steps 22-25 Concern scrubbing turbines 3A/4A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 22. To scrub turbines 3A/4A, set the following valves:
- |             |               |
|-------------|---------------|
| Open: H429M | Close: H6182M |
| H377M       | H9177M        |
| H9175M      |               |
- \_\_\_\_\_ 23. Regulate flow through the turbine string by adjusting pressure regulator PR9175M.
- \_\_\_\_\_ 24. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
- \_\_\_\_\_ 25. Close the following valves:  
H377M  
H9175M

**Caution:**

Steps 26-29 Concern scrubbing turbines 3B/4B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 26. To scrub turbines 3B/4B, set the following valves:

Open: H777M  
H9172M

Close: H6182M  
H9174M

- \_\_\_\_\_ 27. Regulate flow through the turbine string by adjusting pressure regulator PR9172M.
- \_\_\_\_\_ 28. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.
- \_\_\_\_\_ 29. Close the following valves:  
H429M  
H777M  
H9172M

**Caution:**

Steps 30-33 Concern scrubbing turbine 5A/6A and HX7A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 30. To scrub turbines set the following valves:  
  
Open: H431M  
H393M  
H9182M  
H402A (turbine inlet)  
  
Close: H9184M
- \_\_\_\_\_ 31. Regulate flow through the turbine string by adjusting pressure regulator PR9182M.
- \_\_\_\_\_ 32. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.

- \_\_\_\_\_ 33. Close the following valves:  
H393M  
H9182M  
H402A

**Caution:**

Steps 34-38 Concern scrubbing turbine 5B/6B and HX7B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- \_\_\_\_\_ 34. To scrub turbines set the following valves:  
  
Open: H793MM                      Close: H9180M  
H9178M  
H802A (turbine inlet)
- \_\_\_\_\_ 35. Regulate flow through the turbine string by adjusting pressure regulator PR9178M.
- \_\_\_\_\_ 36. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.
- \_\_\_\_\_ 37. Close the following valves:  
H431M  
H793M  
H9178M  
H802A
- \_\_\_\_\_ 38. Secure the utility compressor. Scrubbing is complete.

**6. Documentation**

- 6.1 The check-off lines on the procedure are for place-keeping only. The procedure is not to be initialed or signed, it is not a record.
- 6.2 The Shift Supervisor, or designee, shall document the completion of the procedure in the Cryogenics Control Room Log.

**7. References**

7.1 Drawing 3A995009

7.2 Drawing 3A995032

7.3 Drawing 3A995078

7.4 Refrigerator Valve Reference Guide

7.5 [C-A-OPM-ATT 7.1.28 "Compressor Room Cryogenic Purifier Operation"](#).

**8. Attachments**

8.1 [C-A-OPM-ATT 7.1.13.a "Refrigerator Scrub Valve Lineup"](#).