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LEAK TEST PROCEDURE USING THE VARIAN 960 LEAK DETECTOR

GP-B SCIENCE MISSION PROCEDURE

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1 SCOPE

This procedure describes the method used for leak testing a generic test unit, using the Varian 960 Auto-Test Mass Spectrometer Leak Detector (Figure 1). This procedure assumes the Varian 960 LD is set up in the facility, calibrated, and ready to use. This procedure is not a tutorial on how the leak detector works. Refer to the Varian 960 Instruction Manual, Reference 1, for details on the Leak Detector (LD).

This procedure assumes that test personnel are familiar with the test port interface, and provide the adapter necessary to connect the test article to the test port.

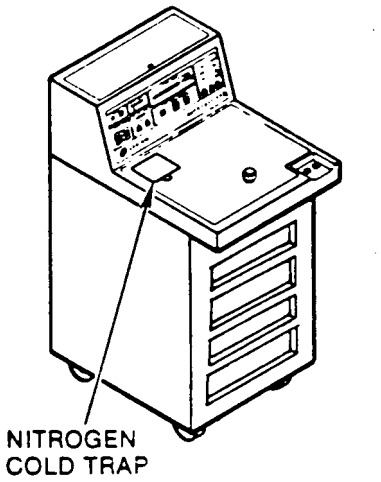

Figure 1. Varian 960 Auto-Test Mass Spectrometer Leak Detector

1.1 Acronyms

sccs He	standard cubic centimeters per second of Helium Defined to be the flow of one cubic centimeter of gas per second at a pressure differential of one standard atmosphere (760 torr at 0 C). Used interchangeably with atm cc/sec, since the difference is insignificant for leak testing purposes.
LD	Leak Detector

2 REFERENCES

1. Varian 960 Auto-Test Leak Detector Instruction Manual, Manual No. 6999-09-775, Revision C, Oct 95

3 GENERAL REQUIREMENTS

3.1 Personnel

The Responsible Engineer of the test unit has overall responsibility for the implementation of this procedure. He shall determine whether other personnel are qualified to operate the Leak Detector.

3.2 Safety

3.2.1 General

Servicing of the Varian 960 Leak Detector shall be performed by authorized personnel only. This includes cleaning, and oil servicing. Only experience personnel shall be allowed to troubleshoot the Leak Detector. Refer to the Instruction Manual , Ref.1, for maintenance and troubleshooting instructions.

3.2.2 Liquid Nitrogen

Take extreme care when handling liquid nitrogen, not to spill cryogen on personnel. Protective gloves and safety glasses shall be worn when handling LN_2.

3.3 Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the Responsible Engineer.

4 REQUIRED EQUIPMENT

Test Unit
Adapters, plumbing lines, as required
Chamber, as required

Varian 960 Auto-Test Leak Detector
Calibration Date _____ Expiration Date _____

5 STARTUP OPERATIONS

5.1 Startup Procedure

5.1.1 Verify that the Cold Trap is properly installed in the Leak Detector cavity. Ensure that the Vent Cap on the Cold Trap is tightly screwed on.

5.1.2 On the back of the LD, verify the CIRCUIT BREAKER is in the ON position, and the ELECTRONICS Switch is in the ON position. Verify that the LD electrical socket is plugged in.

5.1.3 Verify that both the Leak Rate Range and the Transfer switches are in the Auto position.

5.1.4 On the Front Panel, under SYSTEM CONTROL, turn ON the DETECTOR switch. Also turn ON the ROUGHPUMP switch. The LEAK RATE indicator on the panel will flash c9 and c4 and then will read c8 for power interruption condition. The HOLD and NOT READY annunciators will also be lit.

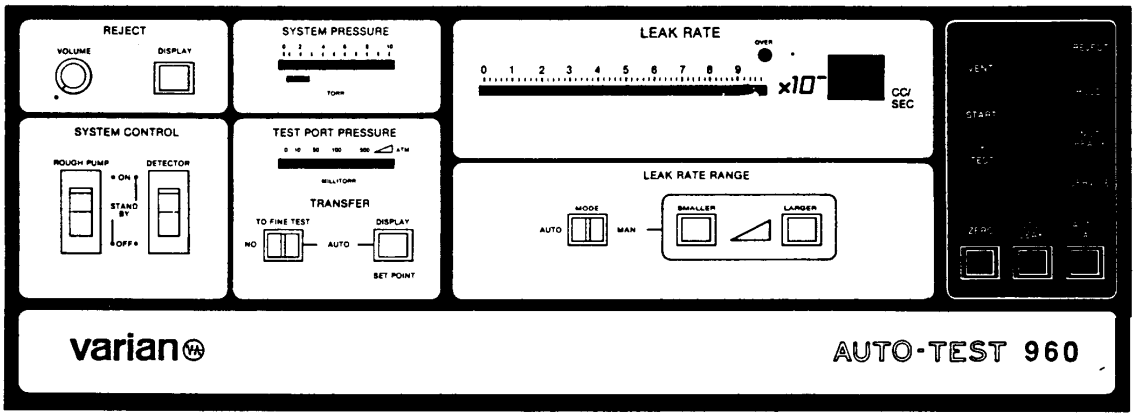

Figure 2. Front Panel of Varian 960 Leak Detector

5.1.5 Watch the SYSTEM PRESSURE gauge on the panel. When it comes down to the green band, the Cold Trap may be filled with LN_2.

5.1.6 Fill the Cold Trap with LN_2. Filling the trap completely will keep the trap cold for 12 to 15 hours. Refill as required to prevent the trap from warming up.

WARNING: Take extreme care not to spill cryogen onto personnel.
Liquid Nitrogen is capable of causing severe frostbite, particularly if it saturates clothing which is in close contact with the skin. Safety glasses and protective gloves shall be worn when handling cryogen.

CAUTION: Allowing the cold trap to warm up while the LD is in operation may cause contamination of the mass spectrometer as well as contamination of the article under test.

5.2 Calibration and Sensitivity Check

5.2.1 Insert the Test Port Plug into the test port.

5.2.2 Push the START button. The START light will come on and after some delay, the START light will go out and the TEST light will come on. Also the REJECT and NOT READY lights will be on.

5.2.3 If the LD does not cross into fine leak check mode as indicated by the sound of solenoid valve operation and the gurgling of the pump, push the ZERO button. The TEST light will go off and after a brief delay, the LD will cross over into fine leak test mode with the TEST light lit again and NOT READY still lit. (Note: This should not be necessary, but has been found to be an effective remedy to an uncorrected defect in the Model 960 used in the GP-B program.)

5.2.4 Press the AUTO CAL button on the panel. The NOT READY indicator should go off and the c8 indication should disappear.. Wait for the LD to complete the Auto Cal sequence. At completion of the Auto Cal sequence, the AUTO CAL annunciator will go off and the LD will be ready for test. If instead the LEAK RATE display shows an error code, try repeating the Auto Cal sequence. If it still doesn't successfully complete the Auto Cal sequence, call a knowledgeable engineer or technician before proceeding.

5.2.5 Press the STD LEAK button on the panel. The LEAK RATE display should go to the internal calibrated leak rate as marked inside the hinged top cover. Confirm that it is equal to this rate within 10%. (nominally 1.6×10^{-7} sccs). Press the STD LEAK button to turn off.

6 LEAK TESTING THE TEST ARTICLE

6.1 Connecting the Test Article

6.1.1 Press the VENT button on the main body of the LD. This will close the valves inside, and vent the LD test port.

6.1.2 Remove the test port plug and connect the test article to the port via an adapter which mates with the 1 1/8" diameter quick coupling on the LD.

6.2 Leak Test for Small Test Article Under Evacuation

6.2.1 Press the START button on the main body of the LD to evacuate the part. When the TEST light comes on, the LD is operating in the gross leak check mode.

6.2.2 If no leaks are found at this stage, the LD will automatically cross over into its fine leak mode. Wait for the the leak rate to stabilize. The acceptable background leak rate is determined by the Responsible Engineer, usually between 10^{-6} and 10^{-9} sccs He.

6.2.3 Leak check the test article using the spray method or the bag method.

6.2.3.1 With the spray method, spray the surface of the test object at each joint with a gaseous helium (GHe) probe. Start at the uppermost connection and work down. Wait at least 2 minutes at each connection for the LD to stabilize. If there is a leak, the LEAK RATE indicator will indicate a rapid and steady rise in the leak rate.

6.2.3.2 With the bag method, envelope the test object with a bag or container filled with gaseous helium. If there is a leak, the LEAK RATE indicator will indicate a rapid and steady rise in the leak rate. (Note: A slow steady increase in leak rate may be indicative of permeation rather than a true leak.)

6.3 Leak Test for Small Test Article Under Pressure

For articles such as the Caging Diaphragm Assembly, the test article is placed in a small vacuum chamber with the test article pressurized.

6.3.1 Connect the bottom adapter flange of the chamber onto the leak detector. Clamp with a 1 inch Qwik Flange.

6.3.2 Connect the test article coming out of the chamber to the pressure source and control unit.

6.3.3 Pump down the chamber until the leak rate stabilizes at approximately 1×10^{-9} sccs. Record the background leak rate in the parent to this procedure.

6.3.4 Pressurize the test article to the specified pressure at the specified rate. Record the leak rate in the parent procedure.

6.3.5 When test is completed according to the parent procedure, depressurize the test article.

6.3.6 Vent the LD and remove the test article from the chamber.

6.3.7 Disconnect the chamber from the leak detector.

6.4 Leak Test for Large Test Article Under Evacuation

For large test items, such as the dewar vacuum space:

6.4.1 To leak check a large vacuum system, the pump down of the system should be assisted by a large external rough pump which is teed into the pumping line with an adjustable vacuum isolation valve.

6.4.2 Start the leak check process by starting the external rough pump and opening its isolation valve. Press the LD START button.

6.4.3 When the TEST light comes on, the LD is operating in the gross leak check mode. Initial leak checking may be performed at this stage. If any leaks are found at this stage, close the external pump isolation valve, vent the LD, and repair the leak before proceeding further.

6.4.4 When the LD enters into the fine leak check mode (as described in 5.2.3), slowly close the isolation valve to the external rough pump as much as possible while maintaining the SYSTEM PRESSURE in the green range. Leak check again in this condition. Note that a leak check in this condition is at a reduced sensitivity and is not calibrated due to the fact that a portion of the gas stream is being diverted to the rough pump.

NOTE: If the SYSTEM PRESSURE goes outside the green band, the LD will automatically shut off. It will no longer be in leak check mode, and the system will have to be re-cycled by hitting the START button.

6.4.5 After the external rough pump isolation valve is fully closed, a final calibrated leak check may be performed. Note: Do not leave the external pump isolation valve open to the LD or the article under test for any longer than necessary. To do so will subject both system to backstreaming and contamination. If the article under test is sensitive to contamination, the external pump should be a turbopump system where the turbopump is started up once the sytem pressure drops below approximately 500 mtorr.

6.4.6 After completing the leak check, make sure the external pump isolation valve is closed and push the LD VENT button.

WARNING To protect against accidental pressing of the VENT button, switch the VENT DISABLE switch inside the hinged cover to the Vent Disable position . Turn back to its normal position when venting Leak Detector.

7 SHUT DOWN OPERATIONS

7.1 Shutdown Procedure

7.1.1 Turn the ROUGHPUMP switch OFF. Turn the DETECTOR switch OFF.

7.1.2 Slowly vent the cold trap by carefully cracking open the vent knob at the top of the cold trap, and listen for turbo deceleration.

7.1.3 When the trap is fully vented, remove the trap from the LD (it is only held in place by the atmospheric pressure differential when the system is evacuated), and dispose of the LN_2 Be careful to not lose the o-ring under the trap flange and be sure to observe the Warning at 5.1.5.

7.1.4 Using a heat gun, warm up the trap. Wipe the trap with ethanol and dry.

7.1.5 Check that the o-ring is clean and properly installed, and reinstall the trap.

7.1.6 Verify that the trap vent valve is fully closed.

7.1.7 Turn on both the ROUGH PUMP and DETECTOR switches and wait for the SYSTEM PRESSURE to reach the green range.

7.1.8 Turn off both the ROUGH PUMP and DETECTOR switches. This will leave the LD in a clean and evacuated condition.

7.1.9 On the back of the LD, de-energize the CIRCUIT BREAKER.

8 DATA BASE ENTRY

The following data shall be entered into the GP-B Data Base:

- Name, number and revision of this procedure