If you are using a printed copy of this procedure, and not the on-screen version, then you MUST make sure the dates at the bottom of the printed copy and the on-screen version match.
The on-screen version of the Collider-Accelerator Department Procedure is the Official Version. Hard copies of all signed, official, C-A Operating Procedures are available by contacting the ESSHQ Procedures Coordinator, Bldg. 911A

C-A OPERATIONS PROCEDURES MANUAL

15.5.22 LINAC: Vent, Start-up, Leak Check

(Vacuum Group Procedures VA-008.18.1.22)

Note: This document was formerly a C-A Group Procedure. The content of the group procedure was reviewed by the Technical Supervisor. All approvals and/or issue dates of the original group procedure are maintained for present use.

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

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

S. Gill

Vacuum Group Procedure VA-008.18.1.22
Original Issue Date: 01/01/00
Revision 01

*****IMPORTANT*****

PRIOR TO THE PERFORMANCE OF ANY WORK WITHIN THE SCOPE OF THIS PROCEDURE, IT IS THE RESPONSIBILITY OF THE SUPERVISOR TO ENSURE THAT ***WORK PLANNING*** HAS BEEN REVIEWED FOR THE PROTECTION OF WORKERS, EQUIPMENT, AND THE ENVIRONMENT.

1.0 PURPOSE:

1.1 To provide an effective procedure for AGS vacuum technicians to leak check, start-up, and vent the L1NAC vacuum system.

2.0 RESPONSIBILITIES:

2.1 The AGS vacuum supervisor shall be responsible for the implementation of this procedure.

3.0 DISCUSSION:

3.1 This procedure is written so that trained AGS vacuum technicians will be able to successfully and safely perform all associated vacuum related duties on the L1NAC vacuum system.

4.0 PRECAUTIONS:

4.0.1 The technician shall be aware of radiation levels in the area and, where required, shall obtain a radiation work permit.

4.0.2 The technician will ensure that he (or she) is in fact using a safe and properly functioning gas regulator and bottle cart. Those found to be unsafe shall be returned for repair.

4.0.3 The technician should be aware of what constitutes a L1NAC vacuum sector (TANK).

4.0.4 The technician shall not remove any materials or equipment from the L1NAC tunnel unless they are first checked by health physics.

4.0.5 The technician shall be aware that upon removal of a HV CABLE from an ion pump within the locked out tank, that the cable and connector **MUST** be properly discharged using an OSHA approved resistive type grounding stick.

4.0.6 **LN2 IS EXTREMELY COLD AND SHOULD BE HANDLED VERY CAREFULLY AND THE TECHNICIAN SHALL WEAR SAFETY GOGGLES AND GLOVES DURING THIS PROCESS.**

4.1 PRECAUTIONS DEALING WITH THE INTERLOCK SYSTEM:

4.1.1 All tank and rough valves have pressure differential switches which can prevent a valve from opening without any indication on the control panel.

4.1.2 Tank valves are interlocked by first and last (sixth) pump “under voltage malfunction”. When both of these pumps trip off, valves will close on respective tank.

4.1.2.1 ***Exception: any two pumps in TANK #1.***

4.1.3 Tank valve interlock is clear when pumps are commanded off.

4.1.4 Roots blowers interlocked until internal vacuum switch closes, which occurs at approx. 20 Torr.

4.1.5 Blowers interlocked by cooling water pressure switch. 4.16 Rough valve will not open until rough pump is started.

5.0 PREREQUISITES:

5.0.1 The technician will have been trained in this procedure

5.0.2 LOTO 15.17.00.02

5.0.3 Electrical Safety 15.17.00.04

5.0.4 Ring and cave access training
5.0.5 Activation worker training (BNL OH&S guide 3.5.0)
5.0.6 Safety glasses required during use of LN2.
5.0.7 OSHA approved resistive type grounding stick.
5.0.8 Technician has been trained to at least a level of knowledgeable in LOTO vacuum ion pump power disconnect
5.0.9 Affected persons training 15.12.00.01
5.0.10 Technician has been trained in procedure #8.18.1.23 (leak detector calibration).

6.0 OPERATIONAL PROCEDURE FOR LEAK CHECKING:

6.0.1 Ensure that a radiation survey has been done by HEALTH PHYSICS of the area to be worked in.
6.0.2 Verify that the tank valves are closed; if not, close them
6.0.3 Perform LOTO procedures for the ion pump power supplies
6.0.4 Calibrate leak detector as per procedure #8.18.1.23
6.0.5 Start up roughing station:
- 6.0.5.1 If the tank is at atmospheric pressure then the rough station must also be at atmosphere. Bleed up station with dry nitrogen line into manual vent valve located on manifold above the cold trap. After bleed up press rough valve open command, and the valve will open when pump station is turned on.
- 6.0.5.2 *If the tank is still under* a *vacuum* then the rough station must also be under a vacuum before attempting to open the roughing valve. Proceed with steps 6.052 thru 6.055 and then open the roughing valve.
- 6.0.5.3 Check switch lever on right side of contactor box. Pull knob at center of box. Mechanical pump will start and pneumatic isolation valve will open.
- 6.0.5.4 Open water valve for cooling blowers. (On tank 8/9 station you must first insert hose into floor drain).
- 6.0.5.5 Turn on blower breakers: knobs on small contactor boxes below each unit. Blower should start automatically when internal pressure switch closes (20 Torr).
- 6.0.5.6 When pressure reaches $10e^{-4}$ Torr, fill cold trap with LN2.

6.0.6 Connect leak detector to port supplied on tank in the old ion pump position #4 and start up leak detector.
6.0.7 Open rough valve to leak detector.
6.0.8 Using helium probe, gently apply a gentle mist of helium to each seal, joint, or component.

CAUTION:
Too much helium spray can result in a "drift" (a long gradual rise in the leak detector leak indicator gauge). Helium entering through the component enters the leak detector spectrometer tube where it is detected as a leak.

6.0.9 Once an indication appears, immediately stop spraying the helium. Allow the leak detector to return to its initial leak rate indication. Repeat step 6.08.

6.0.10 If and when possible, “bag” the suspect component with plastic sheet and spray again. When and if it is established that a leak does exist, remove the plastic and probe to pinpoint the exact location of the leak.

6.0.11 Each component and seal *M-U-S-* T be checked. There are no guarantees that only one leak exists in an area where as many as 100 or so seals and components are located.

6.0.12 Upon completion of leak check and repair (if necessary) of leaks found, remove red tags from ion pump power supply. Proceed with ion pump start up procedure.

6.2 OPERATIONAL PROCEDURE FOR ION PUMP START UP:

6.2.1 Insure that the tank valves are commanded closed and that the pressure in the tank is $<1 \times 10e^{-4}$ Torr.

6.2.2 With the tank command button off, press the "on command' button for individual ion pumps that are to be started. Hold 'under voltage override' button in. Use tank command button to turn pumps on and off.

6.2.3 Cycle the pumps on and off three times at one minute intervals. Then cycle the pumps at five minute intervals.

6.2.4 When pressure reaches $<5e^{-6}$ Torr, leave pumps on and close roughing valve.

6.3 OPERATIONAL PROCEDURE FOR VENTING A L1NAC TANK:

6.3.1 Ensure that a radiation survey has been done by HEALTH PHYSICS of the area to be worked in.

6.3.2 Verify that the tank valves are closed; if not, close them

6.3.3 Perform LOTO procedures for the ion pump power supplies.

6.3.4 Do a rate of pressure rise (where applicable) on tank to be vented.

6.3.5 Affix N2 hose to bleed up valve on tank.

6.3.6 Set regulator to approx.2 psig and verify that the over pressure relief valve opens freely.

6.3.7 Open the vent valve and vent tank.

6.3.8 When tank reaches atmospheric pressure, close N2 tank valve and remove hose.

6.3.9 Close the vent valve.

7.0 ACCEPTANCE CRITERIA FOR LEAK CHECKING PROCEDURE:

7.0.1 Every component and seal has been found to be leak tight.

7.1 ACCEPTANCE CRITERIA FOR ION PUMP START UP:

7.1.1 Tank has achieved vacuum integrity.

7.2 ACCEPTANCE CRITERIA FOR VENTING L1NAC TANK:

7.2.1 Tank is at atmospheric pressure.

8.0 FINAL CONDITIONS:

8.01 Work area has been cleaned and all equipment and/or tools have been removed from the L1NAC tunnel after being checked by HEALTH PHYSICS.

8.02 Dosimeter readings have been logged in the dosimeter log book located in the vacuum lab.