SPECIFICATION FOR LEAK CHECKING

APPROVALS	DATE	REV	DCN NO.	BY	CHECK	DCC	DATE
AUTHOR:							
CHECKED:							
APPROVED:							
DCC RELEASE							

1.0 PURPOSE

The purpose of this procedure is to define the necessary steps to ensure that equipment fabricated by Process Systems International (PSI) meets the leak rate specification for each component. The procedure includes proposed methods for leak checking welded joints and the double O-ring /pumped annulus flange joints. Where required ,additional data will be gathered and tests will be performed to confirm the methods.

2.0 GENERAL

The leak testing methods will make use of a dry (oil free) Helium Mass Spectrometer Leak Detector. All leak testing methods and calibration will be derived from A.S.T.M. E498 Standard Test Methods for Leaks Using the MSLD

All Weld Joints and Conflats shall be tested and shall have leakage rates less than or equal to 1.0×10^{-9} Torr-L/S.

Annulus Passages shall Pass if they can be pumped to a pressure less than 1×10^{-5} Torr using a pump capable of 50 L/S pumping speed.

All roughing vacuum pumps shall be OIL-FREE Scroll type.
Turbopumps shall be OIL-FREE Magnetically Levitated Turbo Pumps rated at 500 L/S. Acceptable Vendors are: Edwards, Leybold, Pfeiffer or Varian.
Pumps for testing flange annulus seals shall be OIL-FREE Ion Pumps or Turbopumps rated at 50 L/S.

All gases used to back-fill evacuated components shall be ultra clean (Air or N2).

Post-cleaning vacuum tests shall be performed with dedicated pump sets, flanges, valves and other equipment, procured new from high-quality manufacturers. Such equipment will be dedicated solely to these tasks under the subject procurement; will be protected from contamination at all times; and will be furnished to LIGO in serviceable condition (consistent with specified use) at the completion of the contract.

3.0 RESPONSIBILITY

The seller shall incorporate the requirements of this specification in their detailed Leak Checking Procedure.

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4.0 PROCEDURE

4.1 Joint Categories:

Category I
Welded joint located away from the double O-ring flange assembly .

Category II
Welded joint located near the double O-ring flange assembly .

Category III
CF flange joint.

Category IV
Atmospheric O-ring. (O-ring between atmosphere and annulus channel.)

Category V
UHV O-ring. (O-ring between annulus channel and UHV chamber.)

4.2 Leak Checking Welded Joints

All Weld Joints shall be tested and shall have leakage rates less than or equal to 1.0×10^{-9} Torr-L/S.

Category I
Welded joint located away from the double O-ring flange assembly .

These leaks can be detected using standard MSLD leak detection procedures with He as the tracer gas. The leak detector is sensing the vacuum chamber and He is sprayed external to the vessel.

Category II
Weld joint located near a double O-ring flange assembly .

Helium leak detection procedures are still preferred. The proposed method is to bag the O-ring flanged joint and introduce a pure nitrogen purge into the bag. This will keep the concentration of helium in the bag low in order to minimize permeation or leakage of He through the atmospheric O-ring seal. Maintaining a vacuum in the O-ring annulus is required to prevent helium from permeating thru the UHV O-ring and enter ingthe vacuum chamber.

4.3 Leak Checking Conflats

All Conflats shall be tested and shall have leakage rates less than or equal to 1.0×10^{-9} Torr-L/S.

Category III
Conflats.

The conflats can be leak checked using standard Helium MSLD procedures. As in Category II leak detection, nearby O-ring flange assemblies may need bagging and nitrogen purging.

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4.4 Leak Checking O-rings

All Annulus passages shall be capable of being pumped to less than or equal to 1 x 10^{-5} Torr.

Category IV
Atmospheric O-ring. (O-ring between atmosphere and annulus channel.)

Leak checking method
An Ion vacuum gauge will be used to sense the vacuum pressure in the pumped annulus volume between the atmospheric O-ring seal (Cat.IV) and the UHV O-ring (Cat.V). Air that leaks across or diffuses through the O-ring seals will be pumped by the test annulus pumping system . If the annulus vacuum pressure, as measured by the Ion guage is less than or equal to 1 x 10^{-5} Torr, the annulus seals pass the test.

Category V
UHV O-ring. (O-ring between UHV space and annulus channel.)

Leak checking method
Same as Category IV O-ring leak checking method described above.

Outgassing of O-Rings (reference)

Air contains approximately 1% Argon , 5 ppm Helium, 18ppm Neon.Outgassing of these gasses from the O-ring will contribute to the background levels during leak checking.
As an estimate , the outgassing load from the O-ring is 10^{-11} Torr-L/sec for Helium and Neon, and 10^{-8} Torr-L/sec for Argon.

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LEAK TEST DATA SHEET

	1	2	3	
Component Name				
Model Number				
Serial Number				
Drawing Number				
Detector Name				
Model Number				
Serial Number				
Detector Calibration				
Expiration Date				
Standard Leak Rate				
Background				
Standard Response				
Leak Test Data				
Location /Date				
Tracer Gas				
Pressure				
Duration				
Response				
Leak Rate				
Measured				
Calculated				
Allowable				
Performed By :	Date :			
Witnessed By :	Date :			
Signature :	Date :			
Title :				

Remarks :

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SPOOL SECTION LEAK TEST SUMMARY SHEET

Name							
Model No.							
Serial No.							
Drwg.No.							
Location	Category	Leak Rate	Allowable	Pass	Fail	Signature	Date
		Torr	Torr				
Annulus-1	IV		$1x10^{-5}$				
Annulus-2	IV		$1x10^{-5}$				
Annulus-1	V		$1x10^{-5}$				
Annulus-2	V		$1x10^{-5}$				
		Torr-L/s	Torr-L/s				
Weld Joint	I		$1x10^{-9}$				
Weld Joint	II		$1x10^{-9}$				
Conflat	III		$1x10^{-9}$				
Comments							
Witnessed Signature Title Date:							