QUALIFICATION ENVIRONMENTS

FOR

POSITIVE EXPULSION PROPELLANT TANK

ATK P/N 80222-1

Table 1: P/N 80222-1 Positive Expulsion Propellant Tank

Specifications

Parameters	Requirements
Operating Pressure	400 psig
Proof Pressure	600 psig, Actual Proof: 600 psig
Burst Pressure	800 psig, Actual Burst: psig
External Pressure	Not tested
Internal Vacuum	Not tested
Material of Construction	Lightweight spherical 6AL-4V titanium tank. Fluid connection consists of a 3/16 inch outside diameter tube for propellant and a 1/8 inch outside diameter tube for pressurant.
Membrane Thickness	"
Tank Mount(s)	Tank mounting is accomplished with a cylindrical flanged standoff integral with the propellant hemisphere, and a mounting boss integral with the pressurant hemisphere..
Expulsion Efficiency	99.8%
Design Fill Fraction	-
Tank Capacity	424 in^3
Internal Dimensions	9.60" Ø spherical
Tank Weight	Maximum tank weight is 2.85 lbs, Actual tank weight is 2.65 lbs
Propellant Capacity	-
Shell Leakage	$<5x10^{-6}$ std cc/sec He max, Actual: None @ 400 psig
Failure Mode	Burst
Natural Frequency	-
Temperature Environment	-
On Orbit Life	-

80222-1 was subjected to the following qualification tests:

Test and Sequence
Acceptance Tests
Vibration Test
Internal Helium Leak Test
External Helium Leak Test
Life Cycle Test
Internal Helium Leak Test
Post Test Inspection

The following tests are listed in the report:

1) Proof Pressure Test
2) Vibration Test (Sine & Random)
3) Life Cycle & Expulsion Test

No Burst Test was performed.

Proof Pressure Test

Tank is pressurized to 600 psig and held for five minutes. Pressurization rate is 200 psig/min and one cycle total was performed.

PSI 2017 camfield avenue los angeles, cal. 90040
PRESSURE SYSTEMS, INC.

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REV	N/C			

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PROOF PRESSURE TEST

(PARA. 4.3)

CUSTOMER HAMILTON STANDARD
DATE 12-31-74
CUSTOMER P/N SV 761697-1 D
PART NAME PROPELLANT TANK ASSY.
CUSTOMER S/N
PSI P/N 80222-1
PSI S/N 0002
TEST EQUIPMENT

TEST MEDIA: DISTILLED, DEIONIZED WATER

	ACTUAL	REQUIRED
SPECIMEN PRESSURE	600	600 $\pm^{15}_{0}$ PSIG
PRESSURE HOLD PERIOD	5	5 MINUTES MIN.
PRESSURE CYCLES	ONE	1
PRESSURIZATION RATE	200	200 PSIG/MINUTE

DEFORMATION OBSERVED NO VISUAL DEFORMATION

TESTED BY Les Rose PSI 26 DATE 12-31-74 SPECIMEN PASSED PSI 30 PA
WITNESSED BY DATE 12-31-74 SPECIMEN FAILED
NS WITNESS 12-31-74
EVENT LOG

Sine Vibration (Wet)

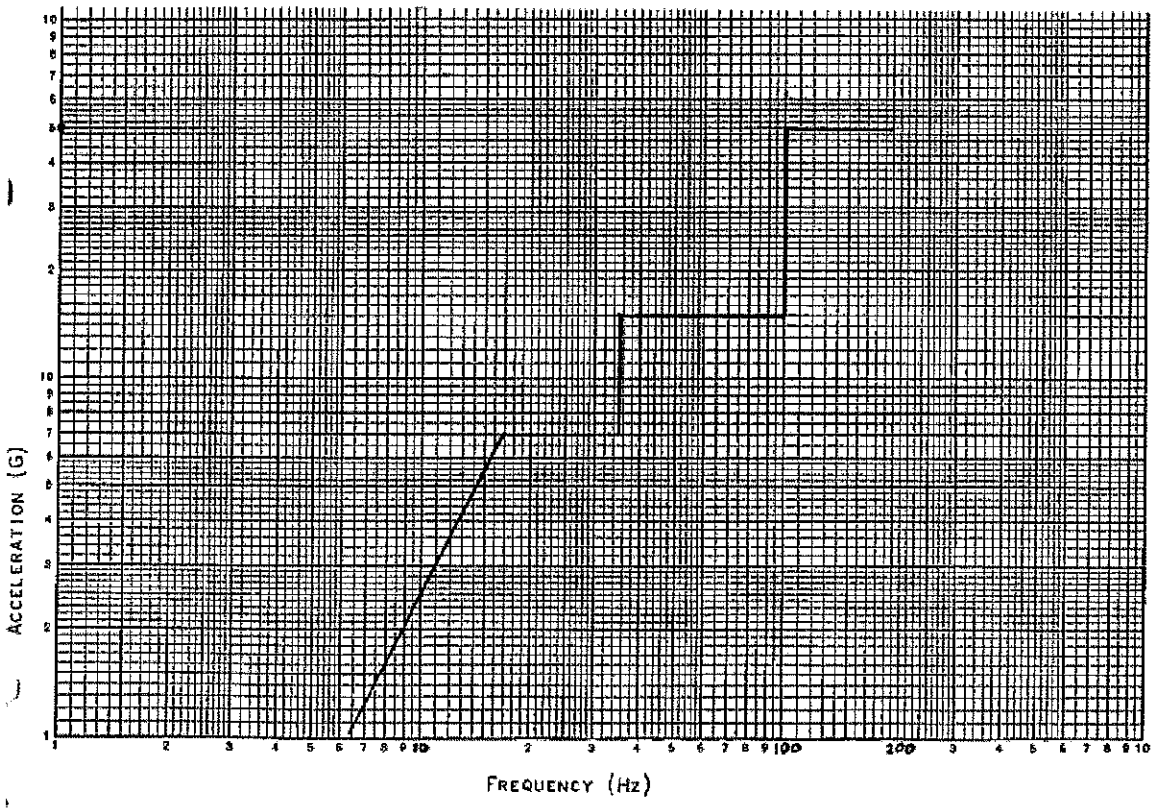
4.8 kg

Tank is loaded with 10.5 ± 0.25 lbs of deionized water and pressurized to 400, +10/-0 psig.

SINUSOIDAL VIBRATION LEVELS

Axis	Frequency Hz	Acceleration, G	Sweep Rate
All Axes, X, Y, Z	5 - 17	.48 DA	2 octaves per minute
	17 - 35	7.0	
	35 - 100	15.0	
	100 - 200	50.0	

DISPLACEMENT: 0.48 IN DA MAXIMUM



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SINUSOIDAL VIBRATION

(PARA. 4.1)

REVISIONS: N/C

CUSTOMER HAMILTON STANDARD

CUSTOMER P/N SV 761697-1 D

CUSTOMER S/N

PSI P/N 80222-1

PSI S/N 0002

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400 + 10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	D.A. INCHES	G PEAK	SWEEP RATE MINUTES/OCTAVE	DURATION TOTAL MINUTES	DATE	MAXIMUM AMPLIFICATION
Z	5	17	0.48					
(THRUST)	17	35		7.0				
	35	100		15.0				
	100	200		50.0	0.5 min/oct	2.6	1-6-75	70g @ 200 HZ
								Q = 1.4

DATE	TIME	LOG ENTRIES
1-6-75	2250	5-200 HZ UPSWEEP WITH WEIGHT 10.75 POUNDS PRESS @
		START 408 PSIG. PRESS @ END 408 PSIG. TANK RESP
		LIMITED TO 70g's.

TESTED BY: M.R. Mustard DATE 1-6-75

WITNESSED BY: R.J. Eaton DATE 1-6-75

H.S. WITNESS C.R. Duffy (SEA) 1-6-75

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SINUSOIDAL VIBRATION

(PARA. 4.1)

REVISIONS: N/C

CUSTOMER HAMILTON STANDARD

CUSTOMER P/N SV 761697-1 D

CUSTOMER S/N

PSI P/N 80222-1

PSI S/N 0002

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400 + 10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	D.A. INCHES	G PEAK	SWEEP RATE MINUTES/OCTAVE	DURATION TOTAL MINUTES	DATE	MAXIMUM AMPLIFICATION
X	5	17	0.48					
	17	35		7.0				3.7g @ 9 Hz
	35	100		15.0				Q = 2
	100	200		50.0	0.5 min/oct	2.6	1-7-75	57g @ 170 Hz
								Q = 1.14

DATE	TIME	LOG ENTRIES
1-7-75	1957	5-200 Hz UPSWEEP TANK RESP. LIMITED TO 70g's
		WATER WEIGHT 10.75 POUNDS
		PRESS START: 408 PSIG PRESS @ END: 408 PSIG

TESTED BY: M.L. Mustard DATE 1-7-75

WITNESSED BY: Lt. Flaherty DATE 1/7/75

H.S. WITNESS G.R. Duffy (SIA) 1/7/75

DATA SHEET A

SINUSOIDAL VIBRATION

(PARA. 4.1)

REVISIONS: N/C

CUSTOMER HAMILTON STANDARD

CUSTOMER P/N SV 761697-1

CUSTOMER S/N

PSI P/N 80222-1

PSI S/N 0002

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400 + 10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	D.A. INCHES	G PEAK	SWEEP RATE MINUTES/OCTAVE	DURATION TOTAL MINUTES	DATE	MAXIMUM AMPLIFICATION
"Y"	5	17	0.48					
	17	35		7.0				
	35	100		15.0				
	100	200		50.0	2 OCT/MIN	2.6	1-9-75	

DATE	TIME	LOG ENTRIES
1-9-75	1545	"Y" AXIS 5-200 HZ UPSWEEP TANK RESP HELD TO A MAXIMUM
		OF 70g's TANK FILLED WITH 10.75 POUNDS OF WATER
		PRESSURE @ 408 PSIG

TESTED BY: M.R. Mustard DATE 1-9-75

WITNESSED BY: S.J. Epstein DATE 1-9-75

H.S. WITNESS G. Reduggo (SIA)

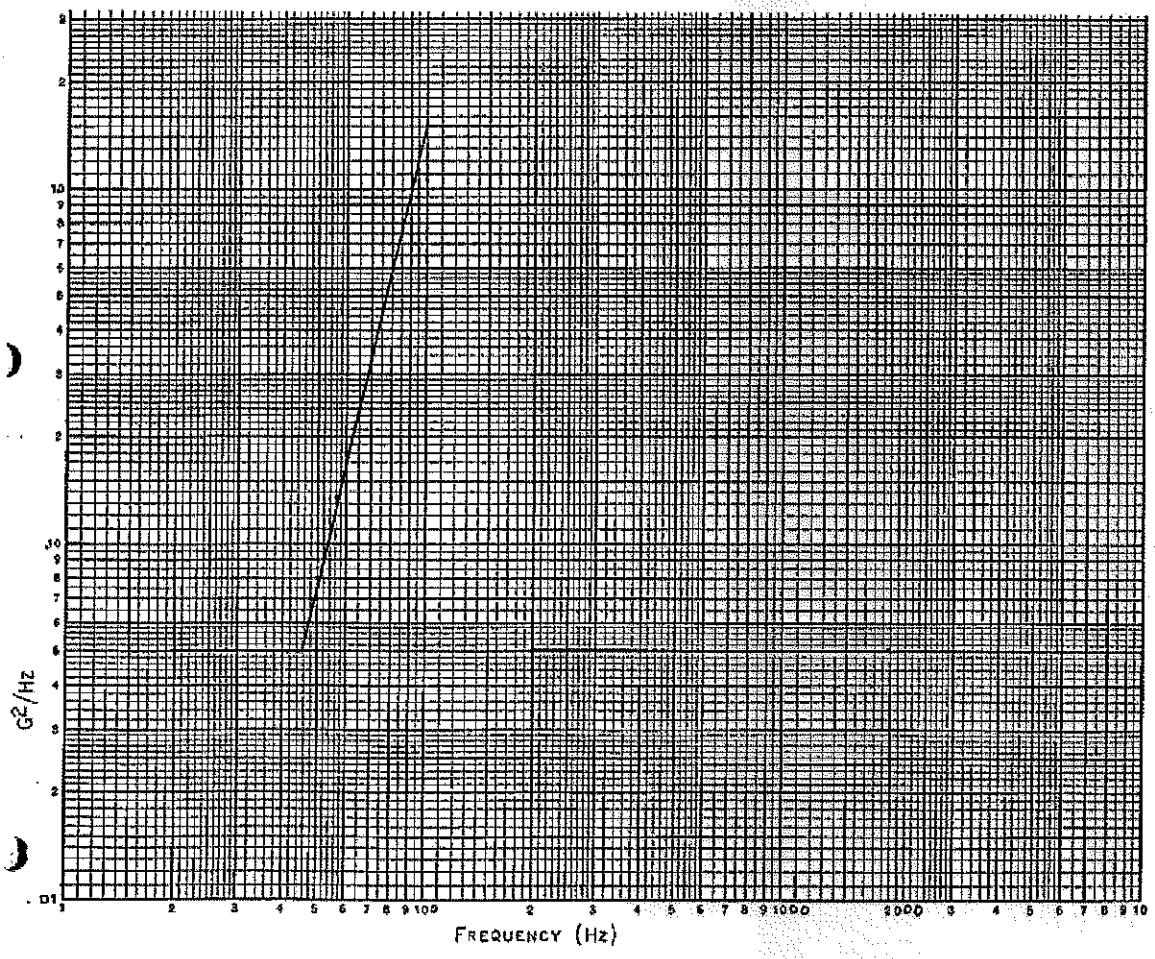
Random Vibration (Wet)

Tank is loaded with 10.5 ± 0.25 lbs of deionized water and pressurized to 400, +10/-0 psig.

RANDOM VIBRATION LEVELS

Axis	Frequency Hz	Spectral Density, G^2/Hz	Overall Level
All Axes, X, Y & Z	20 - 45	.05	16.5g RMS
	45 - 100	+12 dB/octave	
	100 - 200	1.5	
	200 - 2000	0.5	

Test Duration: 2 minutes/axis



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RANDOM VIBRATION

REVISIONS: N/C

(PARA. 4.1)

CUSTOMER HAMILTON STANDARD

PSI P/N 80222-1

CUSTOMER P/N SV 761697-1 D

PSI S/N 0002

CUSTOMER S/N

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400, +10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	DB/OCT	RUN TIME	DATE
Z	20	45		0.05			
	45	100			+12.0		
	100	200	1	1.5			
	200	2000	16.5	0.05		2 MID	1-7-75

DATE	TIME	LOG ENTRIES
1-7-75	0900	RUN LOW LEVEL TO DETERMINE TANK RESONANCE
1-7-75	1000	RUN 2 MID FULL LEVEL RUN

TESTED BY: C WHITTAKER DATE 1-7-75

WITNESSED BY: [signature] DATE 1-7-75

U.S. WITNESS [signature] (SIA) 1-7-75

DATA SHEET B-2

RANDOM VIBRATION

(PARA. 4.1)

REVISIONS: N/C

CUSTOMER HAMILTON STANDARD

CUSTOMER P/N SV 761697-1 D

CUSTOMER S/N

PSI P/N 80222-1

PSI S/N 0002

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400, +10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	DB/OCT	RUN TIME	DATE
Z	20	45		0.05			
	45	100			+12.0		
	100	200		1.5			
	200	2000	16.5	0.05		2 MIN	1-7-75

DATE	TIME	LOG ENTRIES
1-7-75	2010	RUN LOW LEVEL TO DETERMINE TANK RESONANCE.
-7-75	2110	RUN 2 MIN FULL LEVEL RUN
1-7-75	2113	PRESS @ TEST END @ 110PSIG -SEE D.I.D #1

STED BY: M.R. Mustard DATE 1-7-75

TNESSED BY: K.T. Dossing DATE 1/7/75

S. WITNESS G.P. Duffy (SN) 1/7/75

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RANDOM VIBRATION

(PARA. 4.1)

REVISIONS: N/C

CUSTOMER HAMILTON STANDARD

PSI P/N 80222-1

CUSTOMER P/N SV 761697-1 D

PSI S/N 0002

CUSTOMER S/N

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400, +10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	DB/OCT	RUN TIME	DATE
X	20	45		0.05			
(REPEAT)	45	100			+12.0		
	100	200		1.5			
	200	2000	16.5	0.05		2 MIN	1-9-75

DATE	TIME	LOG ENTRIES
1-9-75	1400	RUN LOW LEVEL TO DETERMINE TANK RESONANCE
1-9-75	1425	RUN 2 MIN FULL LEVEL RUN

TESTED BY: M L Mustard DATE 1-9-75

WITNESSED BY: C J Eaton DATE 1-9-75

H.S. WITNESS [illegible] (SIA) 1-9-75

DATA SHEET B-2

RANDOM VIBRATION

REVISION: N/C

(PARA. 4.1)

CUSTOMER HAMILTON STANDARD

PSI P/N 80222-1

CUSTOMER P/N SV 761697-1 D

PSI S/N 0002

CUSTOMER S/N

PART NAME: PROPELLANT TANK ASSEMBLY

TANK LOAD: 10.5 ± 2.5 LBS.

TANK PRESSURE: 400, +10, -0 PSIG

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	DB/OCT	RUN TIME	DATE
Y	20	45		0.05			
	45	100			+12.0		
	100	200		1.5			
	200	2000	16.5	0.05		2 MIN	1-9-75

DATE	TIME	LOG ENTRIES
1-9-75	1550	RUN LOW LEVEL TO DETERMINE TANK RESONANCE
1-9-75	1613	RUN 2 MIN FULL LEVEL RUN

TESTED BY: M. R. Mustard DATE 1-9-75

WITNESSED BY: C. L. Eyster DATE 1-9-75

H.S. WITNESS: G. Pfluger (SH) 1-9-75

Life Cycle Test

Tank is loaded with 10.5 ± 0.25 lbs of water and pressurized to 400, +10/-0 psig. Tank is then discharged. Number of cycles is 100, +2.

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PRESSURE SYSTEMS, INC.

PSI TEST REPORT No. 56-000066
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REVISIONS: N/C

DATA SHEET E

LIFE CYCLE & EXPULSION EFFICIENCY TEST

CUSTOMER HAMILTON STANDARD DATE 1-13-75

PART NUMBER SV 761697-1 D PART NAME PROPELLANT TANK ASSEMBLY

SERIAL NUMBER PSI P/N 80222-1

TEST PROCEDURE PARA. No. 4.4 PSI S/N 0002

TEST EQUIPMENT: SCALE E0290 CALIB EACH TEST

LIFE CYCLE TEST MEDIA: DISTILLED, DEIONIZED WATER

	ACTUAL	REQUIREMENT
SIMULATED PROPELLANT LOAD	10.5	10.5 ± 2.5 LBS.
EXPULSION PRESSURE	400	400, +20, -0 PSIG
NUMBER OF CYCLES	100	100, +2, -0 CYCLES
* TOTAL FILLED FLUID WEIGHT (WT)	15.3 (S14)	RECORD
* RESIDUAL FLUID WEIGHT (WR) (.030 LBS)	14 CC	RECORD
* EFFICIENCY	99.8% (S14) **	99% MINIMUM

* LAST CYCLE

** EFFICIENCY = $\frac{WT - WR}{WT} \times 100\%$

TESTED BY L. Rose DATE 1-13-75 SPECIMEN PASSED

WITNESSED BY: R. T. Looney DATE 1/13/75 SPECIMEN FAILED

H.S. WITNESS G. P. Duffy (S14) 1/13/75

EVENT LOG