



Vacuum Group Procedure VA-008.18.1.23  
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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 operate & calibrate a helium sensitive leak detector

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 & efficiently operate & calibrate a helium sensitive l.d. this procedure is divided into three categories:

Calibration	(Section 6.0 thru 7.0)
Startup	(Section 8.0 thru 12.0)
Shutdown	(Section 13.0 thru 16.0)

4.0 PRECAUTIONS:

- 4.1 LN2 is extremely cold & should be handled very carefully while wearing safety glasses & gloves.
- 4.2 The technician shall be aware of radiation levels in the area and, where required, shall obtain a radiation work permit.
- 4.3 The technician will ensure that he is in fact using a safe and properly functioning gas regulator and bottle cart. those found to be unsafe shall be returned for repair.
- 4.4 The technician should be aware of what constitutes a vacuum sector. for example, Sector "AB" starts at A14 and ends at the B3 main magnet Sector "B" starts at B4 and ends at the B13 main magnet. a schematic representing the entire AGS layout is posted in the vacuum lab.
- 4.5 The technician shall not remove any materials or equipment from the ags ring unless they are first checked by health physics.

**NOTE:**

Items 4.2 through 4.5 for when working in a controlled area.

5.0 PREREQUISITES:

- 5.1 The technician will have been trained in this procedure.
- 5.2 Lockout/Tagout 15.17.00.02
- 5.3 Electrical Safety 15.17.00.04
- 5.4 AGS Ring Access Training
- 5.5 Activation Worker Training (BNL OH&S Guide 3.5.0)
- 5.6 Safety glasses must be worn for this procedure
- 5.7 Gloves must be worn during this procedure.

**NOTE:**

Items 5.2 through 5.5 for when working in a controlled area.

## 6.0 OPERATIONAL PROCEDURE: CALIBRATION

### NOTE:

Prior to tuning, the I.d. should be operating and ready for use. Refer to the startup procedure if necessary. Fill cold trap with LN2.

### CAUTION:

LN2 is extremely cold; use safety glasses and gloves!

- 6.1 Place the START/VENT switch in the VENT position.
- 6.2 Install a calibrated leak in the test port. Open its valve.
- 6.3 Place the START/VENT switch in the START position & adjust the TRANSFER PRESSURE control so that transfer occurs & the TEST lamp on the I.d. panel lights.
- 6.4 Adjust the range selector switch on the Leak Indicator Panel until an on-scale LEAK RATE meter indication occurs.
- 6.5 Turn off the calibrated leak. The leak rate indication will move towards zero, indicating that the reading was coming from helium in the calibrated leak. If this DOESN'T occur, go to STEP #6.9.
- 6.6 Adjust the zero control on the Leak Indicator Panel until the LEAK RATE meter shows zero. It may be necessary to use the COARSE ZERO control on the Control Panel.
- 6.7 Turn on the calibrated leak again. If the LEAK RATE meter indication agrees with the calibrated leak, the procedure is complete. If not, turn the CALIBRATE control fully counterclockwise & continue with STEP #8.
- 6.8 Make S-M-A-L-L adjustments to the FOCUS, EMISSION and ION controls to be sure each contributes to the highest leak rate condition. If the leak rate still doesn't equal the calibrated leak, adjust the CALIBRATE control until it does.
- 6.9 If the machine has no response to helium, proceed as follows:
  - a. Turn of calibrated leak.
  - b. Turn the CALIBRATE adjustment fully counterclockwise for minimum gain.
  - c. Turn the REPELLER control fully clockwise.
  - d. Set the ION control to zero.
  - e. Adjust the EMISSION control so that the EMISSION meters show approx. 1.
  - f. Set the Range Selector Control fully counterclockwise.
  - g. Set the ZERO Control fully clockwise.
  - h. Rotate the COARSE ZERO control until the LEAK RATE meter slows one or two minor divisions.
  - I. Adjust the ZERO control until the LEAK RATE meter reads zero.
  - J. Adjust the REPELLER control fully clockwise and EMISSIONS to 5. If the LEAK RATE meter pegs full scale, set the Range Selector control so that the LEAK RATE meter reading is approx. mid-scale.
  - k. Turn on the calibrated leak.
  - l. Adjust the FOCUS & EMISSION controls for maximum LEAK RATE

meter indications.

- m. As tuning progresses, set the Range Selector control to the most sensitive range that provides an on-scale LEAK RATE indication.
- n. Rotate the ION control slowly clockwise from zero until the Helium peak is noted on the LEAK RATE meter. The readings will first drop, then rise to the helium peak, then fall away from the peak & the rise again.
- o. To be sure that the helium peak is obtained, turn off the calibrated leak and verify that the LEAK RATE meter reading moves toward zero. Turn on the calibrated leak again. The reading should rise again.
- p. Readjust the ION, FOCUS, & EMISSION controls to obtain the maximum reading on the LEAK RATE meter. Repeat as necessary.
- q. Adjust both source magnet controls (the large black knobs on the spectra meter tube inside the right-hand side panel) for maximum reading on the LEAK RATE meter. Be sure to replace the side panel after adjustment.
- r. Turn off the calibrated leak, & verify that the LEAK RATE meter reading moves toward zero.
- s. If necessary, adjust the ZERO control to obtain zero on the LEAK RATE meter.
- t. Turn on the calibrated leak.
- u. Turn the CALIBRATE control clockwise until the reading on the LEAK RATE meter agrees with the value of the calibrated leak.

#### **7.0 ACCEPTANCE CRITERIA:**

- 7.1 In the final analysis, the leak rate meter must agree with the value of the calibrated leak.
- 7.2 The leak detector log book must be updated with the date, the operators name, and any problems noted.

#### **8.0 OPERATIONAL PROCEDURE: LEAK DETECTOR START-UP-COMplete START-UP**

- 8.1 Plug all test ports.

8.2 Set the following controls to the initial indication

START/VENT	RESET
LEAK	OFF
GROSS LEAK TEST	OFF
TRANSFER PRESSURE	HOLD
PUMPS (all 3)	OFF
ELECTRONICS	OFF
PUMPING MODE	SERVICE PUMP
REJECT LEVEL	10
CALIBRATE	FULL CCW
FILAMENT	1
COARSE ZERO	As Factory set*
EMISSION	“ ”
ION	“ ”
REPELLER	“ ”
FOCUS	“ ”
THRESHOLD	FULL CCW*
VOLUME	“ ”
ZERO	As Factory set *
RANGE CONTROL	Center Position
SCALE BLACK	$10^{-10}$ to $10^{-7}$ Face

\* **NOTE:** or as left at prior shutdown or standby.

- 8.3 Plug machine into appropriate receptacle. The compressor will start. Some of the panel lamps will light, indicating that the pumps & the filament are off.
- 8.4 Turn on the circuit breakers for the ROUGH, FORE, & DIFF pumps. The respective RP OFF, FP OFF, & DP OFF warning lamps on the Leak Indicator Panel turn off as each pump turns on. The diffusion pump lamp (DP OFF) remains lighted until the pressure in the diffusion pump foreline has been sufficiently reduced (approx. 1 minute) & sufficient cooling air prevails.
- 8.5 Turn the SENSITIVITY control (at back of the upper cabinet, inside the cover) to LOW to heat the diffusion pump more quickly.
- 8.6 Allow 30 minutes for the diffusion pump to warm up, and then place the ELECTRONICS circuit breaker in the ON position. Verify that the SPECTROMETER TUBE PRESSURE meter reads upscale, then turn the PUMPING MODE switch to the OPERATE position. Fill cold trap with LN2.

**CAUTION:**

LN2 is extremely cold; use safety glasses and gloves!!

- 8.7 When the SPECTROMETER TUBE PRESSURE meter is in the green band, set the FILAMENT ON/OFF switch in the AUTO RESET position to turn on the filament. (Switch may be returned to ON position if the I.d. will be left unattended.) The pressure will fall into the green band in about 10 minutes. When

the filament turns on, the green indicator on the Leak Indicator Panel will light & the FIL OFF lamp will turn off.

- 8.8 Set the TRANSFER PRESSURE control to approx. 9 o'clock (about 20 *m/torr*).
- 8.9 Set the START/VENT switch in the START position. The roughing pump now evacuates the test port. When the pressure in the test port reaches 20 millitorr, the roughing valve closes; the test valve opens to expose the test port to the spectrometer tube, & the TEST lamp lights to show that the I.d. is ready for testing.
- 8.10 Check calibration of I.d. before leak check procedures.

#### **9.0 OPERATIONAL PROCEDURE: LEAK DETECTOR STARTUP AFTER OVERNIGHT STANDBY:**

- 9.1 Verify that all four circuit breakers (PUMPS & ELECTRONICS) are on, then place the START/VENT switch in the RESET position. Make sure that the SPECTROMETER TUBE PRESSURE meter shows less than 0.2 millitorr (in the green band) & that the filament-on green lamp on the Leak indicator Panel is on.
- 9.2 Check calibration of I.d. before leak checking procedures.

#### **10.0 OPERATIONAL PROCEDURE: LEAK DETECTOR START-UP AFTER WEEKEND STANDBY:**

- 10.1 Verify that the roughing pump is operating (warning lamp not on). If Hot, turn on the corresponding circuit breaker.
- 10.2 Verify that the ELECTRONICS circuit breaker is *ON*.
- 10.3 Set the FILAMENT ON/OFF switch in the AUTO RESET position. Verify that the EMISSION meter shows a current.
- 10.4 Check calibration of I.d. before leak checking procedures.

#### **11.0 OPERATIONAL PROCEDURE: L.D. START-UP AFTER TEMPORARY INTERRUPTION OF POWER:**

If power to the I.d. is interrupted for less than 5 minutes, no special procedure is necessary. The power can be restored or the machine plugged in & put directly to use. However, if the I.d. is unplugged or the power fails for longer than 5 minutes, proceed as follows:

- 11.1 Turn the PUMPING MODE switch to the SERVICE PUMP position before plugging in or restoring power.
- 11.2 Turn off ELECTRONICS circuit breaker.
- 11.3 Leave the PUMPING MODE switch in the SERVICE PUMP position for 30 minutes and then set it to OPERATE. If interruption is less than 30 minutes, then this period can be reduced to an interval equal to the interruption time.
- 11.4 Turn on ELECTRONICS circuit breaker.
- 11.5 If the spectrometer tube pressure is in the green band, turn on the filaments and make sure that the EMISSION meter reads upscale.
- 11.6 Check calibration of I.d. before leak checking procedures.

#### **12.0 ACCEPTANCE CRITERIA:**

- 12.1 The spectrometer tube pressure shows reading in the green band with the filament on and the emission meter reading upscale.

**13.0 OPERATIONAL PROCEDURE: LEAK DETECTOR SHUTDOWN-  
OVERNIGHT STANDBY MODE:**

If the I.d. is unplugged or power fails for 5 minutes or less, no precautions need to be taken. The necessary valves automatically close to protect the spectrometer tube & the diffusion pump. The I.d. automatically returns to the same operating condition once power is restored. If power remains off longer than 5 minutes, set the PUMPING MODE switch to the SERVICE PUMP position & turn off the ELECTRONICS circuit breaker. (SEE PROC.11.0)

- 13.1 Be sure the cold trap has been completely filled late in the day to insure that it has enough LN2 to last overnight.

**CAUTION:**

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- 13.2 Place the plug in the test port.  
13.3 Set the START/VENT switch in the START position. Make sure that the TEST light turns on.  
13.4 Set orifice switch in OUT position.

**14.0 OPERATIONAL PROCEDURE: LEAK DETECTOR SHUTDOWN--WEEKEND  
STANDBY:**

- 14.1 Plug test port & move START/VENT switch to RESET.  
14.2 Set the ELECTRONICS c.b. in the OFF position.  
14.3 Turn the PUMPING MODE switch to the SERVICE VENT position.  
14.4 Remove the cold trap. Pour out any residual LN2, wash the outside surface of the cold trap with hot water. Use detergent if necessary. Rinse thoroughly & wipe completely dry with a lint-free cloth.

**CAUTION:**

LN2 is extremely cold; use safety glasses and gloves!!

- 14.5 Wipe off the O-ring with a lint-free cloth & replace the cold trap, making sure it is centered & properly seated on the O-ring.  
14.6 Turn the PUMPING MODE switch to the SERVICE PUMP position & wait until the TEST PORT PRESSURE meter shows 5 to 10 millitorr.  
14.7 Turn the PUMPING MODE switch to the OPERATE position.  
14.8 Set orifice switch in OUT position.  
15.0 **OPERATIONAL PROCEDURE: LEAK DETECTOR SHUTDOWN-  
COMPLETE SHUTDOWN:**  
15.1 Set the ELECTRONICS & DIFFUSION PUMP c.b. to OFF.  
15.2 Turn the PUMPING MODE switch to the SERVICE VENT position.  
15.3 Remove the cold trap. Pour out any residual LN2, wash the outside surface of the cold trap with hot water. Use detergent if necessary. Rinse thoroughly & wipe

- completely dry with a lint-free cloth.
- 15.4 Wipe off the O-ring with a lint-free cloth & replace the cold trap, making sure it is centered & properly seated on the O-ring.
  - 15.5 Place the plug in the test port.
  - 15.6 Turn the PUMPING MODE switch to the SERVICE PUMP position & wait until the TEST PORT PRESSURE meter shows 5 to 10 millitorr.
  - 15.7 Set the ROUGH PUMP c.b. to OFF.
  - 15.8 When the diffusion pump has been off for 20 minutes, turn off the FOREPUMP circuit breaker.
  - 15.9 If desired, unplug I.d. power cord.

**16.0 ACCEPTANCE CRITERIA:**

START/VENT	RESET
LEAK	OFF
GROSS LEAK TEST	OFF
TRANSFER PRESSURE	HOLD
PUMPS (all 3)	OFF
ELECTRONICS	OFF
PUMPING MODE	SERVICE PUMP

- 16.1 The leak detector log book must be updated with the date, the operators name, and any problems noted.