Memorandum

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Date: 2005-05-25

Revisions:

2005-05-19	jee	Initial
2005-05-25	jee	Corrected Varian from 979 to 979

Subject: Leak Test Results for Band 6 Cartridge SN002

1. Introduction

Leak rates were measured for components installed on the 300K plate of the Band 6 cartridge and for the entire cartridge, which measured about 3×10^{-7} mbar-l/sec.

The present design of this cartridge uses a dual 51-pin connector assembly manufactured by Pave[1], but leak rates were also measured for the equivalent connector manufactured by Plug In[2]. Both connectors exhibit the same leak rates of about 1×10^{-7} mbar-l/sec.

2. Procedure

Based on procedures agreed to during a recent ALMA telecon[3], *most* leak tests reported here were measured over several hours using a mass spectrometer helium leak detector. This duration is required to account for the diffusion time of the helium through o-ring seals and the device under test. Calibration of the leak detector was checked and plotted at the end of the measurement period.

The device under test was installed in a fixture and then mounted on the Varian 979 Leak Detector. Nearly constant pressure was applied to the device during the test period using either a balloon inflated with helium, as shown on the upper right in Figure 1, or a bag supplied with a constant source of helium, as shown in Figure 2. *Trojan* brand condoms were also tried as balloons to supply constant helium pressure but unfortunately leaked helium excessively. A strip chart recorder is connected to the leak detector's analog output to facilitate recording the data over a long period of time.

[1] Part number 2575, Pave Technology Company, 2751 Thunderhawk Court , Dayton, Ohio 45414-3445 USA, http://www.pavetechnologyco.com/html/home.html
[2] Part number PL 4504 0362, Plug In, 5 ru due corps Franc du Sidobre, Roquecourbe, F-81210, France, http://www.plugin.fr
[3] Meeting minutes available at: http://almaedm.tuc.nrao.edu/forums/alma/dispatch.cgi/iptfedocs/showFolder/101362/def/def/3648810 and procedures are at: http://almaedm.tuc.nrao.edu/forums/alma/dispatch.cgi/iptfedocs/showFolder/101413/def/def/8504705

Prior to use, the leak detector is calibrated using its internal calibration standard and automatic switching valves. During the automated calibration sequence, the device under test and standard leak ports are closed with a value, and the background leak rate is recorded. The leak detector then measures the apparent leak rate of the calibration device included with the Varian, which is nominally 1.3×10^{-7} mbar-l/sec, and adjusts offsets accordingly. Finally, the port to the calibration device is closed and the device under test port is reopened.

Measurements continue until the leak rate stabilizes and falls within the measurement noise of the leak detector. After the readings stabilize, another calibration sequence is executed and the leak rate is again recorded to ensure the system hasn't drifted or become contaminated with helium.

The leak rate was measured using helium but the cartridge builders agreed to convert all measured leak rates to air equivalents. Darren Erickson of HIA provided conversion factors based on the Parker Hannifin Corporation's O-Ring Handbook data. All Band 6 o-rings are Buna-N, so the leak rate conversion from helium to air is 0.71 as described in Darren's e-mail of Mon 2005-04-18 at 17:13.

3. Results

Figure 3 shows air leakage rates for WR-10 LO waveguide windows consisting of a 127 µm (5 mil) thick copper shim with an epoxy plug installed in the waveguide opening. A helium filled balloon covers the atmospheric port of the test fixture as shown in Figure 1. The air leak rate for the LO windows reaches a maximum of 1×10^{-8} mbar-l/sec.

The LO window *assembly* consists of two WR-10 waveguide windows separated by a 1.06 mm (40 mil) spacer. Window assembly SN003 shows much lower leak rates than the identical SN005 because it was measured by periodically squirting He near the window, rather than applying constant He under pressure using the He balloon shown in Figure 1.

Figure 4 shows leak test results for the Dynawave 1110-2899-6289 Rev AA blind mate connectors used for the IF signals. The o-rings supplied by Dynawave were easily damaged during assembly and consequently were replaced by Buna-N o-rings. As shown in the figure, the Dynawave connectors leak at a rate of about 1×10^{-8} mbar-l/sec.

Figure 5 shows measured leak rates for both Pave's and Plug In's dual 51-pin hermetic connectors. The leak rates are essentially identical for these connectors, which were measured sequentially over a period of two days. Remeasurement of the Plug In connector show leakage that was close to the original results.

Finally, air equivalent leak rates for Band 6 Cartridge SN002 measured about 3×10^{-7} mbar-l/sec and is graphed in Figure 6. A anti-static bag was inflated with Helium under constant pressure using a configuration similar to that shown in Figure 2 to measure the leak rate of the entire cartridge.

Figure 1: Varian 979 Leak Detector with Balloon installed over LO waveguide window

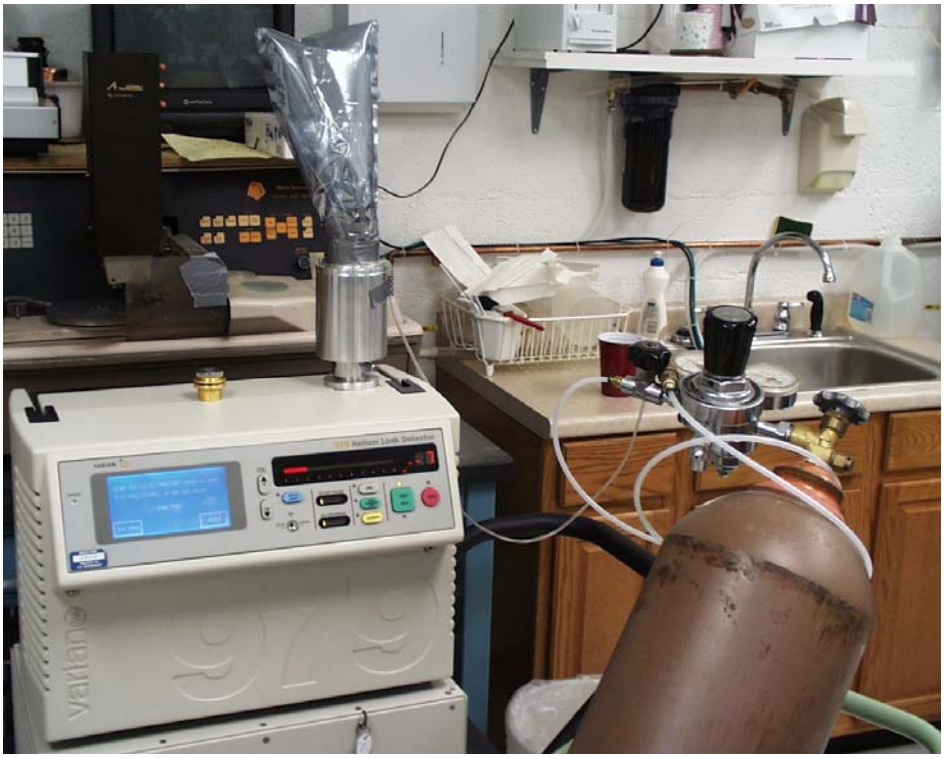

Figure 2: Equipment Setup for 51-pin Hermetic Connector Tests

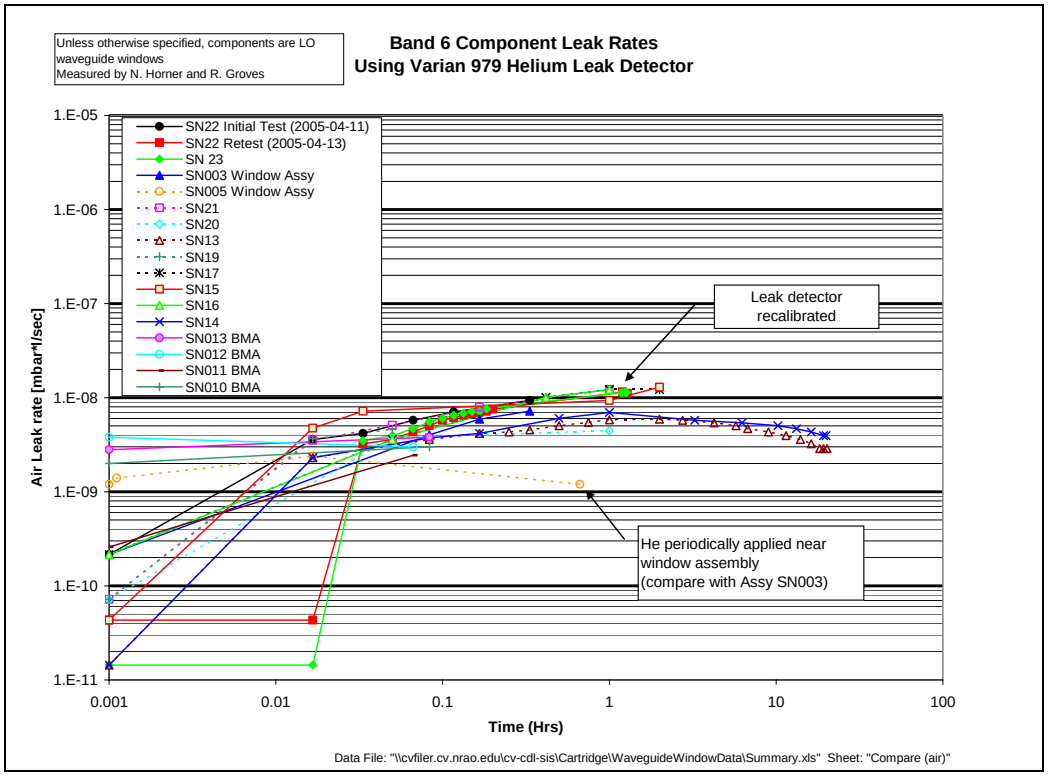

Figure 3: Measured results of LO waveguide windows and window assembly

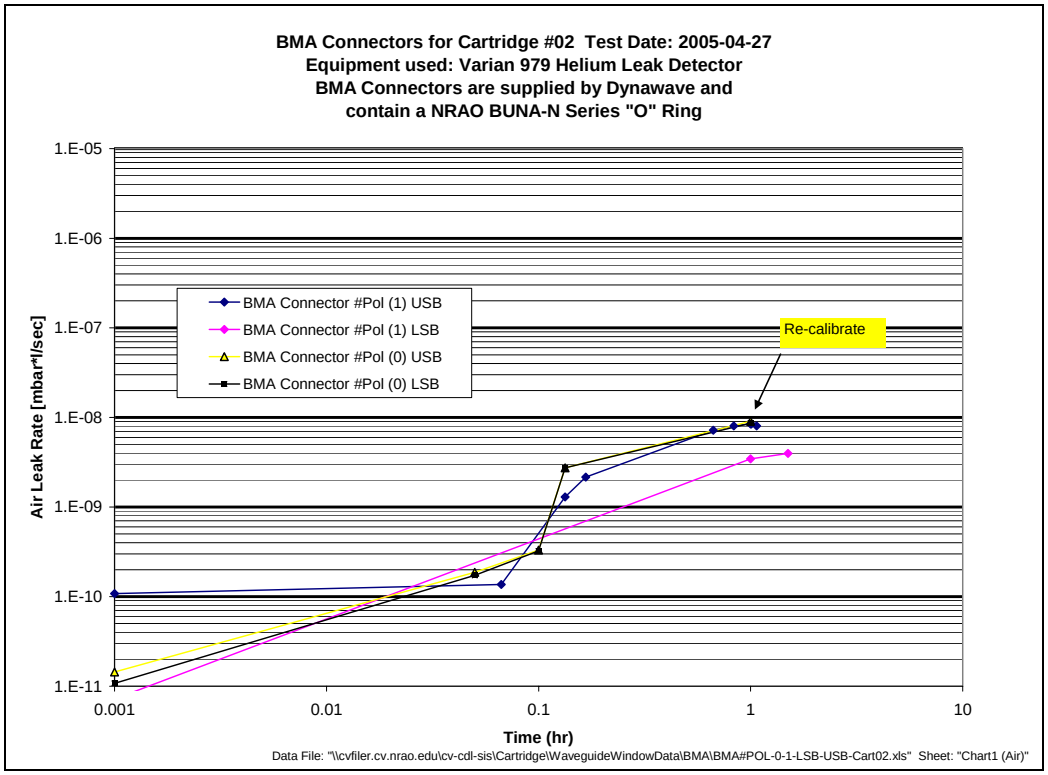

Figure 4: Leak rates for IF Blind Mate Connectors

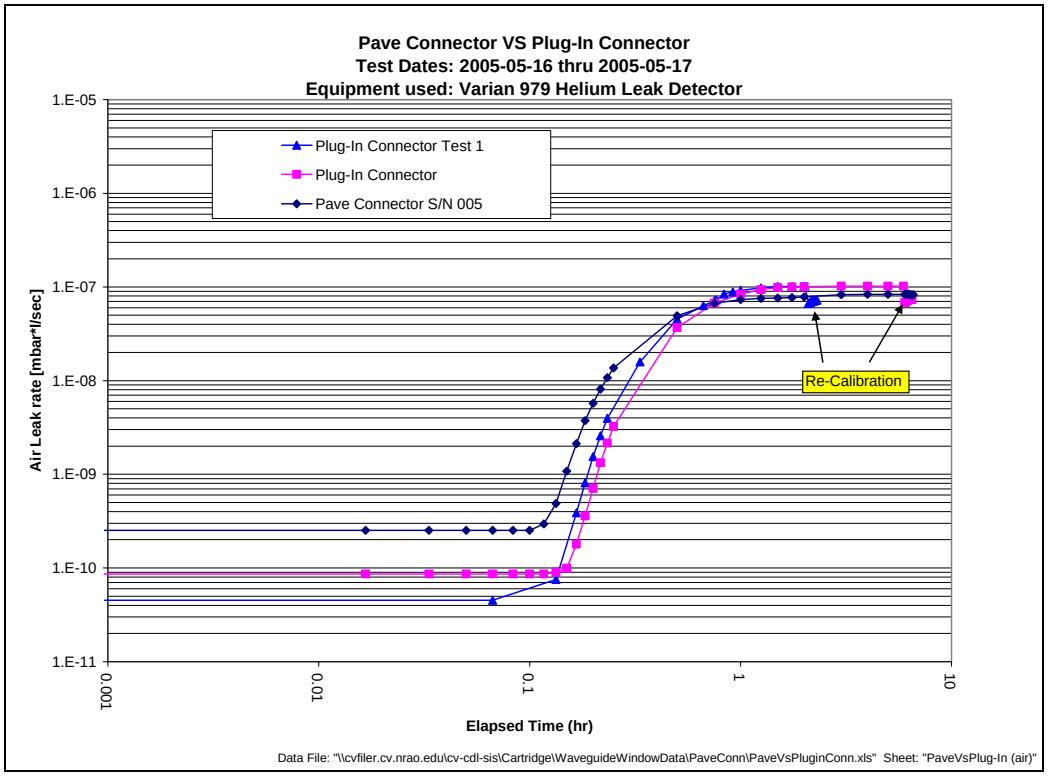

Figure 5: Air leak rates for Pave and Plug In Connectors

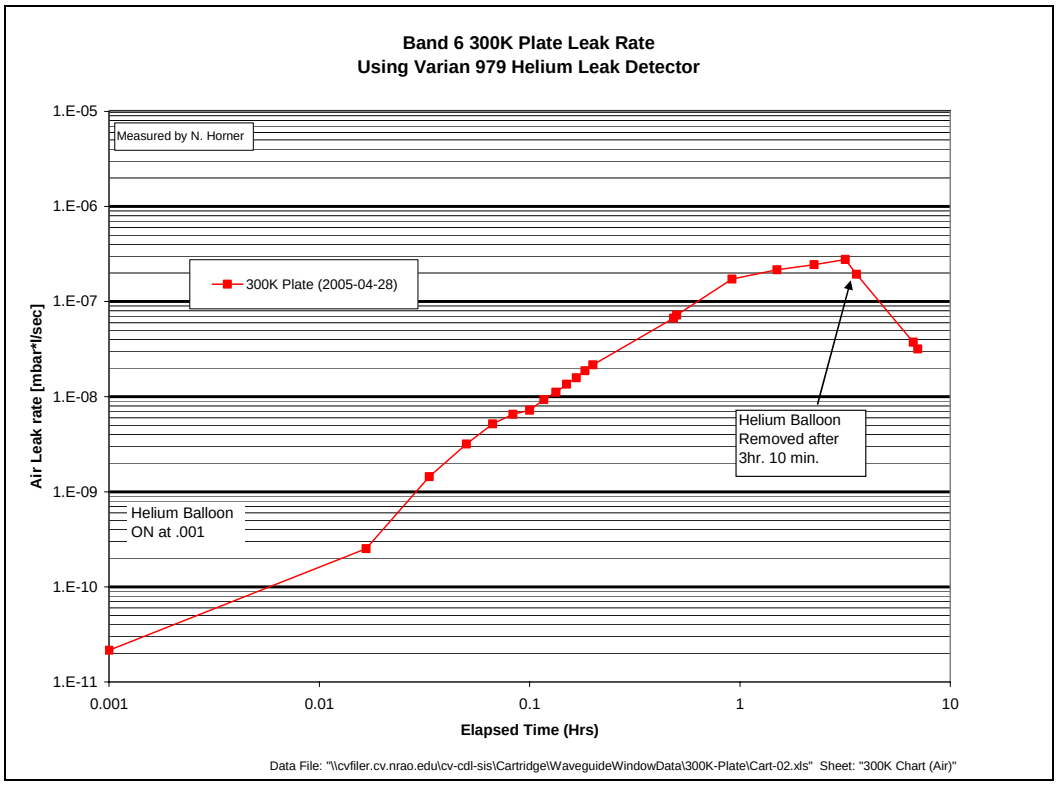

Figure 6: Leak Rate Data for Cartridge SN002