QUALIFICATION ENVIRONMENTS

FOR

POSITIVE EXPULSION PROPELLANT TANK

ATK P/N 80303-1

Table 1: P/N 80303-1 Positive Expulsion Propellant Tank Assembly Specifications

Parameters	Requirements
Operating Pressure	340 psig
Proof Pressure	792 psig, Actual Proof: 800 psig
Burst Pressure	1584 psid, Actual Burst: , Rupture @ psig
External Pressure	Not performed
Internal Vacuum	Not performed
Material of Construction	Spherical 6Al-4V Titanium Tank fabricated from closed die forgings and machine welded at the girth. Fluid connections are made thru .250 inch (Pressurant) and .250 inch (Propellant) outside Diameter transition tubes.
Membrane Thickness	0.046″
Tank Mount(s)	Mounting is accomplished by lugs located on the propellant hemisphere adjacent to the girth weld.
Expulsion Efficiency	99.9 %
Design Fill Fraction	-
Tank Capacity	2328.6 in^3
Internal Dimensions	16.5″ Ø spherical
Tank Weight	Maximum tank weight is 13 lbs, Actual tank weight is 12.25 lbs
Propellant Capacity	1955 in^3
Shell Leakage	$<1x10^{-6}$ std cc/sec He max, Actual: None @ 390 psig
Failure Mode	Burst
Natural Frequency	-
Temperature Environment	-
On Orbit Life	-

80303-1 was subjected to the following qualification tests:

Test Sequence	Test Description
1	Acceptance Test
2	Random Vibration
3	Internal (Diaphragm) Leakage High and Low Pressure
4	External Leakage
5	Proof Pressure
6	Internal (Diaphragm) Leakage High and Low Pressure
7	External Leakage
8	Life Cycle and Expulsion Efficiency
9	Internal (Diaphragm) Leakage High and Low Pressure
10	External Leakage

Note: The following tests are only listed in this document

1) Pressure Log
2) Proof Pressure Test
3) Random Vibration Test
4) Life Cycle and Expulsion Efficiency

Pressure Log

OPERATING TIME/CYCLE AND PRESSURE
DATA CYCLE

PURCHASE ORDER NO. M2H3BGG-390172D

PART NAME Propellant Tank - RCS

REVISION "A"

SERIAL NUMBER 18229 Class 1 0001

Requirement 100 cycle
435 PSIG Maximum operating pressure
5 minutes maximum duration per cycle at 435 PSIG

Date	No. cycles	Time	Pressure	Remaining useful cycles	Remarks
1-14-83	1	16 sec.	800 PSIG	99	Proof Pressure
1-15-83	1	45.5 Min.	102 PSIG	98	Internal Leak (High)
1-15-83	1	45.0 Min.	6 PSIG	97	Internal Leak (Low)
1-15-83	1	2.5 Min.	390 PSIG	96	External Leak
1-20-83	3	3.0 Min.	332 PSIG	93	Vibration
1-21-83	1	45.0 Min.	102 PSIG	92	Internal Leak (High)
1-21-83	1	45.0 Min.	5.5 PSIG	91	Internal Leak (Low)
1-21-83	1	2.0 Min.	390 PSIG	90	External Leak

Proof Pressure Test

Pressurized to 610 psig for a test duration of 5.1 minutes. Tank is continued pressurized to 800 psig and held for a duration of sixteen (16) seconds. No deformation or failure visible.

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PSI REPORT No. 56-00009B
APPENDIX "A", PAGE A-46

N/C	A						

DATA SHEET C
PROOF PRESSURE

DATE: 1-14-83

PSI PART No. 80303-1

PSI SERIAL No. 18229 CLASS 10001

PSI PART NAME: HYDRAZINE SUPPLY TANK

TEST EQUIPMENT: HEISE GAUGE (0978)
0-2000 PSIG, CALIBRATION Dec 4-6-83

TEST MEDIA: DEIONIZED WATER

	ACTUAL	REQUIRED
SPECIMEN PRESSURE	610 PSIG	606, +10, -0 PSIG
TIME AT PRESSURE (REF: 606 PSIG)	5.1 MINS	5, +1, -0 MINUTES
SPECIMEN PRESSURE	800 PSIG	792, +10, -0 PSIG
TIME AT PRESSURE (REF: 792 PSIG)	16 SEC	15, +5, -0 SECONDS
VISIBLE EVIDENCE OF DEFORMATION OR FAILURE	NONE	NONE ALLOWED

TESTED BY [signature] DATE 1-14-83 SPECIMEN PASSED YES

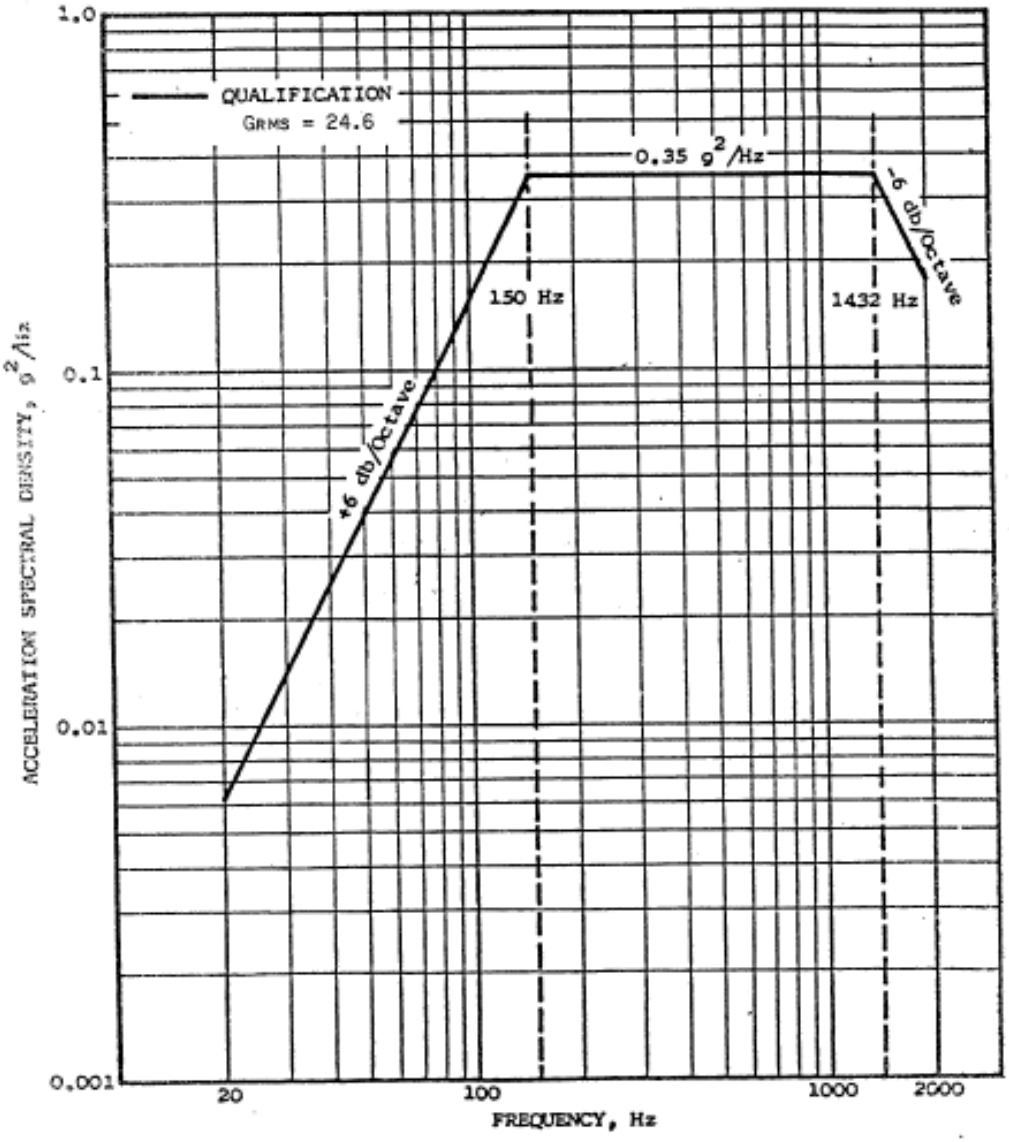
Random Vibration (Wet)

Random Vibration – The specimen was loaded with 71 pounds of water and pressurized to 332 psig, the specimen was then subjected to the following random vibration levels:

	RANDOM			
Axis	Frequency (Hz)	Level (G^2/Hz)	Overall Level G rms	Time Minutes/Axis
X, Y & Z	20 - 150	+6 dB/Oct		3
X, Y & Z	150 - 1432	0.35	24.6	3
X, Y & Z	1432 - 2000	-6 dB/Oct		3

FIGURE NO. 3A

RANDOM VIBRATION LEVELS



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N/C	A					

DATA SHEET "F"
RANDOM VIBRATION

DATE: 1-18-83

PSI PART No. 80303-1

PSI SERIAL No. 18229 CLASS 1000 1

PSI PART NAME: HYDRAZINE SUPPLY TANK

TEST EQUIPMENT: H.P. 5427A DIGITAL VIBRATION CONTROL SYSTEM

	REQUIREMENT	ACTUAL
WEIGHT OF WATER IN SPECIMEN:	71 ± 1 POUNDS	71 LBS.
SPECIMEN PRESSURE:	330 ± 10 PSIG	332 PSIG
FASTENER TORQUE:	170 ± 5 INCH LBS.	170 INCH LBS
WATER RESISTIVITY:	500,000 OHMS MIN.	17 MEG OHMS
WATER pH:	5.5 - 8.0	7.0

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	dB/OCT	dB/OCT	RUN TIME	DATE
Y	20	150	12.3		+6		1 MIN	1-18-83
	150	1432		.0875				
	1432	2000				-6		

DATE	TIME	LOG ENTRIES
1-18-83	14:45	COMPLETED Y AXIS ACCEPTANCE VIBRATION.

TESTED BY STEVEN A. WOOD DATE 1-18-83 SPECIMEN PASSED ✓YES NO

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N/C	A					

DATA SHEET "F"
RANDOM VIBRATION

DATE: 1-20-83

PSI PART No. 80303-1

PSI SERIAL No. 1B229 CLASS 1000

PSI PART NAME: HYDRAZINE SUPPLY TANK

TEST EQUIPMENT: H.P. 5427A DIGITAL VIBRATION CONTROL SYSTEM.

	REQUIREMENT	ACTUAL
WEIGHT OF WATER IN SPECIMEN:	71 ± 1 POUNDS	71 LBS
SPECIMEN PRESSURE:	330 ± 10 PSIG	332 PSIG
FASTENER TORQUE:	170 ± 5 INCH LBS.	170 INCH LBS
WATER RESISTIVITY:	500,000 OHMS MIN.	17 MEGOHMS
WATER pH:	5.5 - 8.0	7.0

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	dB/OCT	dB/OCT	RUN TIME	DATE
Z	20	150	12.3		+6		1 MIN	1-20-83
	150	1432		.0875				
	1432	2000				-6		

DATE	TIME	LOG ENTRIES
1-20-83	10:05	COMPLETED Z AXIS ACCEPTANCE VIBRATION.

TESTED BY STEVEN WOOD DATE 1-20-83 SPECIMEN PASSED ✓ YES

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PSI REPORT No. 56-000098
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N/C	A					

DATA SHEET "F"
RANDOM VIBRATION

DATE: 1-19-83

PSI PART No. 80303-1

PSI SERIAL No. 8279 CLASS 10001

PSI PART NAME: HYDRAZINE SUPPLY TANK

TEST EQUIPMENT: H.P. 5427A DIGITAL VIBRATION CONTROL SYSTEM.

	REQUIREMENT	ACTUAL
WEIGHT OF WATER IN SPECIMEN:	71 ± 1 POUNDS	71 LBS.
SPECIMEN PRESSURE:	330 ± 10 PSIG	332 PSIG
FASTENER TORQUE:	170 ± 5 INCH LBS.	170 INCH LBS.
WATER RESISTIVITY:	500,000 OHMS MIN.	17 MEGOHMS
WATER pH:	5.5 - 8.0	7.0

AXIS	FREQUENCY FROM	FREQUENCY TO	G RMS	G^2/Hz	dB/OCT	dB/OCT	RUN TIME	DATE
X	20	150	12.3		+6		1 MIN	1-19-83
	150	1432		.0875				
	1432	2000				-6		

DATE	TIME	LOG ENTRIES
1-19-83	10:30	COMPLETED X AXIS ACCEPTANCE VIBRATION.

TESTED BY STEVEN D WOOD DATE 1-19-83

SPECIMEN PASSED ✓YES
SPECIMEN FAILED NO

Proof Cycle

The water filled specimen was subjected to 100 proof pressure cycles. Each Cycle consisted of pressurizing the specimen between 610 and 615 psig, holding for one (1) minute, then decreasing the pressure to "0" psig.
Specimen measurements were taken prior to and after the 100 proof pressure cycles. No change in specimen size was measured compared to an allowable increase of 0.2 percent.

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DATA SHEET "G
LIFE CYCLE & EXPULSION EFFICIENCY

DATE: 1-29-83
PSI PART No. 80303-1
PSI SERIAL No. 0001
TEST EQUIPMENT: GAUGE, ASHCROFT NO. 5T0270 0-500 PSIG CALIB DUE 4-6-83, SCALE TOLEDO 8130 0-2000 LBS. CAL DUE PRIOR USE
PSI PART NAME: HYDRAZINE SUPPLY TANK

	ACTUALS	REQUIRED
WATER RESISTIVITY	17 MEG OHMS	500,000 OHMS MIN
WATER PH	7.2	5.5 - 8.0

TEST MEDIA: DEIONIZED WATER AND NITROGEN

LIFE CYCLE TESTS	ACTUAL	REQUIRED
LIFE CYCLE	SEE DATA SHEET "G-1"	100 CYCLES (1)
WATER LOADED	SEE DATA SHEET "G-1"	71 ± 1 LBS
TEST PRESSURE	SEE DATA SHEET "G-1"	330 ± 10 PSIG

NOTE: (1) EXPULSION EFFICIENCY SHALL BE MEASURED AFTER THE 100TH CYCLE

EXPULSION EFFICIENCY TEST	ACTUAL	REQUIRED
1. SPECIMEN & FIXTURE DRY WT. = W_D (FROM PARA. 4.8 C)	118.1	RECORD
2. SPECIMEN & FIXTURE LOADED WT. = W_L (FROM 100TH CYCLE)	189.1	RECORD
3. SPECIMEN & FIXTURE WET WT. = W_W (AFTER COMPLETE EXPULSION)	118.2	RECORD
4. EXPULSION EFFICIENCY	99.9 %	99.0% MINIMUM

$$\frac{W_L - W_W}{W_L - W_D} \times 100 = \text{EXPULSION EFFICIENCY}$$

STED BY: J. Ramellet DATE 1-29-83 SPECIMEN PASSED YES

Life Cycle & Expulsion Efficiency

The specimen was subjected to 100 loading and expulsion cycles with a simulated propellant load between 70 and 71.9 pounds of water and pressurized between 322 and 336 psig.
On the 100th cycle the specimen water load was expelled to completion and expulsion efficiency was measured and determined to be 99.9% compared to a minimum requirement of 99.0%.

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DATA SHEET "G"

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LIFE CYCLE & EXPULSION EFFICIENCY

CYCLE	H_2O LOAD LBS.	TEST PRESS. PSIG	CYCLE	H_2O LOAD LBS.	TEST PRESS. PSIG	CYCLE	H_2O LOAD LBS	TEST PRESS. PSIG	CYCLE	H_2O LOAD LBS.	TEST PRESS. PSIG
1	70.0	332	26	70.6	328	51	70.9	329	76	71.2	334
2	71.1	330	27	71.6	328	52	71.2	330	77	71.3	332
3	71.0	334	28	70.5	328	53	70.9	326	78	70.9	336
4	71.0	335	29	71.2	328	54	71.0	328	79	71.0	332
5	71.2	335	30	70.6	330	55	70.8	328	80	70.9	334
6	71.3	330	31	70.7	330	56	70.7	330	81	71.1	332
7	71.0	338	32	70.7	326	57	70.9	328	82	70.7	330
8	71.9	335	33	71.0	332	58	71.0	330	83	71.2	328
9	71.4	330	34	71.1	326	59	70.3	330	84	70.7	328
10	70.5	325	35	70.9	326	60	70.8	328	85	71.2	328
11	70.1	322	36	70.9	328	61	70.7	326	86	70.7	330
12	70.7	322	37	70.8	328	62	70.9	330	87	71.0	328
13	70.2	324	38	70.7	326	63	71.0	328	88	70.8	326
14	71.3	328	39	70.8	330	64	70.7	330	89	70.8	330
15	71.0	330	40	70.9	332	65	70.7	328	90	71.0	328
16	71.9	328	41	70.6	328	66	70.8	328	91	71.1	330
17	71.3	332	42	70.9	328	67	70.9	332	92	70.1	330
18	71.2	332	43	70.9	332	68	71.0	330	93	70.9	328
19	71.2	332	44	70.8	330	69	71.1	328	94	71.1	332
20	71.0	334	45	71.1	334	70	70.5	330	95	71.2	334
21	71.0	334	46	70.9	330	71	70.9	332	96	71.0	334
22	70.9	334	47	70.8	328	72	70.5	330	97	70.6	334
23	71.2	336	48	70.9	330	73	71.1	328	98	71.2	332
24	71.3	336	49	71.1	330	74	71.2	332	99	70.7	334
25	70.8	334	50	70.9	328	75	71.4	326	100	71.0	330

Burst Test

Burst tank pictures