	IDENTIFICATION			
CBI	HMST3N LIGO-E950068-02-B			
TITLE HELIUM MASS SPECTROMETER HOOD TEST OF PUMP PORTS WITH VALVE, LN_2 PUMP AND BLIND FLANGE WITH RGA ASSEMBLY PRODUCT LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	REFERENCE NO. 930212		SHT _1_ OF _5_	
	OFFICE RSE		REVISION 2	
	MADE BY CNS	CHKD BY EEB	MADE BY WAC	CHKD BY MLT
	DATE 3/15/94	DATE 5/1/94	DATE 11/8/95	DATE 11/9/95

1.0 SCOPE:

1.1 This procedure covers the final helium mass spectrometer hood test of each pump port flange to 10"Ø valve flange seal, 10"Ø valve body and stem seal, 10"Ø valve flange to LN_2 pump flange seal, the LN_2 pump housing and internal cryogenic tubing, the LN_2 pump flange seal to the blind flange, the blind flange to the 40 CF-F and 40 KF flange fittings and the RGA head and the cold cathode gauge head and the valve to which it is connected. Use this procedure in conjunction with the current revision of procedure LIGOTP.

1.2 Perform the leak testing outlined in this procedure on the beam tube can sections with pump ports after each of these applicable can sections has:

1.2.1 Been successfully HMS leak tested in accordance with procedure HMST1N

1.2.2 Been final cleaned in accordance with procedure CL1N.

1.2.3 Had the following installed on the 10"Ø pump port. A 10"Ø UHV gate valve, LN_2 pump, and a blind flange with 40 CF-F connections to an RGA head, a valved cold cathode gauge head and a valved potential HMS test connection.

1.2.4 Been installed in the partially erected beam tube module.

1.2.5 Been welded to the previous can section in the beam tube module being erected and that weld joint has been successfully HMS leak tested in accordance with procedure HMST2N and locally cleaned.

2.0 LEAK TESTING EQUIPMENT TO BE USED IN THIS PROCEDURE:

2.1 The helium mass spectrometers used to perform the leak testing outlined in this procedure shall be the Alcatel Model ASM 110TCL, Leybold Model UL400, Varian Model 960, Veeco Model 18AB or equivalent with an optimum high sensitivity in the range of 10^{-11} atm. cc/sec. of helium. All leak detectors shall be turbo pumped. Diffusion pumped units are not acceptable.

2.2 A 16" x 42" x varying depth (30" minimum) rectangular shaped cylinder metal box with a metal cover containing a 40 KF (1 1/2"Ø) short flange for connection to the helium mass spectrometer and a 16 KF (5/8"Ø) short flange connection for the system permeation helium standard leak. Shape the open end of the box to fit the curvature of the beam tube. The box shall be of such a size as to fit over the outside of the pump port nozzle, the 10"Ø valve and the LN_2 pump with blind flange with an RGA head and a valved cold cathode gauge head. It shall be HMS leak tested and all leaks repaired and retested before being used in production. Use a double tip cross section 60 durameter gasket to make the seal of the box to the outside of the beam tube. See the test set-up sketch at the end of this procedure. See drawing ER-125 and ER-126.

2.3 Approximately ten (10) feet of flexible stainless steel hose with 40 KF (1-1/2"Ø) connectors on the ends for connecting the HMS to the metal vacuum box.

M. Sellberg CBI 11/10/95 LIGO 11/10/95

2.4 6 to 10 mil polyethylene for making local hoods (bags).

2.5 2" to 4" wide duct tape for sealing local hoods (bags).

2.6 Sealing compound such as Duct Seal electrical putty.

2.7 Standard helium calibrated leak, 1-5 X 10^{-10} atm. cc/sec. of helium

2.8 Pump port plug and hoses.

3.0 PROCEDURE:

3.1 After final cleaning of a can section with a pump port, install equipment on the pump port as follows:

3.1.1 Unbolt the blind flange from the pump port. Clean the pump port interior neck by wiping with lint free cloths soaked with isopropyl alcohol. Visually inspect the pump port flange and the valve flanges and sealing surfaces to ensure that those surfaces are free of scratches. Then clean those surfaces by wiping with lint free cloths soaked with isopropyl alcohol.

3.1.2 Install a metal seal and bolt the valve to the pump port with the valve seating surface toward the pump port.

3.1.3 Close the 10"∅ isolation valve.

3.1.4 Visually inspect the LN_2 pump flanges and sealing surfaces to ensure that those surfaces are free of scratches. Then clean those surfaces by wiping with lint free cloths soaked with isopropyl alcohol.

3.1.5 Install a metal seal and bolt the LN_2 pump to the valve.

3.1.6 Visually inspect for scratches on the blind flange containing one 40 CF-F (1 1/2"∅) flange fitting and one 40 KF (1 1/2"∅) short flange valved fitting. Check the already cleaned surface of the LN_2 pump flange and reclean if necessary. Clean the surface of the blind flange by wiping with lint free cloths soaked with isopropyl alcohol.

3.1.7 Install a metal seal and bolt the blind flange to the LN_2 pump.

3.1.8 Visually inspect the blind flange fitting sealing surfaces for scratches. Clean those surfaces with isopropyl alcohol. Then install the RGA head to the 40 CF-F fitting and install vacuum valves on the other two 40 CF-F fittings. Connect the flexible metal hose from the HMS to one of the valves. Open that valve. Connect a cold cathode gauge head to the other valve. Make sure that valve is open.

3.2 Start and calibrate (peak tune) the HMS to obtain the optimum test sensitivity for the model instrument being used. The instrument sensitivity, based on the smallest division on the most sensitive scale of the leak indicator, must be no less than 2×10^{-11} atm. cc/sec.

3.3 Connect the flexible metal hose to the HMS and evacuate the LN_2 pump with the HMS. When the HMS throttle valve is all the way open and the system absolute pressure has stabilized (reached a plateau) and the HMS leak indicator is on a scale that is sufficiently sensitive to enable the operator to detect 10^{-11} atm. cc/sec. range leakage, inject helium into the inlet side of the LN_2 pump cryogenic tubes for about 30 seconds.

3.4 If any leakage is indicated in the LN_2 pump tubes by a signal increase on the HMS leak indicator within one (1) minute, vent the LN_2 pump and replace that LN_2 pump with another unit and repeat steps 3.1.4 through 3.3 until no leakage is indicated in the tubes.

3.5 Disconnect the HMS flexible metal hose from the LN_2 pump blind flange valve.

3.6 Wipe the interior of the metal vacuum box with isopropyl alcohol. Install a permeation helium standard leak on the 16 KF (5/8"∅) connection in the metal vacuum box. Then install the metal box over the pump port, valve, LN_2 pump and blind flange with RGA head and cold cathode gauge head. Pull the box tight to the can section with straps connected to turnbuckles as shown in Drawing ER-125.

3.7 Connect the HMS flexible metal hose to the 40 KF (1 1/2" ∅) fitting on the metal vacuum box and then evacuate the metal box with the HMS auxiliary vacuum pump. After it has evacuated to approximately 50 to 100 millitorr, throttle open the HMS high vacuum system to the metal box. Should the vacuum in the metal box stabilize at a higher pressure indicating potential leakage, tracer probe the perimeter of the seal to detect and pinpoint the area of leakage. If seal leakage is detected and pinpointed, apply sealing compound such as electrical putty, around the perimeter of the seal as necessary until no seal leakage is indicated.

3.8 Place a tight fitting, gasket sealed, plug into the pump port opening from the inside of the tube. This plug shall have 1/4" dia. holes at the top and bottom edges. These holes shall be equipped with attached rubber stoppers.

3.9 When the HMS high vacuum absolute pressure meter indicator has stabilized (reached a plateau) and the leak rate meter indicator is on a scale that will enable the operator to detect 10^{-10} atm. cc/sec. range leakage, calibrate the test system as follows:

3.9.1 Record the HMS background signal in divisions. A division shall be based on the smallest increment on the most sensitive scale of the leak rate indicator meter.

3.9.2 Record the helium signal and open the valve to the system standard leak in the metal box. There will be a brief sudden surge in signal due to the small pressure burst from the unevacuated space in the end of the leak. As soon as the leak indicator signal peaks and stabilizes, record this signal in divisions. Start a stop watch and close the standard leak valve and record the response time for stabilization and the background signal after it has stabilized.

3.9.3 Subtract the post calibration background signal from the standard leak signal. Divide the helium leakage rate of the standard leak by the net leak indicator signal received in the test system from that system standard leak to obtain the system sensitivity for helium in atm. cc/sec./division.

3.9.4 The goal is to attain a test system sensitivity that will enable an operator to detect a total helium leakage rate of 2×10^{-11} atm. cc/sec. or larger. If this desired test system sensitivity cannot be readily achieved, then the test system sensitivity that must be attained is that which will enable an operator to detect a total helium leakage rate of 1×10^{-10} atm. cc/sec. or larger. If the test system sensitivity is inadequate, the metal box must be evacuated to a lower absolute pressure that will enable it to be achieved.

3.10 After successful completion of the system calibration in step 3.9, record the HMS background signal in divisions.

3.11 With a pressure regulated helium probe, inject helium into the bottom hole of the port plug while allowing the air to vent from the top hole in the plug. Maintain a slight pressure inside the helium plug, less than 1 psia. After purging with helium for about 15 seconds, seal the top vent hole and fill with helium.

3.12 Determine leakage rate after monitoring the helium signal level for an observation period which is the greater of three times the measured response time or one minute. Leakage equal to or larger than 1×10^{-10} atm. cc/sec. of helium as indicated by a signal on the HMS leak indicator is unacceptable. Pinpoint and repair unacceptable leakage. If site repair is not possible, replace the unacceptable part or parts and retest the same pump port assembly in accordance with this procedure. Repeat this as necessary *until* no leakage equal to or larger than 1×10^{-10} atm. cc/sec. of helium is indicated.

3.13 After a successful HMS leak test with the pump port valve closed, vent the evacuated test system and remove the metal box and putty seal if any sealing compound was used.

3.14 Open the pump port isolation valve.

3.15 HMS test the same pump port assembly again by repeating steps 3.6 through 3.12.

3.16 If no leakage equal to or larger than 1×10^{-10} atm. cc/sec. of helium is indicated during the repeat of steps 3.6 through 3.12, remove the helium plug from the pump port on the inside of the can section, vent the evacuated test system and remove the metal vacuum box and putty seal if any sealing compound was used. Final clean inside of pump port with solvent. Cap HMS port on blind flange.

3.17 Leave the pump port isolation valve in the open position when this HMS test of the pump port assembly is completed.

3.18 Repeat steps 3.1 through 3.17 for each 10"∅ pump port assembly on the beam tube can sections with a pump port.

4.0 DOCUMENTATION:

Document in accordance with item 5.0 of procedure LIGOTP.