PROTOFLIGHT ENVIRONMENTS

FOR

BSAT-2 HYDRAZINE TANK

ATK P/N 80420-3

80420-3 was subjected to the following protoflight tests:

TEST SEQUENCE	TEST DESCRIPTION
1	Examination of Product, Preliminary
2	Volumetric Capacity Measurement
3	Proof Pressure Test
4	Volumetric Capacity Measurement
5	PMD Bubble Point Test
6	Vibration Test
7	Differential Pressure Test
8	Expulsion Efficiency Test
9	PMD Bubble Point Test
10	External Leak Test
11	Weld Quality Inspection
12	Mass Measurement
13	Final Visual Inspection
14	Final Cleanliness & Dry

Vibration Test

Tests conducted on each of the three orthogonal axes.

Test	Propellant Load	Pressurization
(1) Wet sinusoidal vibration test, including pre-test and post-test surveys	251 lbm	MEOP, +10, -0 psig
(2) Wet random vibration test, including pre-test and post-test surveys	251 lbm	MEOP, +10, -0 psig
(3) Dry sinusoidal vibration test, including pre-test and post-test surveys	None	MEOP, +10, -0 psig
(4) Dry random vibration test, including pre-test and post-test surveys	None	MEOP, +10, -0 psig

The MEOP is defined as 414.7 psig @ 122°F.

Temperature (°F)	MEOP Pressure (psig)	Correction Factor (ref.)
40°	443.7	1.070
43°	442.8	1.068
45°	442.2	1.066
48°	441.5	1.065
50°	440.7	1.063
53°	439.8	1.061
55°	438.9	1.058
58°	438.1	1.056
60°	437.2	1.054
63°	436.3	1.052
65°	435.5	1.050
70°	433.7	1.046
73°	432.9	1.044
75°	432.0	1.042
80°	430.3	1.038
83°	429.4	1.035
85°	428.3	1.033
90°	426.4	1.028
95°	424.7	1.024
98°	423.8	1.022
100°	422.9	1.020

Vibration Test (continued)

Specification 087-PF4750, Table 6

Protoflight Sine Vibration Levels

Axis	Frequency (Hz)	Acceleration (g)	Sweep Rate
Wet Tank			
Spacecraft thrust (Z)	5-18	0.5 in DA	4 oct/min
	18-25	12.5	
	25-100	2.5	
Spacecraft lateral (X) and (Y)	5-13	0.5 in DA	4 oct/min
	13-20	12.5	
	20-100	2.0	
Dry Tank			
Spacecraft thrust Z	5-13	0.5 in DA	4 oct/min
	13-50	7.5	
	50-100	2.5	
Spacecraft lateral X and Y	5-13	0.5 in DA	4 oct/min
	13-20	7.5	
	20-100	2.0	

Notes:

1. Sine input may be notched to limit hydrazine tank response to:

   Spacecraft thrust (Z axis): 16.3 g (-0, +5%)
   Spacecraft lateral (X axis): 12.5 g (-0, +5%)
   Spacecraft lateral (Y axis): 6.3 g (-0, +5%)

2. Low level sine sweep survey from 4 to 100 Hz shall be performed prior to and after each vibration axis. Any resonant frequency shift greater than 5% or resonant magnitude change greater than 10% from the pre to post surveys shall require review and approval by Orbital.

3. The 16.3 g thrust, 6.3 g Y lateral and 12.5 g X lateral loads must be reached through resonance even if it means raising the levels of the sine input.

4. Re-test on 1 complete axis is allowed.

Vibration Test (continued)

Protoflight Random Vibration Levels

Frequency (Hz)	Protoflight Level	Units
Wet Tank		
20-50 50-500 500-2000	6 0.16 –3	dB/oct g^2/Hz dB/oct
Overall 13.7 G_{rms} Duration: 60 seconds per axis		
Dry Tank		
20-50 50-500 500-2000	6 0.4 -3	dB/oct g^2/Hz dB/oct
Overall 21.6 G_{rms} Duration: 60 seconds per axis		

Notes:

1. Random input spectra may be notched to limit tank response to:

   Spacecraft thrust (Z axis): 16.3 g (-0, +5%)
   Spacecraft lateral (X axis): 12.5 g (-0, +5%)
   Spacecraft lateral (Y axis): 6.3 g (-0, +5%)

2. Minimum frequency of the test fixture shall be greater than 200 Hz.

3. A low level random survey shall be performed prior to and after each vibration axis. Any resonant frequency shift greater than 5% or resonant magnitude change greater than 10% from pre to post low level surveys shall require review and approval by Orbital.

4. It is permissible to start with a –12dB survey, followed by –9 dB, -6 dB, and –3 dB runs as required prior to starting the full level vibration testing.

Differential Pressure Test

Test measures the pressure differential between ullage and tank outlet. Tank assembly pressure drop shall not exceed 5.0 psid at a maximum flow rate of 0.10 lbm/sec (0.72 gpm).

This differential pressure test measures the actual pressure drop at 0.10 lbm/sec (0.72 gpm) flow rate. Tank is loaded with 251, +0.5/-0 lbm of D. I. water.