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C-A OPERATIONS PROCEDURES MANUAL

7.1.36 Regeneration System Normal Operation

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Hand Processed Changes

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

M. Sardzinski

7.1.36 Regeneration System Normal Operation

1. Purpose

- 1.1 To provide instruction on the operation of the 25KW Helium Regeneration System (Regen skid). This system is used to warm and remove moisture from subsystems of the refrigerator.
- 1.2 The system consists of two primary parts. The skid and the distribution manifold. The skid consists of: a 60KW inlet heater (which warms the cold return gas) a precooler and water separator, drying towers, gas filter turbo compressor, 12KW preheater (which heats the outgoing regen supply gas) and related instruments and controls the distribution manifold carries the heated helium to/from the refrigerator subsystems.

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 in the process of regeneration, shift supervisor shall report to the technical supervisor for instructions before continuing.

3. Prerequisites

- 3.1 Pure helium system available.
- 3.2 The pressurized liquid nitrogen system is operating.
- 3.3 At least one of the two drying towers reactivated and pressurized with clean helium.
- 3.4 Main cooling water system operating (cooling towers)
- 3.5 All personnel working on any electrical system or equipment in the C-AD shall be familiar with BNL [SBMS Electrical Safety](#), BNL [SBMS Lockout/Tagout \(LO/TO\)](#), [C-A-OPM 1.5, "Electrical Safety Implementation Plan"](#), [C-A-OPM 1.5.3 "Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs"](#), [C-A-OPM 2.36, "Lockout/Tagout for Control of Hazardous Energy"](#). C-AD will provide on-site/work specific training to individuals in the electrical safety aspects of their job functions and assignments.

4. Precautions

- 4.1 If there is liquid in the refrigerator pots, all personnel entering the refrigerator wing of building 1005R must be ODH Class 1 qualified, have a Personal Oxygen Monitor (POM) and carry an emergency escape pack.
- 4.2 Hearing protection shall be worn when the compressors are in operation.
- 4.3 Approved eye protection and safety shoes shall be worn at all times.
- 4.4 All personnel entering the refrigeration wing of 1005R must have personal ODH monitor and carry an emergency escape pack, if there is liquid helium in the pots.

5. Procedure

5.1 Start up of Regen System

_____ 5.1.1 Ensure closed 120VAC circuit breakers 25____, 27____ and 29____ in panel RP-2 (located next to CB3 and CB5 calorimeter local control panels).

_____ 5.1.2 Ensure closed the following 480VAC circuit breakers (panel located on east wall of lower level):

Subsection D:

Breaker 1____, Regeneration System Cold Gas (Inlet) Heater

Breaker 2____, Regeneration system Compressor

Subsection E:

Breaker 6____, Regeneration Compressor Lube Pump

Subsection F:

Breaker 1____, Regeneration System Dryer Heater 1A

Breaker 2____, Regeneration System Dryer Heater 1B

Breaker 3____, Regeneration System Pre-Heater

_____ 5.1.3 Ensure closed 480VAC disconnects on skid, Inlet Heater _____, and Pre-Heater_____.

_____ 5.1.4 Ensure the following distribution system valves are closed:

Lower Level

H447M_____	H163M_____	H9114M_____
H9105M_____	H428M_____	H430M_____
H405M_____	H415M_____	H812M_____
H243M_____	H265M_____	H423M_____
H305M_____	H236M_____	H61M_____
H705M_____	H9113M_____	
H306M_____	H174M_____	
H9194M_____	H269M_____	
H9101M_____	H9111M_____	
H706M_____	H239M_____	
H9195M_____	H9115M_____	
H9106M_____	H267M_____	
H847M_____	H237M_____	
H9110M_____	H268M_____	

Upper Level on Adsorber Beds

H418M_____	H9088M_____	H819M_____
H9170M_____	H818M_____	H9091M_____
H9167M_____	H9176M_____	
H419M_____	H9173M_____	

_____ 5.1.5 Ensure bypass valve H9100M is open.

_____ 5.1.6 Ensure the following skid valves are closed:

N677M_____	N608M_____
N651M_____	N643M_____
N647M_____	N607M_____
N646M_____	W629M_____
N645M_____	

_____ 5.1.7 Ensure the following skid valves are open:

N600M_____	N622M_____
N618M_____	N626M_____
N617M_____	N609M_____

_____ 5.1.8 If desired, align back pressure regulator N606P by opening valve N643M. Regulator N606P is set to 210 psig.

_____ 5.1.9 To place dryer tower “A” online:

5.1.9.1 Ensure the following valves are closed:

H6205M_____	H6142M_____
H6139M_____	H6104M_____
H6106M_____	
H6102M_____	

5.1.9.2 Ensure the following valves are open:

H6105M_____

H6103M_____

_____ 5.1.10 To place dryer tower “B” online:

5.1.10.1 Ensure the following valves are closed:

H6105M_____	H6140M_____
H6103M_____	H6142M_____
H6207M_____	

5.1.10.2 Ensure the following valves are open:

H6205M_____

H6139M_____

_____ 5.1.11 Open cooling water return and supply valves W632M_____ and W637M_____.

_____ 5.1.12 Adjust flow to approximately 11 gpm, as read on FI635W, by throttling valve W649M.

_____ 5.1.13 Adjust pre-cooler water flow to approximately 11 gpm, as read on FI634W, by throttling valve W636M.

_____ 5.1.14 Ensure oil level of pump gearbox is visible in sight glass.

_____ 5.1.15 Set inlet heater controller to 80°F _____ and set pre-heater controller to 130°F _____.

_____ 5.1.16 Depress “System Control Reset” button, this resets skid and dryer tower controller. System should reset and valve N601A will open.

- _____ 5.1.17 Pressurize Regen system to approximately 120 psi through valve H647M. Read pressure on PI605N or PI624N. Ensure closed valve H647M
- _____ 5.1.18 Place auxiliary oil pump selector switch to “Auto,” pump should start.

Caution:
The compressor must never be operated without a flow path.

- _____ 5.1.19 Depress the “Compressor Control On” button. If the oil pressure has reached 15 psi (switch, no gauge), the compressor and compressor driven oil pump will start. When the oil pressure reaches 25 psi (switch, no gauge), the auxiliary oil pump will shut down.
- _____ 5.1.20 Place the inlet heater control switch to “Auto.”

Caution:
Do not turn on the pre-heater with skid on bypass. Heater will be turned on after Regen flow has been established through a refrigerator subsystem.

- _____ 5.1.21 Verify differential pressure across gas filter is less than 3 psid, as read on DP610N
- _____ 5.1.22 Align hygrometer and open sample valve N605M. Take an initial Dew Point reading. _____
- _____ 5.1.23 After approximately 30-45 minutes of circulating gas through the by-pass valve, ensure that the dew point is getting less than the initial reading. If the reading is increasing this is an indication that the adsorption tower is saturated and needs to be reactivated. Otherwise the system is ready.

5.2 Shut Down of Regen System

- _____ 5.2.1 Ensure bypass valve H9100M is open.
- _____ 5.2.2 Turn off inlet heater _____ and pre-heater _____.
- _____ 5.2.3 Shutdown hygrometer and close sample valve N605M.
- _____ 5.2.4 If necessary, lower skid pressure by venting thru valves N643M and N607M.
- _____ 5.2.5 Turn off compressor (push button). Leave the auxiliary oil pump on for 20 seconds.

- _____ 5.2.6 Place oil pump selector switch to “OFF” position.
- _____ 5.2.7 Close skid return valve N600M_____ and supply valve N626M_____.
- _____ 5.2.8 Close cooling water supply valve W637M.
- _____ 5.2.9 Reactivate used dryer towers per C-A OPM 7.1.35.

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 shall document the completion of the procedure in the Cryogenics Control Room Log.

7. **References**

- 7.1 Drwg 3A995060, Regeneration System
- 7.2 Drwg 3A995009, 25 kW Helium Refrigerator P&ID
- 7.3 [C-A-OPM 1.5, “Electrical Safety Implementation Plan”](#).
- 7.4 [C-A-OPM 1.5.3 “Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs”](#).
- 7.5 [C-A-OPM 2.36, “Lockout/Tagout for Control of Hazardous Energy”](#).
- 7.6 [SBMS Electrical Safety](#).
- 7.7 [SBMS Lockout/Tagout \(LOTO\)](#).

8. **Attachments**

None