

**QUALIFICATION ENVIRONMENTS**  
**FOR**  
**PROPELLANT TANK ASSEMBLY**  
**ATK P/N 80356-1**

ATK P/N 80356-1 PMD Tank



**Table 1: P/N 80356-1 Propellant Tank Assembly Specifications**

<b>Parameters</b>	<b>Requirements</b>
Operating Pressure	325 psig
Proof Pressure	439 psig, Actual Proof: 440 psig
Burst Pressure	508 psig, Actual Burst: 787 psig
External Pressure	Not Tested
Internal Vacuum	Not Tested
Material of Construction	All-welded, machined 6AL-4V titanium pressure vessel including an internal vane-type propellant management device.
Membrane Thickness	0.037"
Tank Mount(s)	
Expulsion Efficiency	99.8 %
Design Fill Fraction	-
Tank Capacity	27758 in <sup>3</sup>
Internal Dimensions	28" Ø x 48.5" cylindrical
Tank Weight	Maximum tank weight is 60 lbs, Actual tank weight is 57.75 lbs
Propellant Capacity	650 lbs
Shell Leakage	<1x10 <sup>-6</sup> std cc/sec He max, Actual: 9.5x10 <sup>-10</sup> scc/sec He @ 330 psig
Failure Mode	N/A
Natural Frequency	-
Temperature Environment	-
On Orbit Life	-

80356-1 was subjected to the following qualification tests:

<u>Test Sequence</u>	<u>Test Description</u>	<u>I</u>
1.	Preliminary Inspection of Product	
2.	Radiographic & Penetrant Inspection	
3.	Volumetric Capacity Test	
4.	Proof Pressure Test	
5.	Post Proof Volumetric Capacity Test	
6.	External Leakage Test	
7.	Radiographic and Penetrant	
8.	Weight Measurement	
9.	Final Dimension Inspection	
10.	Cleanliness Tests	
11.	Flow Rate and Pressure Drop Test	
12.	Cyclic Pressurization Test	
13.	Static Acceleration Test	
14.	Natural Frequency Test	
15.	Leak Test	
16.	Radiographic and Penetrant Inspection	
17.	Burst Pressure Test	
18.	Preparation for Delivery	

Note: The following tests are only listed in this report.

- 1) Pressure Log
- 2) Proof Pressure Test
- 3) Cyclic Pressurization Test
- 4) Static Acceleration Test
- 5) Natural Frequency Test
- 6) Burst Pressure Test

# Pressure Log

TRW PRESSURE SYSTEMS, INC.

DATA SHEET "A"  
PRESSURE LOG

TRW PSI Procedure No. 50-000366  
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Propellant  
Part Name: Tank Assembly

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Item	Performing Department	Fluid Medium	Title of Test	Specification Pressure	Actual Pressure	No. Cycles	Date
4.3	70	H <sub>2</sub> O	PROOF PRESSURE	439 <sup>+10</sup> <sub>-0</sub> PSIG	440 PSIG	1	9/18/90
4.6	70	He	EXTERNAL LEAK	325 <sup>+10</sup> <sub>-0</sub> PSIG	330 PSIG	1	9/19/90
4.9	70	H <sub>2</sub> O/GN <sub>2</sub>	FLOW RATE AND PRESSURE DROP	325 <sup>+8</sup> <sub>-0</sub> PSIG	326 PSIG	1	10/4/90
4.10	70	H <sub>2</sub> O/GN <sub>2</sub>	1.25 MBP CYCLE TEST	405 <sup>+5</sup> <sub>-0</sub> PSIG	406-408 PSIG	8	10-4-90
4.10.2	70	H <sub>2</sub> O/GN <sub>2</sub>	MBP CYCLE TEST	325 <sup>+5</sup> <sub>-0</sub> PSIG	325-327 PSIG	68	10-4-90
4.11	70/OP	H <sub>2</sub> O/GN <sub>2</sub>	ACCELERATION	325 <sup>+10</sup> <sub>-0</sub> PSIG	325 PSIG	3	11/2/90
4.12	70/OP	H <sub>2</sub> O/GN <sub>2</sub>	NATURAL FREQ.	325 <sup>+10</sup> <sub>-0</sub> PSIG	330 PSIG	1	12/13/90
4.13	70	He	EXTERNAL LEAK	325 <sup>+10</sup> <sub>-0</sub> <del>328</del> PSIG	328 PSIG	1	12/18/90
4.15	70	H <sub>2</sub> O	BURST	PB MIN. 508 PSIG	787 PSIG	1	12/20/90

**Proof Pressure Test**

Tank is pressurized to a pressure of 440 psig and held for a test period of thirty (30) seconds. One cycle is performed.

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DATA SHEET "D"  
PROOF PRESSURE

Date: 9/18/90  
TRW PSI Part No. 80356-11  
TRW PSI Serial No. DD03  
Propellant  
Paragraph No. 4.3, 4.5 TRW PSI Part Name: Tank Assembly  
Test Equipment: GAUGE: S/N 62515 #ST-0625 CALIB 9/5/90 DUE 3/5/91

Test Media: Distilled/Deionized Water

	<u>Actual</u>	<u>Required</u>
A) Specimen Pressure	<u>440 psig</u>	<u>439, +10.0, -0.0 psig</u>
B) Test Period	<u>30 sec.</u>	<u>30, +3, -0 seconds</u>
C) Cycle	<u>1 cycle</u>	<u>One (1) Cycle</u>
D) Deformation	<u>NONE</u>	<u>None</u>
E) Specimen Drying (4.5)	<u>-72 deg. F</u>	<u>-65 degree F maximum Dewpoint</u>
F) Pressurization Rate	<u>* psig/min.</u>	<u>100-300 psig/min.</u>

\* MEASUREMENTS TAKEN @ INCREMENTAL PRESSURE STEPS PER TRW/ATD INSTRUCTIONS 9/18/90  
PER SIR #569293

Tested By: [Signature] Date 9/18/90 Specimen Passed YES

**Cyclic Pressurization Test**

Tank is completely filled with water.

Tank is pressurized to 405, +5/-0 psig and held for a minimum of 10 seconds.

Number of cycles is 8.

Tank is pressurized to 325, +5/-0 psig and held for a minimum of 10 seconds.

Number of cycles is 68.

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DATA SHEET "J"  
MOP CYCLE TEST (68 CYCLES)  
PAGE 1 OF 4

Date: 10/4/90

TRW PSI Part No. 80356-11

Customer Serial No. 101

TRW PSI Serial No. 0003

Paragraph No. 4.10, 4.10.2

Propellant  
TRW PSI Part Name: Tank Assembly

Test Equipment: Gauge: S/N 62515 # ST-0625 CALIB 9/5/90 DUE 2/5/91

Date	Cycle No.	Pressure Ambient psig (10 psig or Less)	Test Pressure 325, +5, -0 psig	Time at Test Press. Sec. (10 Sec Min.)	Operator Stamp
	1	0	326	10	
	2	0	328	11	
	3	0	326	12	
	4	0	327	11	
	5	0	326	11	
	6	0	326	12	
	7	0	326	12	
	8	0	326	11	
	9	0	328	11	
	10	0	326	11	
	11	0	325	11	
	12	0	325	11	
	13	0	326	11	
	14	0	325	11	
	15	0	328	12	
	16	0	326	11	
	17	0	325	11	
	18	0	326	11	



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DATA SHEET "J"  
MOP CYCLE TEST (68 CYCLES)  
PAGE 2 OF 4

Date: 10/4/90

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Paragraph No. 4.10, 4.10.2

Propellant

TRW PSI Part Name: Tank Assembly

Test Equipment: SEE PAGE 1 OF 4

Date	Cycle No.	Pressure Ambient psig (10 psig or Less)	Test Pressure 325, +5, -0 psig	Time at Test Press. Sec. (10 Sec Min.)	Operator Stamp
	19	0	326	11	
	20	0	327	11	
	21	0	326	11	
	22	0	326	11	
	23	0	326	11	
	24	0	326	11	
	25	0	326	11	
	26	0	326	11	
	27	0	326	11	
	28	0	326	11	
	29	0	326	11	
	30	0	326	11	
	31	0	326	11	
	32	0	326	11	
	33	0	326	11	
	34	0	326	11	
	35	0	326	11	
	36	0	326	11	

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DATA SHEET "J"  
MOP CYCLE TEST (68 CYCLES)  
PAGE 3 OF 4

Date: 10/4/90

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Paragraph No. 4.10, 4.10.2

Propellant

TRW PSI Part Name: Tank Assembly

Test Equipment: See page 1 of 4

Date	Cycle No.	Pressure Ambient psig (10 psig or Less)	Test Pressure 325, +5, -0 psig	Time at Test Press. Sec. (10 Sec Min.)	Operator Stamp
	37	0	326	11	
	38	0	328	11	
	39	0	324	11	
	40	0	327	12	
	41	0	325	11	
	42	0	325	11	
	43	0	325	11	
	44	0	325	11	
	45	0	324	11	
	46	0	325	11	
	47	0	324	11	
	48	0	326	11	
	49	0	326	11	
	50	0	326	11	
	51	0	326	11	
	52	0	326	11	
	53	0	325	11	
	54	0	326	11	

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DATA SHEET "J"  
MOP CYCLE TEST (68 CYCLES)  
PAGE 4 OF 4

Date: 10/4/90

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Paragraph No. 4.10, 4.10.2

TRW PSI Part Name: Tank Assembly

Test Equipment: see page 1 of 4

Date	Cycle No.	Pressure Ambient psig (10 psig or less)	Test Pressure 325, +5, -0 psig	Time at Test Press. Sec. (10 Sec Min.)	Operator Stamp
	55	0	326	11	PSI 28
	56	0	327	11	PSI 28
	57	0	326	11	PSI 28
	58	0	326	11	PSI 28
	59	0	326	11	PSI 28
	60	0	326	11	PSI 28
	61	0	326	11	PSI 28
	62	0	327	11	PSI 28
	63	0	327	11	PSI 28
	64	0	326	11	PSI 28
	65	0	326	11	PSI 28
	66	0	326	11	PSI 28
	67	0	326	11	PSI 28
	68	0	326	11	PSI 28

Specimen Deformation NONE (None Permitted)

Tested By: Mutta Fawcett Date 10-4-90 Specimen Passed YES

## Static Acceleration Test

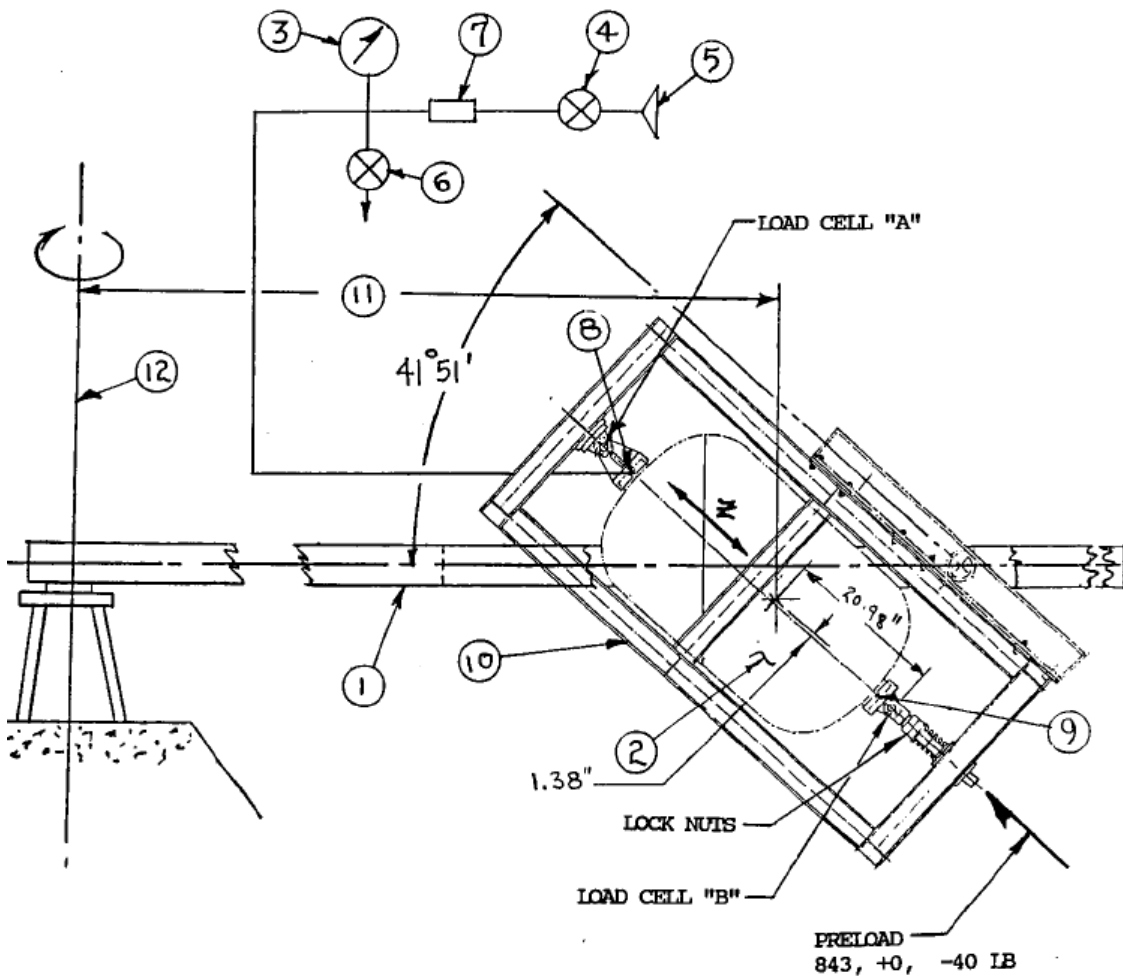
Acceleration test is conducted at 15.81 g's along the defined axis in figure.

Tank is loaded with 583, +10/-0 lbs of distilled, deionized water and pressurized to 325, +10/-0 psig with gaseous nitrogen.

Final load cell requirements:

7184, +640, -0 lbs (axial force) for load cell "A"

3886, +335, -0 lbs (shear force) for load cell "B"



- |                             |                                |
|-----------------------------|--------------------------------|
| 1. CENTRIFUGE ARM           | 7. FILTER                      |
| 2. SPECIMEN                 | 8. PRESSURANT PORT (GAS)       |
| 3. PRESSURE GAGE            | 9. PROPELLANT PORT (FUEL)      |
| 4. PRESSURE REGULATOR VALVE | 10. TEST FIXTURE (T-4278 HOFX) |
| 5. NITROGEN PRESSURE SUPPLY | 11. CENTRIFUGE ARM DISTANCE    |
| 6. NITROGEN VENT VALVE      | 12. SPIN AXIS                  |

DATA SHEET "K"  
ACCELERATION TEST

Date: 11/2/90

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Test Equipment: \_\_\_\_\_

Propellant  
TRW PSI Part Name: Tank Assembly

SCALE: E-0723 CALIB PRIOR TO USE; GAUGE: ST-0270 CALIB 8/9/90 DUE 2/9/91

	<u>Actual</u>	<u>Required</u>
Specimen Loading (water)	<u>584 lbs</u>	<u>583, + 10, - 0 lb</u>
Specimen Pressure	<u>330 psig</u>	<u>325, + 10, - 0 psig</u>
Bolt Torque to 68 to 76 in-lbs.	<u>YES</u>	<u>Compliance</u>
Test Direction	<u>41°48'</u>	<u>41 deg 51' +/- 1 deg</u>
Test Period	<u>34 sec</u> <del>1 min</del> <u>191</u>	<u>1 minute minimum</u>

Centrifuge Arm Distance inches	Centrifuge RPM	Acceleration Level
<u>257"</u>	<u>46.2</u>	<u>16.0g</u>

Loadcell Reading	STEP A)	STEP B)	STEP C)	STEP D)	STEP G)
Loadcell "A"	<u>* N/A</u>	<u>175 <sup>lb</sup> <sub>g</sub></u>	<u>473 lb</u>	<u>* N/A</u>	<u>5681 lb *</u>
Loadcell "B"	<u>* N/A</u>	<u>31 lb</u>	<u>258 lb</u>	<u>* N/A</u>	<u>4040 lb</u>

Tested By: Richard A. Ventura Date 11-2-90 Specimen Passed N/D

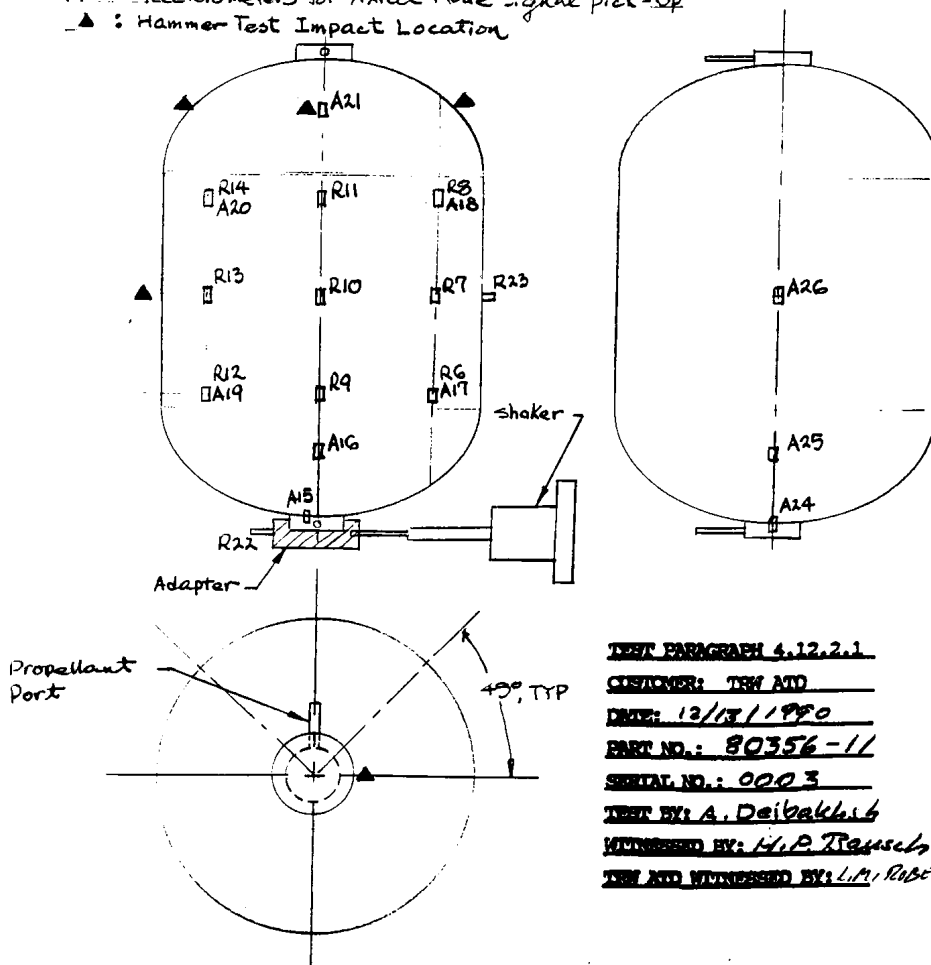
# Natural Frequency Test Set-Up

TSW PRESSURE SYSTEMS, INC.

TSW PSI Procedure No. 50-000366  
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DATA SHEET "L"  
SHEET 1 OF 2  
NATURAL FREQUENCY TEST  
LOCATION OF INPUT FORCE AND ACCELEROMETERS

R# : Accelerometers for Radial Mode Signal Pick-Up  
A# : Accelerometers for Axial Mode Signal Pick-Up  
▲ : Hammer Test Impact Location



TEST PARAGRAPH 4.12.2.1  
CUSTOMER: TSW ATD  
DATE: 12/13/1990  
PART NO.: 80356-11  
SERIAL NO.: 0003  
TEST BY: A. Deibekhs  
WITNESSED BY: H.P. Trussel  
TSW ATD WITNESSED BY: L.M. ROBERTSON

**Natural Frequency Test**

Tank is loaded with 650, +10/-0 lbs of D.I. water and pressurized to 325, +10/-0 psig. A constant amplitude force is conducted, sweeping from 5 – 200 Hz to identify the first 5 natural frequencies. Test is started with small force that is not to go beyond 100 lb.

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DATA SHEET "L"  
SHEET 2 OF 2  
NATURAL FREQUENCY TEST

Date: 12/13/90

TRW PSI Part No. 80356-11

TRW PSI Serial No. 0003

Test Equipment: SEE WPLC Equip LIST

Propellant  
TRW PSI Part Name: Tank Assembly

SCALE CALIB 12/6/90 DUE 12/6/91; GAUGE L-014 CALIB 11/6/90 DUE 5/6/91

A) TRW test fixture approval and authorization to proceed (Paragraph 4.12.1.1)

[Signature] 12/13/90  
(Signature) [Signature]  
12-12-90

	<u>Record</u>	<u>Required</u>
B) Specimen water load	<u>650</u> lb	650, +10, -0 lb
C) Specimen pressure	<u>325</u> psig	325, +10, -0 psig
D) Specimen stabilization time	<u>&gt;10</u> minutes	10.0 Minutes min.
E)* The first five natural frequencies of the specimen	1) <u>53.4 ± .5</u> Hz 2) <u>75</u> Hz 3) <u>124</u> Hz 4) <u>133</u> Hz 5) <u>152</u> Hz	> 50 Hz > 50 Hz > 50 Hz > 50 Hz > 50 Hz

Tested By: ANIR DEBBAKISH Date 12/13/90 Specimen Passed ✓

**Burst Pressure**

The tank design burst pressure is 488 psig, normalized to 508 psig.

The actual burst pressure was 787 psig, normalized to 765.46 psig.



TRW PRESSURE SYSTEMS, INC.

TRW PSI Procedure No. 50-000366  
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DATA SHEET "O"  
BURST TEST

Date: 12/20/19  
 TRW PSI Part No. 80356-11  
 TRW PSI Serial No. 0003  
 Paragraph No. 4.15 TRW PSI Part Name: Propellant Tank Assembly  
 Test Equipment: Calvac SW 62515 & ST-0625 calvac 9/15/19 DVC 2/15/19  
Pressuremeter ST-0908 calvac 9/15/19 DVC 2/15/19

Test Media: Deionized Water

	<u>Record</u>	<u>Required</u>
A) Specimen Temperature	<u>59</u> deg. F	<u>Record</u>
B) Design Burst Pressure (=P <sub>B</sub> ) (from Paragraph 4.15 C)	<u>508</u> psig	<u>Record</u>
C) Specimen Test Pressure	<u>508</u> psig	P <sub>B</sub> ± 10  <u>+20, -0</u> psig
D) Time at Burst Pressure	<u>11</u> sec	<u>10 to 60 seconds</u>
E) Specimen Failure Pressure	<u>787</u> psig	P <sub>B</sub> MINIMUM  <u>488, +20, -0</u> psig min.
F) Pressurization Rate	<u>200</u> psig/min.	<u>100 - 300 psig/minute</u>

Tested By:   Date 12/20/19 Specimen Passed YES



**Burst Tank Pictures**

