

**QUALIFICATION ENVIRONMENTS**  
**FOR**  
**ETS8 PROPELLANT TANK ASSEMBLY**  
**ATK P/N 80411-1**

**Table 1: P/N 80411-1 ETS8 Propellant Tank Assembly**

<b>Parameters</b>	<b>Requirements</b>
Operating Pressure	psig
Proof Pressure	psig, Actual Proof: psig
Burst Pressure	psig, Actual Burst: psig
External Pressure	
Internal Vacuum	
Material of Construction	
Membrane Thickness	inch
Tank Mount(s)	
Expulsion Efficiency	%
Design Fill Fraction	
Tank Capacity	in <sup>3</sup>
Internal Dimensions	" Ø x "
Tank Weight	
Propellant Capacity	lbs
Shell Leakage	<1x10 <sup>-6</sup> std cc/sec He max, Actual: <sup>-8</sup> scc/sec He @ 335 psig
Failure Mode	
Natural Frequency	
Temperature Environment	
On Orbit Life	

**80411-1 was subjected to the following qualification tests:**

<b><u>Test Sequence</u></b>	<b><u>Test Description</u></b>
1	Preliminary Inspection of Product
2	Mass Measurement
3	Pre-Proof Volumetric Capacity, Ambient Proof Pressure, Visual Inspection, and Post-Proof Volumetric Capacity
4	External Leakage Test
5	Tank Assembly Bubble Point Test
6	Pressure Cycling Test & Visual Inspection
7	Sine and Random Vibration Test, Visual Inspection and Cleanliness Check
8	Shock Test & Visual Inspection
9	Volumetric Capacity & Expulsion Test
10	Tank Assembly Bubble Point Test
11	External Leakage Test
12	Radiographic Inspection
13	Dye Penetrant Inspection
14	Cleanliness Check
15	Burst Test & Visual Inspection
16	Data Review

Note: The following tests are only listed in this report

- 1) Ambient Proof Pressure
- 2) Pressure Cycling Test
- 3) Sine and Random Vibration Test
- 4) Shock Test
- 5) Burst Test

## **Pressure Cycling**

### **Internal Pressure**

Tank is pressurized to 312.5, +10/-0 psig and held for 5 seconds maximum.  
Number of cycles is 5.

Tank is pressurized to 250, +5/-0 psig and held for 5 seconds maximum.  
Number of cycles is 50.

### **External Pressure**

Tank is evacuated to a differential pressure of 3.5, +0.1/-0 psid and held for 30,  
+6/-0 seconds. Number of cycles is 5.

## **Vibration Tests**

The vibration tests shall be performed in the following sequence.

Dry Sine & Random – All Axes  
Wet Random – One Axis (X, Y, or Z)  
Wet Random – 2<sup>nd</sup> Axis  
Wet Random – 3<sup>rd</sup> Axis  
Wet Sine – One Axis (X, Y, or Z)  
Wet Sine – 2<sup>nd</sup> Axis  
Wet Sine – 3<sup>rd</sup> Axis

## Sine Vibration

### Qualification Sine Vibration Levels (Dry)

<u>AXIS</u>	<u>FREQUENCY (HZ)</u>	<u>ACCELERATION (G) (0-PEAK)</u>
Lateral (X & Y)	5-13	.25 inch SA
	13-17	4.3
	17-45	3.0
	45-100	2.0
Axial (Z)	5-20	.25 inch SA
	20-24	10.2
	24-50	2.6
	50-100	1.3

Tank is pressurized to 100, +0/-10 psig.

### Qualification Sine Vibration Levels (Wet)

<u>AXIS</u>	<u>FREQUENCY (HZ)</u>	<u>ACCELERATION (G) (0-PEAK)</u>
Lateral (X & Y)	5-13	.25 inch SA
	13-17	4.3
	17-45	3.0
	45-100	2.0
Axial (Z)	5-20	.25 inch SA
	20-24	10.2
	24-50	2.6
	50-100	1.3

Tank is filled with 4363, +5/-0 lb of PF-5060 fluid and pressurized to 250, +0/-10 psig.

### Acceleration Load Limits

<u>AXIS</u>	<u>FREQUENCY (HZ)</u>	<u>ACCELERATION (G) (0-PEAK)</u>
Lateral (X & Y)	5-100	5.0
Axial (Z)	5-100	8.75

## Random Vibration

### Random Vibration Levels (Dry)

<u>Frequency (HZ)</u>	<u>Levels</u>
20-100	+6dB/Octave
100-800	.054G <sup>2</sup> /Hz
800-2000	-3dB/Octave
Overall G-rms	8.7

The 8.7 G-rms random vibration spectrum may be split into two bands, if necessary, to meet vibration shaker equipment limitations.

Tank is pressurized to 100, +0/-10 psig.

### Random Vibration Levels (Wet)

<u>Frequency (HZ)</u>	<u>Levels</u>
20-100	+6dB/Octave
100-800	.054G <sup>2</sup> /Hz
800-2000	-3dB/Octave
Overall G-rms	8.7

The 8.7 G-rms random vibration spectrum may be split into two bands, if necessary, to meet vibration shaker equipment limitations.

Tank is filled with 3038, +5/-0 lb of distilled, deionized water and pressurized to 250, +0/-10 psig.

### Acceleration Load Limits

<u>AXIS</u>	<u>FREQUENCY (HZ)</u>	<u>ACCELERATION (G) (0-PEAK)</u>
Lateral (X & Y)	20-2000	5.0
Axial (Z)	20-2000	8.75

## **Shock Test**

<b><u>FREQUENCY (HZ)</u></b>	<b><u>SHOCK RESPONSE SPECTRUM (SRS)</u></b>
100-1500 1500-4000	+8dB/Octave 715G

Tank is empty and pressurized to 100 psig.

Test is conducted so that responses are obtained in each of the three orthogonal axes.

Test is conducted twice.



## **Burst Test**

The tank design burst pressure is 375 psig.

The actual burst pressure is N/A.