Title: SPECIFICATION FOR LEAK CHECK PLAN LIGO VACUUM EQUIPMENT

JAN 15 1997

SPECIFICATION FOR LEAK CHECK PLAN FOR LIGO VACUUM EQUIPMENT

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REV LTR	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
2	GS 11/14/97	11/14/97	Revised Per DEO # 0407
1	SM 12/4/96	RCB 12/4/96	REVISED PER DEO 0378
Ø	GS 10/10/96	—	Release for tab Per DEO# 0302
Ø	SM 5/4/96	RCB 5/4/96	INITIAL RELEASE DEO 0162 FOR FDR

PROCESS SYSTEMS INTERNATIONAL, INC.				SPECIFICATION	
INITIAL APPROVALS	PREPARED	DATE 5/4/96	Approved DATE RCB 5/4/96	Number: A V049-2-014 LIGO-E970002-02-V	Rev. 2

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

This specification will be periodically updated to reflect the latest leak check test data that becomes available from prototype and production component testing.
The leak testing methods will make use of a Residual Gas Analyzer and 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 or RGA in Tracer Probe Method

3.0 RESPONSIBILITY

This procedure is applicable to PSI Testing Department and its personnel.

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

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. If there are multiple or large leaks the potential problem of building a high He background level in the vessel exists.

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 will also help by removing helium before it can permeate the UHV O-ring and enter the vacuum chamber.

4.3 Leak Checking Conflats

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.

4.4 Leak Checking O-rings

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

Leak checking method
An Ion vacuum gauge will be sensing 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 annulus pumping system . The vacuum pressure, as measured by the Ion guage, in the annulus will be compared to previously successfully tested systems.If the vacuum pressure is comparable,the o-ring seals are considered to be good.

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.
The solubility for these individual gasses in Viton is unknown, therefore actual outgassng levels for these gasses will have to be determined experimentally.
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.

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 : _____

_____

BSC 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-3	IV		$1x10^{-5}$				
Annulus-4	IV		$1x10^{-5}$				
Annulus-5	IV		$1x10^{-5}$				
Annulus-1	V		$1x10^{-5}$				
Annulus-2	V		$1x10^{-5}$				
Annulus-3	V		$1x10^{-5}$				
Annulus-4	V		$1x10^{-5}$				
Annulus-5	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							