W. W. Hansen Experimental Physics Laboratory

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305 - 4085

Gravity Probe B Relativity Mission

Pre- and Post- Vibration Leak Test Procedure 2.5" and 6" Vacuum Valves (3179 and 3223)

GP-B P0484 Rev. A

14 May 1999

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Prepared by: L. Sokolsky
Vatterfly Engineer Date

_____

Approved: C. Warren Date
Integration Engineer

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Approved : D. Bardas Date
Vatterfly RE

_____

Approved : B. Taller Date
Quality Assurance

_____

Approved : S. Buchman Date
Hardware Manager

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1 GENERAL TEST INFORMATION

1.1 This is critical flight hardware. The proper care should be taken in its handling.

1.2 Redline authority is given to test director with approval of QA

1.3 Test Environment

1.3.1 Temperature: 60-85 ^{o}F

1.3.2 Humidity: not critical

1.3.3 Cleanliness

1.3.4 Normal lab environment when valves are capped and bagged

1.3.5 Class 1000 Clean room when valves are open to atmosphere (use clean bench)

1.4 ESD precautions – none needed

1.5 Notify ONR representative (Ed Ingraham) 48 hr before test begins

1.6 Pass-Fail Criteria

1.6.1 The leak rate after shake shall not degrade more than 50% from the level before shake.

1.7 Certified Test Personnel

1.7.1 The test director and test engineer will be Chuck Warren . The quality engineer will be Ben Taller.

1.8 Verfication Matrix N/A

1.9 Nonconformance will be handled per the Stanford GP-B Quality Plan (P0108)

1.10 If a retest of any or all of the hardware is necessary, the test director will determine the appropriate changes in the procedure, with QA approval.

2 GENERAL DESCRIPTION

This procedure is for pressure leak testing of the Stanford 2.5" Vacuum Valves (S/U 3179) and 6" Vacuum Valves (S/U 3223). The valves will have protective covers over the vatterfly section to prevent contamination. These covers are integral to the pressure hardware, and will be installed in a class 10 clean room environment. In addition, the valves will be bagged. The tests will be conducted with the valves at ambient external temperature and pressure.

3 APPLICABLE DOCUMENTS

Document number	Rev	Title
3179	B	Valve, Vacuum, 2.5”
3223	A	Valve, Vacuum, 6”
210126-01		6” Vatterfly Valve, Random Vibration Fixture
210127-01		2.5 “ Vatterfly Valve, Random Vibration Fixture
210125		2.5” PumpValve Cover
210124		2.5” PumpValve Cover Seal Side
210123		6” PumpValve Cover
210122		6” PumpValve Cover Seal Side

4 PARTS

4.1 Take Delivery of Parts from Stores

4.1.1 Accept the following parts from Stores:

Vatterfly Valve Parts List

Description	HFS Part Number	Rev	Serial Number	Installation Complete (QA)
2.5 in. Vat Valve	**3179**			
2.5 in. Vat Valve	**3179**			
2.5 in. Vat Valve	**3179**			
2.5 in. Vat Valve	**3179**			
2.5 in. Vat Valve	**3179**			
6 in. Vat Valve	**3223**			
6 in. Vat Valve	**3223**			
6 in. Vat Valve	**3223**			

5 TEST EQUIPMENT

Equipment	Model and Serial Number	Calibration
Helium Leak Detector		
Pressure Gage		

6 PRE-SHAKE PRESSURE LEAK TEST OF VALVE, VACUUM, 2.5" 3179 (5 items)

6.1.1 QA to attend testing _____.

6.1.2 Testing will be done at Stanford. Assembly will be done on a class 10 clean bench.

6.1.3 This procedure will have been checked out on the flight spare unit _____.

6.1.4 Attach the pump valve covers to valve

6.1.5 Attach leak detector to probe side of valve; evacuate probe side of valve.

6.1.6 Evacuate space side of valve

6.1.7 Inject space side of valve with 14.7± 0.1 psia helium.

6.1.8 Record leak data in Table 1 every 30 sec for the first 5 minutes and every 5 minutes thereafter until equilibrium is reached.

6.1.9 Repeat steps 6.1.4 to 6.1.8 on the four flight valves

6.1.10 Record data in Table 1

7 PRE-SHAKE PRESSURE LEAK TEST OF VALVE, VACUUM, 6" (3223) (3 items)

7.1.1 QA to attend testing _____.

7.1.2 Testing will be done at Stanford. Assembly will be done on a class 10 clean bench.

7.1.3 This procedure will have been checked out on the flight spare unit _____.

7.1.4 Attach the pump valve covers to valve

7.1.5 Attach leak detector to probe side of valve; evacuate probe side of valve.

7.1.6 Evacuate space side of valve

7.1.7 Inject space side of valve with 14.7± 0.1 psia helium.

7.1.8 Record leak data in Table 2 every 30 sec for the first 5 minutes and every 5 minutes thereafter until equilibrium is reached.

7.1.9 Repeat steps 7.1.4 to 7.1.8 on the two flight valves

7.1.10 Record data in Table 2

Table 1.
2.5" Valve Pre-Shake Leak Rates
(proceed until equilibrium leak rate occurs with permeation saturation)

	S/N:	S/N:	S/N:	S/N:	S/N:
Time (min)	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**
0					
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
10.0					
15.0					
20.0					
25.0					
30.0					

Table 2
6" Valve Pre-Shake Leak Rates
(proceed until equilibrium leak rate occurs with permeation saturation)

	S/N:	S/N:	S/N:
Time (min)	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**
0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
0.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
5.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
10.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
15.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
20.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
25.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
30.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$

SHAKE VALVES PER PROCEDURE P0482

8 POST-SHAKE PRESSURE LEAK TEST OF VALVE, VACUUM, 2.5" 3179 (5 items)

8.1.1 QA to attend testing _____.

8.1.2 Testing will be done at Stanford. Assembly will be done on a class 10 clean bench.

8.1.3 Attach the pump valve covers to valve

8.1.4 Attach leak detector to probe side of valve; evacuate probe side of valve.

8.1.5 Evacuate space side of valve

8.1.6 Inject space side of valve with 14.7± 0.1 psia helium.

8.1.7 Record leak data in Table 3 every 30 sec for the first 5 minutes and every 5 minutes thereafter until equilibrium is reached.

8.1.8 Repeat steps 9.1.3 to 9.1.8 on the remaining four flight valves

8.1.9 Record Data in Table 4.

9 POST-SHAKE PRESSURE LEAK TEST OF VALVE, VACUUM, 6" (3223) (3 items)

9.1.1 QA to attend testing _____.

9.1.2 Testing will be done at Stanford. Assembly will be done on a class 10 clean bench.

9.1.3 Attach the pump valve covers to valve

9.1.4 Attach leak detector to probe side of valve; evacuate probe side of valve.

9.1.5 Evacuate space side of valve

9.1.6 Inject space side of valve with 14.7± 0.1 psia helium and allow equalibrium to be reached.

9.1.7 Record leak data in Table 4 every 30 sec for the first 5 minutes and every 5 minutes thereafter until equilibrium is reached.

9.1.8 Repeat steps 10.1.3 to 10.1.7 on the remaining two valves

9.1.9 Record Data in Table 3.

Table 3
2.5" Valve Post-Shake Leak Rates
(proceed until equilibrium leak rate occurs with permeation saturation)

	S/N:	S/N:	S/N:	S/N:	S/N:
Time (min)	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**
0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
0.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
5.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
10.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
15.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
20.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
25.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
30.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$

Table 4
6" Valve Post-Shake Leak Rates

	S/N:	S/N:	S/N:
Time (min)	**Leak Rate (sccs)**	**Leak Rate (sccs)**	**Leak Rate (sccs)**
0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
0.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
1.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
2.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
3.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
4.5	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
5.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
10.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
15.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
20.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
25.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$
30.0	$\times 10^{-}$	$\times 10^{-}$	$\times 10^{-}$

10 PROCEDURE COMPLETION

The results obtained in the performance of this procedure are acceptable:

Integration Engineer _____ Date _____

Integration Engineer _____ Date _____

ITD _____ Date _____

The information obtained under this assembly and test procedure is as represented and the documentation is complete and correct:

QA Representative _____ Date _____

QA Program Engineer_____ Date _____

Copy discrepancies to D-Log and open Discrepancy Reports when required.

11 DATA BASE ENTRY

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

- Name, number and revision of this procedure
- Date of successful completion of procedure.
- Part numbers and serial numbers of Caging Units and their components