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Gravity Probe B Relativity Mission

Proto-qual Vibration Test Procedure
2.5" and 6" Vacuum Valves (3179 and 3223)
Retest of Flight Spare Valves

GP-B P0735 Rev.-

9 August 2000

Prepared by: L Sokolsky Test Director	Date
Approved : G. Asher Vatterfly REE	Date
Approved : D. Ross Quality Assurance	Date
Approved : S. Buchman Relativity Mission Program Manager	Date

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: normal lab environment

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 A leak test will be performed on the valves after test is complete. Procedure number _____

1.7 Certified Test Personnel

1.7.1 The test director and test engineer will be Larry Sokolsky. The quality engineer will be Dorrene Ross.

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 protoflight random vibration testing of the Stanford 2.5" Vacuum Valves (S/U 3179) and 6" Vacuum Valves (S/U 3223), flight spares only. The valves will have protective covers over the vatterfly section to prevent contamination. These covers are integral to the shake fixture hardware, and will be delivered pre-attached to the valves to the shake facility. In addition, the valves will be bagged. The tests will be conducted with the valves at ambient pressure. Because of the over-center design of the valves, leakage during vibration is not an issue as long as the valves pass their acceptance pressure test, so a leak test will not be part of this vibration procedure.

3 APPLICABLE DOCUMENTS

Document number	Rev	Title
3179	B	Valve, Vacuum, 2.5”
3223	A	Valve, Vacuum, 6”
		Large Vatterfly Valve, Random Vibration Fixture
		Small Vatterfly Valve, Random Vibration Fixture
		2.5” Valve Cover, Top
		2.5” Valve Cover, Bottom
		6” Valve Cover, Top
		6” Valve Cover, Bottom

4 PARTS

4.1 Take Delivery of Parts from Stores

4.1.1 Accept the following parts from Stores:

Description	Part Number	Rev	Serial Number
2.5 in Vat Valve	**3179**		
6 in Vat Valve	**3223**		

5 TEST EQUIPMENT

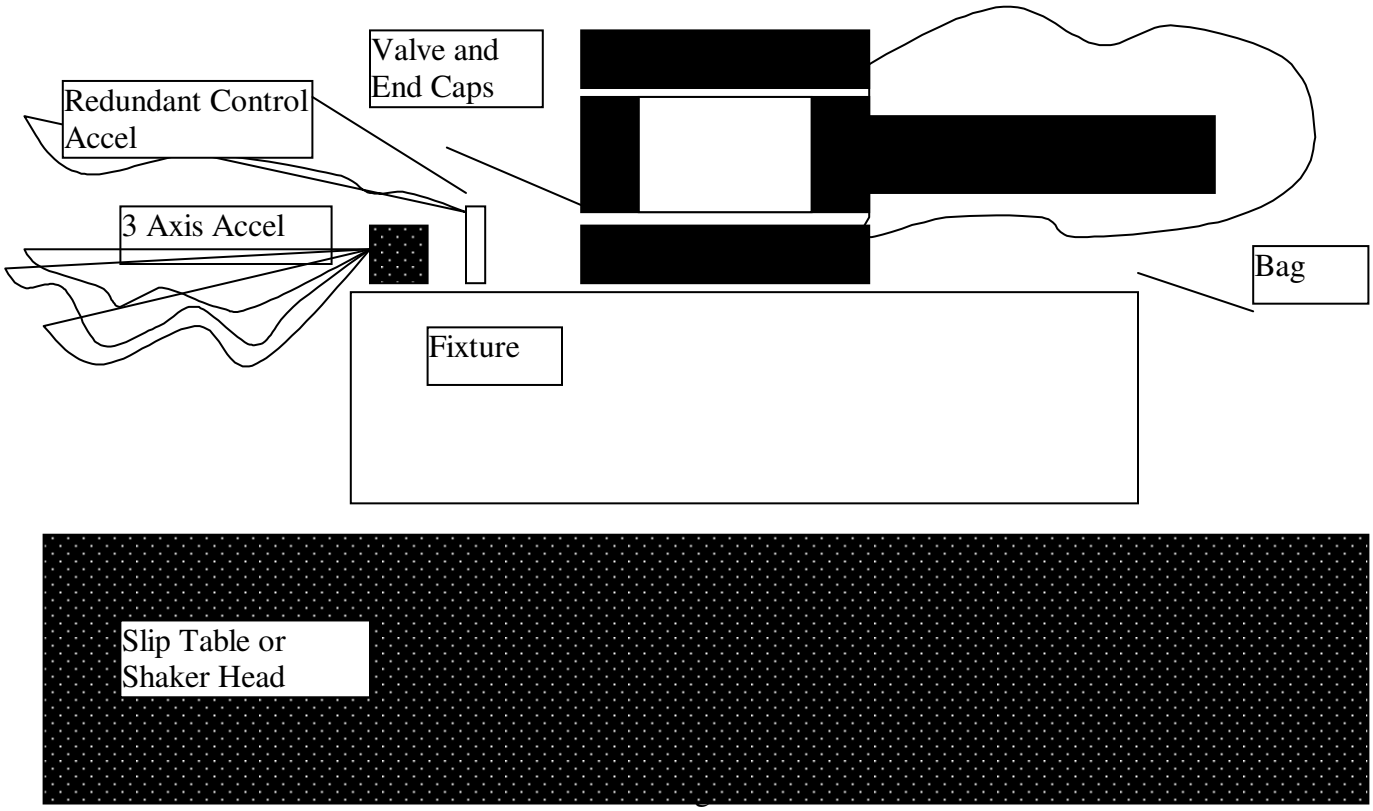
Equipment	Model and Serial Number	Calibration
Shaker		
Vibration Controller		
Accelerometer		
Accelerometer		
Accelerometer		
Accelerometer		

6 RANDOM VIBRATION TEST OF VALVE, VACUUM, 2.5" 3179 (1 ITEM)

6.1.1 QA (Dorrene Ross or appointee) to attend testing _____.

6.1.2 Testing will be done at Bell Technologies. Accelerations in the shake axis will be recorded at the fixture. See Figure 1 for sketch of test set-up. Test can be done either on slip table or on vertical expander head cube adapter, per lab discretion and test director approval _____.

Figure 1
Test Set-Up



6.1.2.1 X Axis Shake

6.1.2.1.1 Bolt 2.5 in valve fixture to slip table in x-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

6.1.2.1.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

6.1.2.1.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

6.1.2.1.4 Bolt 2.5" flight back-up valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 1.

6.1.2.1.5 Vibrate valve in X direction to protoqual levels (Table 7).

6.1.2.1.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

6.1.2.1.7 Remove valve from fixture

6.1.2.1.8 Attach all plots to back of procedure.

Table 1
Torque Values for 2.5 in Valves (X-axis)

2.5 in Valve S/N	Torque Value	QA Witness

6.1.2.2 Y Axis Shake

6.1.2.2.1 Bolt 2.5 in valve fixture to slip table in y-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

6.1.2.2.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

6.1.2.2.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

6.1.2.2.4 Bolt 2.5" flight backup valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 2.

6.1.2.2.5 Vibrate valve in Y direction to protoqual levels (Table 7).

6.1.2.2.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

6.1.2.2.7 Remove valve from fixture.

6.1.2.2.8 Attach all plots to back of procedure.

Table 2
Torque Values for 2.5 in Valves (Y-axis)

2.5 in Valve S/N	Torque Value	QA Witness

6.1.2.3 Z Axis Shake

6.1.2.3.1 Bolt 2.6 in valve fixture to slip table in x-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

6.1.2.3.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

6.1.2.3.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

6.1.2.3.4 Bolt 2.5" flight backup valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 3.

6.1.2.3.5 Vibrate valve in Z direction to protoqual levels (Table 7).

6.1.2.3.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

6.1.2.3.7 Remove valve from fixture

6.1.2.3.8 Attach all plots to back of procedure.

Table 3
Torque Values for 2.5 in Valves (Z-axis)

2.5 in Valve S/N	Torque Value	QA Witness

7 RANDOM VIBRATION TEST OF VALVE, VACUUM, 6" 3223 (1 ITEM)

7.1.1 QA (Dorrene Ross or appointee) to attend testing _____

7.1.2 Testing will be done at Bell Technologies. Accelerations in the shake axis will be recorded at the fixture. See Figure 1 for sketch of test set-up. Test can be done either on slip table or on vertical expander head cube adapter, per lab discretion and test director approval _____.

7.1.2.1 X Axis Shake

7.1.2.1.1 Bolt 6 in valve fixture to slip table in x-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

7.1.2.1.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

7.1.2.1.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

7.1.2.1.4 Bolt 6" flight backup valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 4.

7.1.2.1.5 Vibrate valve in X direction to protoqual levels (Table 7).

7.1.2.1.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

7.1.2.1.7 Remove valve from fixture.

7.1.2.1.8 Attach all plots to back of procedure.

Table 4
Torque Values for 2.5 in Valves (X-axis)

2.5 in Valve S/N	Torque Value	QA Witness

7.1.2.2 Y Axis Shake

7.1.2.2.1 Bolt 6 in valve fixture to slip table in y-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

7.1.2.2.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

7.1.2.2.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

7.1.2.2.4 Bolt 6" flight backup valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 5.

7.1.2.2.5 Vibrate valve in Y direction to protoqual levels (Table 7).

7.1.2.2.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

7.1.2.2.7 Remove valve from fixture

7.1.2.2.8 Attach all plots to back of procedure.

Table 5
Torque Values for 2.5 in Valves (Y-axis)

2.5 in Valve S/N	Torque Value	QA Witness

7.1.2.3 Z Axis Shake

7.1.2.3.1 Bolt 6 in valve fixture to slip table in x-axis configuration. Torque bolts to 90 in-lb Torque_____ Witness_____

7.1.2.3.2 Bond 3 axis accelerometer and redundant accelerometer to fixture.

7.1.2.3.3 Run x-axis fixture trial to protoqual level (Table 7). Approve resulting spectrum and cross-axis responses. Test Director_____

7.1.2.3.4 Bolt 6" valve to fixture 8A01681GSE. Torque to 90 in-lb. Record torques in Table 6.

7.1.2.3.5 Vibrate valve in Z direction to protoqual levels (Table 7).

7.1.2.3.6 Approve resulting spectrum and cross axis responses for flight item (Table 8).

7.1.2.3.7 Remove valve from fixture

7.1.2.3.8 Attach all plots to back of procedure.

Table 6
Torque Values for 2.5 in Valves (Z-axis)

2.5 in Valve S/N	Torque Value	QA Witness

Table 7
Random Vibration Spectrum

Frequency (hz)	Protoqual level (g^2/hz)
20	0.016
50	0.10
800	0.10
2000	0.016
Composite (grms)	**11.2**

Duration: 90 ±5 seconds
Spec: ±3 dB, 20 hz to 2000 hz
RMS: ± 10%

Table 8
Approval of Vibration Spectrum for Flight Valves

S/N	Direction	Test Director Approval
2.5 in	**X**	
	Y	
	Z	
6 in	**X**	
	Y	
	Z	

8 CLOSURE

8.1 Return valves to Stores.

8.2 QA to verify all operations complete. _____