

**QUALIFICATION ENVIRONMENTS**  
**FOR**  
**PROPELLANT TANK ASSEMBLY**  
**ATK P/N 80324-1**

**Table 1: P/N 80324-1 Propellant Tank Assembly  
Assembly Specifications**

<b>Parameters</b>	<b>Requirements</b>
Operating Pressure	400 psig
Proof Pressure	600 psig, Actual Proof: psig
Burst Pressure	850 psig, Actual Burst: 850 psig, Rupture @ 950 psig
External Pressure	Not Tested
Internal Vacuum	Not Tested
Material of Construction	Spherical Titanium 6AL-4V Pressure Vessel
Membrane Thickness	"
Tank Mount(s)	Mounting of specimen is provided by a polar boss and two mounting lugs with tapped holes near the girth.
Expulsion Efficiency	%
Design Fill Fraction	-
Tank Capacity	18,390 in <sup>3</sup>
Internal Dimensions	33.34" Ø spherical
Tank Weight	Maximum tank weight is 44.5 lbs (20.2 kg), Actual tank weight is 43.3 lb <sub>m</sub> (19.7 kg)
Propellant Capacity	lbs
Shell Leakage	<1x10 <sup>-6</sup> std cc/sec He max, Actual: 1x10 <sup>-7</sup> scc/sec He @ 402 psig
Failure Mode	Burst
Natural Frequency	-
Temperature Environment	-
On Orbit Life	-

**80324-1 was subjected to the following qualification tests:**

<u>Data Sheet</u>	<u>Title</u>
A	INSPECTION
B	PRE-PROOF INTERNAL VOLUME
C	PROOF PRESSURE
D	POST PROOF INTERNAL VOLUME
E	INTERNAL PRESSURE CYCLING (6 SHEETS)
F	DRAIN TEST AND DRYING
G	INTERNAL VACUUM CYCLING
H	LEAK TEST
I	RADIOGRAPHIC AND PENETRANT INSPECTION
J	CLEANLINESS
K	RESONANT FREQUENCY SEARCH (3 SHEETS)
L	ACCELERATION TEST (2 Sheets)
M	DRAIN TEST AND DRYING
N	RADIOGRAPHIC INSPECTION AND FINAL EXAMINATION OF PRODUCT
O	LEAK TEST
P	BURST PRESSURE
Q	PRESSURE CYCLE DATA LOG
R	SPECIMEN VACUUM FILLING
S	SPECIMEN DRYING
T	ACCELERATION TEST STRAIN GAGE DATA
U	BURST TEST STRAIN GAGE DATA

Note: The following tests are only discussed in the report

- 1) Pressure Cycle Data Log
- 2) Proof Pressure
- 3) Internal Pressure Cycling
- 4) Internal Vacuum Cycling
- 5) Resonant Frequency Search
- 6) Acceleration Test
- 7) Burst Pressure Test

## **Proof Pressure Test**

**Internal Pressure Cycling**

Tank is pressurized to 600, +20/-0 psig and held for 5 seconds maximum.  
Number of cycles is 5.

Tank is pressurized to 400, +20/-0 psig and held for 5 seconds maximum.  
Number of cycles is 91.

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TRW PSI Procedure No. 50-000312  
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DATA SHEET "E"  
(SHEET 1) B  
INTERNAL PRESSURE CYCLING

Date: SEPT 6, 1991

Part No. 80324-11

Test Para. No. 4.5 A) Serial No. 0003

Test Equipment: SF-0315 CAL 6-14-91 DUR 12-14-91/SF-0625

CAL 8-23-91 DUR 2-23-92/SF-0700 CAL 8-15-91 DUR 2-15-92

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (600, +20, -0 psig)	Time Period at 600 psig (5 seconds maximum)
	1-16	603 psig	5 Seconds
	2-17	600 psig	5 Seconds
	3-18	604 psig	5 Seconds
	4-19	602 psig	5 Seconds
	5-20	600 psig	5 Seconds

Specimen Deformation NONE (None Permitted)

Tested By Math Fucini Date 9-6-91 Specimen Passed YES

DATA SHEET "E"  
(SHEET 1) A  
INTERNAL PRESSURE CYCLINGDate: SEPT 6, 1991Part No. 80324-11Test Para. No. 4.5 A) Serial No. 0003Test Equipment: SI-0700 CAL 8-15-91 DUR 2-15-92SI-0625 CAL 8-23-91 DUR 2-23-92 / SI-0315 CAL 6-14-91DUR 12-14-91

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (600, +20, -0 psig)	Time Period at 600 psig (5 seconds maximum)
	1	608 psig	5 Seconds
	2	610 psig	5 Seconds
	3	602 psig	5 Seconds
	4	601 psig	5 Seconds
	5	602 psig	5 Seconds
	6	605 psig	5 Seconds
	7	600 psig	5 Seconds
	8	610 psig	5 Seconds
	9	601 psig	5 Seconds
	10	602 psig	5 Seconds
	11	603 psig	5 Seconds
	12	601 psig	5 Seconds
	13	605 psig	5 Seconds
	14	600 psig	5 Seconds
	15	600 psig	5 Seconds

DATA SHEET "E"  
(SHEET 2)  
INTERNAL PRESSURE CYCLING

Date: SEPT 6, 1991

Part No. 80324-11

Test Para. No. 4.5 B) Serial No. 0003

Test Equipment: ST-0625 CAL 8-23-91 DUE 2-23-92

ST-0315 CAL 6-14-91 DUE 12-14-91

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (400, +20, -0 psig)	Time period at 400 psig (5 seconds, maximum)
	1	401 psig	5 Seconds
	2	400 psig	5 Seconds
	3	402 psig	5 Seconds
	4	400 psig	5 Seconds
	5	404 psig	5 Seconds
	6	402 psig	5 Seconds
	7	402 psig	5 Seconds
	8	400 psig	5 Seconds
	9	400 psig	5 Seconds
	10	406 psig	5 Seconds
	11	402 psig	5 Seconds
	12	401 psig	5 Seconds
	13	400 psig	5 Seconds
	14	400 psig	5 Seconds
	15	402 psig	5 Seconds
	16	405 psig	5 Seconds
	17	402 psig	5 Seconds
	18	402 psig	5 Seconds

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DATA SHEET "E"  
(SHEET 3)  
INTERNAL PRESSURE CYCLING

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (400, +20, -0 psig)	Time period at 400 psig (5 seconds, maximum)
	19	403 psig	5 Seconds
	20	400 psig	5 Seconds
	21	400 psig	5 Seconds
	22	400 psig	5 Seconds
	23	401 psig	5 Seconds
	24	400 psig	5 Seconds
	25	410 psig	5 Seconds
	26	400 psig	5 Seconds
	27	400 psig	5 Seconds
	28	405 psig	5 Seconds
	29	402 psig	5 Seconds
	30	402 psig	5 Seconds
	31	400 psig	5 Seconds
	32	407 psig	5 Seconds
	33	402 psig	5 Seconds
	34	401 psig	5 Seconds
	35	405 psig	5 Seconds
	36	402 psig	5 Seconds
	37	400 psig	5 Seconds
	38	402 psig	5 Seconds
	39	400 psig	5 Seconds
	40	400 psig	5 Seconds

Wm. H. Beckley  
LMSE/JPA/DR 09/06/91



DATA SHEET "E"  
(SHEET 4)  
INTERNAL PRESSURE CYCLING

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (400, +20, -0 psig)	Time period at 400 psig (5 seconds, maximum)
	41	402 psig	5 Seconds
	42	403 psig	5 Seconds
	43	402 psig	5 Seconds
	44	402 psig	5 Seconds
	45	400 psig	5 Seconds
	46	402 psig	5 Seconds
	47	402 psig	5 Seconds
	48	401 psig	5 Seconds
	49	400 psig	5 Seconds
	50	405 psig	5 Seconds
	51	404 psig	5 Seconds
	52	402 psig	5 Seconds
	53	400 psig	5 Seconds
	54	402 psig	5 Seconds
	55	400 psig	5 Seconds
	56	400 psig	5 Seconds
	57	400 psig	5 Seconds
	58	401 psig	5 Seconds
	59	400 psig	5 Seconds
	60	400 psig	5 Seconds
	61	404 psig	5 Seconds
	62	402 psig	5 Seconds

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DATA SHEET "E"  
(SHEET 5)  
INTERNAL PRESSURE CYCLING

Test Media: Deionized Water


"D"	Cycle	Specimen Pressure (400, +20, -0 psig)	Time period at 400 psig (5 seconds, maximum)	
	63	400 psig	5	Seconds
	64	401 psig	5	Seconds
	65	400 psig	5	Seconds
	66	400 psig	5	Seconds
	67	402 psig	5	Seconds
	68	405 psig	5	Seconds
	69	408 psig	5	Seconds
	70	400 psig	5	Seconds
	71	402 psig	5	Seconds
	72	402 psig	5	Seconds
	73	400 psig	5	Seconds
	74	400 psig	5	Seconds
	75	400 psig	5	Seconds
	76	402 psig	5	Seconds
	77	405 psig	5	Seconds
	78	400 psig	5	Seconds
	79	402 psig	5	Seconds
	80	402 psig	5	Seconds
	81	400 psig	5	Seconds
	82	404 psig	5	Seconds
	83	410 psig	5	Seconds
	84	403 psig	5	Seconds

DATA SHEET "E"  
(SHEET 6)  
INTERNAL PRESSURE CYCLING

Test Media: Deionized Water

"D"	Cycle	Specimen Pressure (400, +20, -0 psig)	Time period at 400 psig (5 seconds, maximum)
	85	400 psig	5 Seconds
	86	402 psig	5 Seconds
	87	407 psig	5 Seconds
	88	401 psig	5 Seconds
	89	404 psig	5 Seconds
	90	402 psig	5 Seconds
	91	401 psig	5 Seconds

Specimen Deformation NONE (none permitted)

Tested By Maths Frusin Date 9-6-91 Specimen Passed YES  
 Witnessed By  N/A Date N/A Specimen Failed NO

## Internal Vacuum Cycling

Tank is evacuated to a pressure of 4500 microns or less and held for 5, +0.5/-0 minutes. Number of cycles is 10.

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### DATA SHEET "G" INTERNAL VACUUM CYCLING

Date: SEPT 9, 1991

Part No. 80324-11

"D"  
Test Para. No. 4.7 Serial No. 0003

Test Equipment: S/N 100417 CAL 2-25-91 DMR 2-25-92  
(S/P 1753) VACUUM GAUGE

Cycle	Specimen Pressure (4500 Microns or Less)		Test Period (5, +0.5, -0 Minutes)	
1	3200	microns	5	min
2	3000	microns	5	min
3	3200	microns	5	min
4	4500	microns	5	min
5	4200	microns	5	min
6	3200	microns	5	min
7	4000	microns	5	min
8	3000	microns	5	min
9	4000	microns	5	min
10	3200	microns	5	min

Final Cycle - Back Fill With He/Dry N<sub>2</sub>  QC

Specimen Deformation NONE (None Permitted)

Tested By Matho Fuscin Date 9-9-91 Specimen Passed YES

Witnessed By (Signature) N/A Date N/A Specimen Failed NO

## Resonant Frequency

<u>Test Condition</u>	<u>Specimen Loading</u>
1	Empty
2	267, +10, -0 lb water
3	587, +10, -0 lb water
4	418, +10, -0 lb freon
5	920, +10, -0 lb freon

Tank is also pressurized to 400, +15/-0 psig.

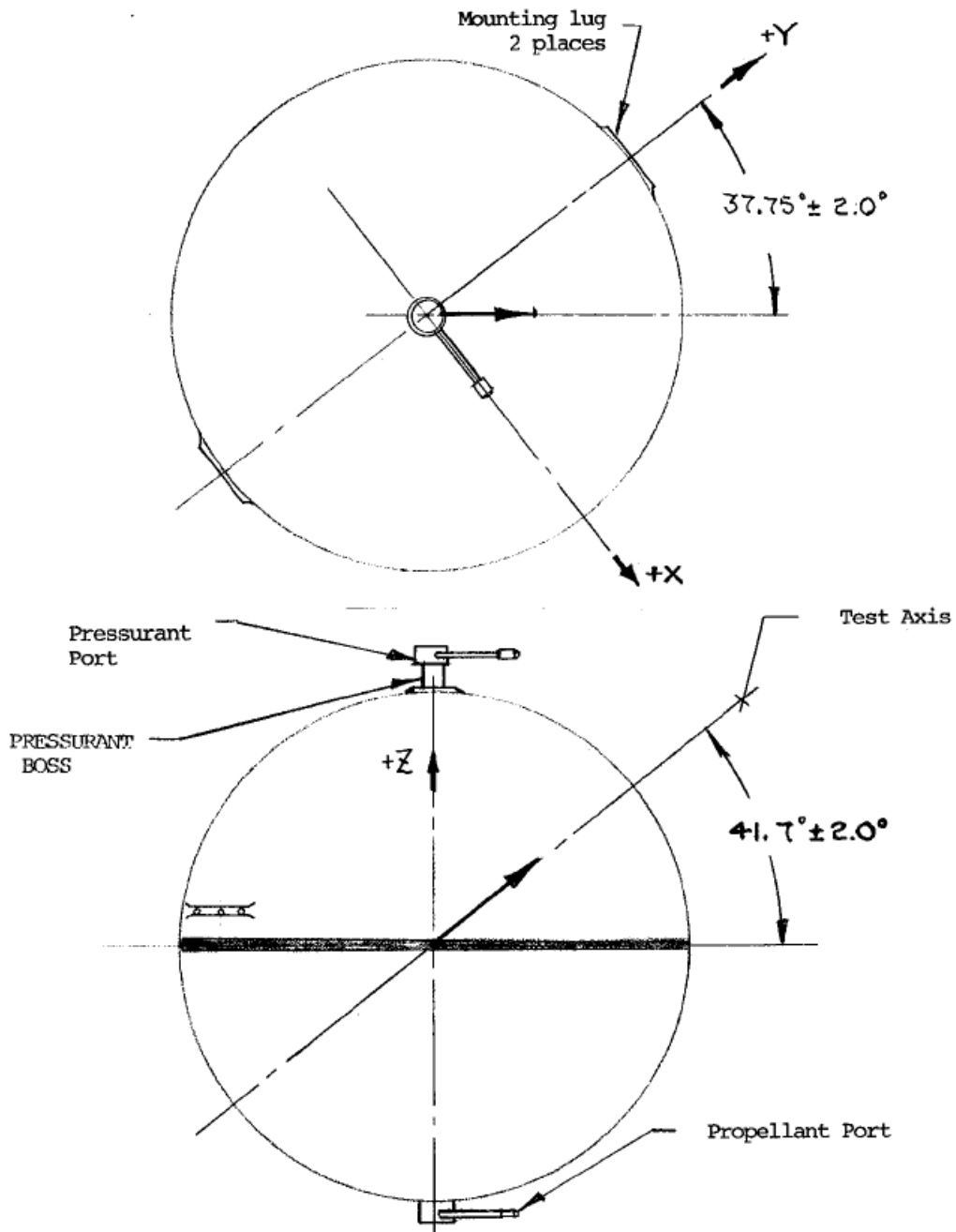
Resonant frequency is found by using an impulse hammer to generate the required frequency (5 – 2000 Hz). Tank is excited with impulse hammer in the +X, +Y, and +Z axis direction.

## Acceleration Test

Acceleration test conducted at  $17.93 \pm 1.5$  G in the two directions along the axis defined below.

Tank is loaded with 920,  $+5/-0$  lbs of Freon and pressurized to 400,  $+15/-0$  psig.

A total of 4 cycles in each orientation is performed.



## Burst Pressure Test

The tank design burst pressure is 850 psig.

The actual burst pressure was 950 psig.

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### DATA SHEET "P" BURST PRESSURE

Date: 9-17-91

Part No. 80324-11

Test Para. No. 4.18 Serial No. 0003

Test Equipment: ST-00621 CAL 5-20-91 QWL 11-20-91 / ST-0625

CAL 8-23-91 QWL 2-23-92 / ST-0716 CAL 7-17-91 QWL 1-17-92

Test Media: Deionized Water

	<u>Record</u>	<u>Required</u>
A) Specimen Temperature	<u>71</u> °F	<u>Record</u>
B) Design Burst Pressure ( $=P_B$ ) (from Paragraph 4.18 C)	<u>850</u> psig	<u>Record</u>
C) Specimen Test Pressure	<u>850</u> psig	<u><math>P_B</math>, +10, -0 psig</u>
D) Time at Burst Pressure	<u>8</u> sec	<u>10 seconds maximum</u>
E) Specimen Failure Pressure	<u>950</u> psig	<u><math>P_B</math> psig minimum</u>

Tested By Math Emission Date 9-17-91 Specimen Passed Yes

Witnessed By [Signature] SPA Date 9-17-91 Specimen Failed NO