

QUALIFICATION ENVIRONMENTS

FOR

TANK, ULLAGE GAS

ATK P/N 80221-1

Table 1: P/N 80221 Tank, ULLAGE GAS Specifications

Parameters	Requirements
Operating Pressure	3000 psig
Proof Pressure	4840 psig, Actual Proof: 4850 psig
Burst Pressure	6000 psig, Actual Burst: Not tested
External Pressure	Not tested
Internal Vacuum	Not tested
Material of Construction	Medium weight spherical 6AL-4V titanium tank. There is one (1) polar port terminating in a ½ inch stainless steel/titanium transition tube. Inside the tank, welded to the transition tube, is a titanium scavenging tube.
Membrane Thickness	"
Tank Mount(s)	The tank is mounted on a threaded fitting at the polar port and on a smooth boss at the opposite polar port.
Expulsion Efficiency	-
Design Fill Fraction	-
Tank Capacity	5371.2 in ³
Internal Dimensions	22.50" Ø spherical
Tank Weight	Maximum tank weight is 57.0 lbs, Actual tank weight is 53.31lbs
Propellant Capacity	-
Shell Leakage	<1x10 ⁻⁶ std cc/sec He max, Actual: 6.0x10 ⁻⁸ std cc/sec He @ 24 psia
Failure Mode	Burst
Natural Frequency	-
Temperature Environment	-
On Orbit Life	-

80221-1 was subjected to the following qualification tests:

TEST SEQUENCE NUMBER	DESCRIPTION OF TEST
1	EXAMINATION OF PRODUCT
2	SCAVENGING TEST
3	VOLUMETRIC CAPACITY
4	PROOF PRESSURE
5	LEAKAGE
6	RADIOGRAPHIC & PENETRANT INSPECTION
7	EXAMINATION OF PRODUCT
8	PROOF PRESSURE
9	TEMPERATURE SENSOR TEST
10	INSULATION RESISTANCE
11	VIBRATION*
12	BLOWDOWN TEST
13	SCAVENGING TEST
14	PROOF PRESSURE
15	LEAKAGE
16	TEMPERATURE SENSOR TEST
17	POST TEST INSPECTION
18	WEIGHT
19	CLEANLINESS TEST**

The following tests are listed in this document:

- 1) Proof Pressure Test
- 2) Temperature Sensor Test
- 3) Insulation Resistance
- 4) Vibration Test
- 5) Blowdown Test
- 6) Scavenging Test

Proof Pressure Test

Tank is pressurized to 4860 psig and held for a pressure hold duration for five minutes. Two cycles are performed.



PSI Test Procedure No. 50-000173
PAGE 19

N.F.I.

PROOF PRESSURE
DATA SHEET

REV	H/C						
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DATE 12-10-74

PSI PART No. 80221-1

CCA No. 3789-1008

PSI SERIAL No. 0002

TEST PROCEDURE PARA. No. 6.4

DESCRIPTION: TANK, ULLAGE GAS

TEST EQUIPMENT GAUGE STO153 CALIB DUE 2-20-75

TEST MEDIUM: <u>DISTILLED AND DEIONIZED WATER</u>		TEST VALUE	REQUIREMENT
SPECIMEN PRESSURE		<u>4850</u> PSIG	<u>4840, +50, -0</u> PSIG
NUMBER OF PRESSURE CYCLES		<u>2</u>	<u>2</u>
PRESSURE HOLD DURATION		<u>5</u> MIN	<u>5 MINUTES MIN.</u>

<p>* PRE TEST</p> <p>A <u>22.133</u></p> <p>B <u>22.267</u></p> <p>C <u>22.167</u></p>		<p>POST TEST</p> <p>A <u>22.134</u></p> <p>B <u>22.268</u></p> <p>C <u>22.166</u></p>
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EXACT DIAMETRAL LOCATIONS SHALL BE MARKED USING WATERPROOF INK AT PRE-TEST MEASUREMENT TO ASSURE SAME LOCATIONS FOR POST TEST MEASUREMENTS.

REMARKS: PRE & POST TEST DIMENSIONS AGREE WITHIN THE ACCURACY OF THE INSTRUMENT. *Jackson*

LMSC
DATE REVIEW 12-15
DATE

TESTED BY Les Kane DATE 12-10-74 SPECIMEN PASSED

Temperature Sensor Installation Integrity

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

PSI TEST PROCEDURE No. 50-000179
PAGE 21



N.F.I.

TEMPERATURE SENSOR
INSTALLATION INTEGRITY
DATA SHEET

REV	N/C						
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DATE 12-17-74
 PSI PART No. 80221-1
 CCA No. 3789 -1008 PSI SERIAL No. 0002
 TEST PROCEDURE PARA. No. 6.7.1 DESCRIPTION: TANK, ULLAGE GAS
 TEST EQUIPMENT GAUGE ST 0153 CALIB DUE 2-20-75

TEST MEDIUM: <u>DISTILLED AND DEIONIZED WATER</u>		
	<u>TEST VALUE</u>	<u>REQUIREMENT</u>
SPECIMEN PRESSURE	<u>4850</u> PSIG	4840, +50, -0 PSIG
PRESSURE HOLD DURATION	<u>5</u> MIN	5 MINUTES, MINIMUM
NUMBER OF PRESSURE CYCLES	<u>ONE</u>	1
DAMAGE NOTED	<u>RECORD BELOW</u>	NONE
<u>NO VISUAL DAMAGE</u>		

TESTED BY Les Rose  DATE 12-17-74 SPECIMEN PASSED 1 

N. F. I.

REV	N/C						
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TEMPERATURE SENSOR TEST
DATA SHEET

CUSTOMER: LOCKHEED MISSILES & SPACE Co. DATE DEC 18 - 1974
 PART No. 8109089-1 PSI PART No. 80221-1
 CCA No. 3789 -1008 PSI SERIAL No. 0002
 TEST PROCEDURE PARA. No. 6.7.2 DESCRIPTION: TANK, ULLAGE GAS
 TEST EQUIPMENT: OHMMETER E-0396 (6-13-75)
POTENTIOMETER E-0215 (5-27-75)

TEMPERATURE SENSOR, ADJACENT TO GIRTH WELD A-B				
NOMINAL TEST TEMP. (°F)	TA - ACTUAL TEST TEMP. (°F)	R1-MEASURED RESISTANCE (OHMS)	*TS-INDICATED TEMPERATURE (±10° F MAX ALLOW)	TA-Ts
ROOM AMBIENT	66 °F	4780	65 °F	-1 °F
90	91 °F	5300	92 °F	+1 °F
110	110 °F	5700	112 °F	+2 °F
130	135 °F	6210	136 °F	+9 °F
150	149 °F	6570	152 °F	+3 °F
185	187 °F	7480	192 °F	+5 °F

TEMPERATURE SENSOR, ADJACENT TO SCAVENGING TUBE C-D				
NOMINAL TEST TEMP. (°F)	TA-ACTUAL TEST TEMP. (°F)	R1-MEASURED RESISTANCE (OHMS)	*TS-INDICATED TEMPERATURE	TA-Ts (±3° F MAX ALLOW)
ROOM AMBIENT	66 °F	4770	65 °F	-1 °F
90	89 °F	5260	90 °F	+1 °F
110	106 °F	5620	108 °F	+2 °F
130	135 °F	6240	135 °F	-0 °F
150	147 °F	6530	150 °F	+3 °F
185	187 °F	7470	190 °F	+3 °F

*OBTAIN FROM TEMPERATURE SENSOR CALIBRATION CURVE FOR THE PARTICULAR UNIT.

TESTED BY S. Carlson DATE 12-18-74 SPECIMEN PASSED
 WITNESSED BY R. J. Looney DATE 12/18/74 SPECIMEN FAILED

LMSC
DATA 5782
REVIEW 1675
DATE

Insulation Resistance Test

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

PSI TEST PROCEDURE No. 50-000179
PAGE 23

N.F.I.

INSULATION RESISTANCE
DATA SHEET

REV	N/C						
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DATE DEC. 18- 1974

PSI PART No. 80221-1

CCA No. 3789 -1008 PSI SERIAL No. 0002

TEST PROCEDURE PARA. No. 6.8 DESCRIPTION: TANK, ULLAGE GAS

TEST EQUIPMENT MEGOhmmeter - I-0430 (1-9-75)

TEST VOLTAGE: 50 ± 5 vdc**


TEMPERATURE: ROOM AMBIENT

CONNECTOR	MEASUREMENT POINTS	RESISTANCE*
J2	A' & TANK SHELL	✓
	B' & TANK SHELL	✓
	C' & TANK SHELL	✓
	D' & TANK SHELL	✓
J2	A' & CONNECTOR SHELL	✓
	B' & CONNECTOR SHELL	✓
	C' & CONNECTOR SHELL	✓
	D' & CONNECTOR SHELL	✓
J2	A' & C'	✓

*RESISTANCE SHALL NOT BE LESS THAN 1 MEGOHM. RECORD ACTUAL VALUES FOR RESISTANCE LESS THAN 10 MEGOHMS. ENTER A ✓ FOR ALL RESISTANCES 10 MEGOHMS AND GREATER.

**DURATION OF VOLTAGE APPLICATION SHALL BE 1.0 MINUTE MINIMUM AT EACH POINT.

TESTED BY Paulson 

DATE 12-18-74 SPECIMEN PASSED 

Sine Vibration (Dry)

FREQUENCY	ACCELERATION (0 TO PEAK)
5 - 50 cps	2.0g EXCEPT ATTENUATE TO MAINTAIN 0.50 D.A. MAX. WHERE NECESSARY
50 - 2000 cps	4.0g

- 1) SWEEP RATE: 2 MINUTES/OCTAVE
- 2) TOLERANCES:
 - A) VIBRATION AMPLITUDE (G OR INCHES) - $\pm 10\%$ OF PEAK LEVEL MEASURED AT INPUT FREQUENCY.
 - B) VIBRATION FREQUENCY (CPS) - $\pm 2\%$ OR 1 CPS, WHICHEVER IS GREATER.

Sine vibration is conducted along the X, Y, and Z axis of the tank.

Tank is pressurized to 2000, +50/-0 psig with GN₂.

Blowdown Test



PSI TEST PROCEDURE No. 50-000180
PAGE 22

N. F. 1-

REV	N/C	A				
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PROPELLANT SCAVENGING DEVICE BLOWDOWN TEST (PAGE 1 OF 2)

DATA SHEET

DATE 12-26-74

PSI PART No. 80221-1

CCA No. 3789-1008

PSI SERIAL No. 0002

(A) TEST PROCEDURE PARA. No. 6.2.2 DESCRIPTION TANK, ULLAGE GAS

TEST EQUIPMENT ENV 501V DUE 1-21-75 RECORDER, P37L 1-26-75 & P122L 1-26-75 GAGAS
6149L 11-22-75 STOP WATCH

TEST MEDIUM: GN₂ PER MIL-P-27401

(A)

FIRST BLOWDOWN	TEST VALUE	REQUIREMENT
INITIAL PRESSURE	<u>2020</u> PSIG	2000, +50, -0 PSIG
INITIAL TEMPERATURE, TANK	<u>63</u> °F.	60° - 95°F.
INITIAL TEMPERATURE, UPSTREAM/ORIFICE	<u>60</u> °F.	60° - 95°F.
INITIAL TEMPERATURE, DOWNSTREAM/ORIFICE	<u>60</u> °F.	60° - 95°F.
FINAL PRESSURE	<u>200</u> PSIG	195 ± 10 PSIG
FINAL TEMPERATURE, TANK	<u>25</u> °F.	RECORD
FINAL TEMPERATURE, UPSTREAM/ORIFICE	<u>23</u> °F.	RECORD
FINAL TEMPERATURE, DOWNSTREAM/ORIFICE	<u>8</u> °F.	RECORD
TIME TO BLOWDOWN	<u>1230</u> SEC.	RECORD

TESTED BY MOH DATE 12-26-74 SPECIMEN PASSED

N.F.L.

REV	N/C	A					
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PROPELLANT SCAVENGING DEVICE BLOWDOWN TEST (PAGE 2 OF 2)
DATA SHEET

CUSTOMER LOCKHEED MISSILES & SPACE Co. DATE 12-26-74
 PART No. 8109089-1 PSI PART No. 80221-1
 CCA No. 3789 -1008 PSI SERIAL No. 0002
 (A) TEST PROCEDURE PARA. No. 6.2.2 DESCRIPTION TANK, ULLAGE GAS

TEST EQUIPMENT ENV 501 V DUE 1-21-75 RECORDER, P37L 1-26-75 & P122L 1-26-75
G149L 11-22-75 STOP WATCH.

(A) TEST MEDIUM: GN₂ PER MIL-P-27401

SECOND BLOWDOWN	TEST VALUE	REQUIREMENT
INITIAL PRESSURE	<u>1125</u> PSIG	<u>1100, +50, -0</u> PSIG
INITIAL TEMPERATURE, TANK	<u>65</u> °F.	<u>60° - 95°</u> F.
INITIAL TEMPERATURE, UPSTREAM/ORIFICE	<u>65</u> °F.	<u>60° - 95°</u> F.
INITIAL TEMPERATURE, DOWNSTREAM/ORIFICE	<u>65</u> °F.	<u>60° - 95°</u> F.
FINAL PRESSURE	<u>265</u> PSIG	<u>265 ±10</u> PSIG
FINAL TEMPERATURE, TANK	<u>35</u> °F.	<u>RECORD</u>
FINAL TEMPERATURE, UPSTREAM/ORIFICE	<u>37</u> °F.	<u>RECORD</u>
FINAL TEMPERATURE, DOWNSTREAM/ORIFICE	<u>23</u> °F.	<u>RECORD</u>
TIME TO BLOWDOWN	<u>730</u> SEC.	<u>RECORD</u>

TESTED BY [Signature] DATE 12-26-74 SPECIMEN PASSED

WITNESSED BY [Signature] DATE 12-26-74 SPECIMEN FAILED

LMSC DATA REVIEW 1-6-75
DATE

Scavenging Test

WPSI 2017 camfield avenue
 PRESSURE SYSTEMS, INC. 103-10375, WASH 20040

PSI TEST PROCEDURE No. 50-000180
 PAGE 22B

N.F-1.

PROPELLANT SCAVENGING DEVICE
 SCAVENGING TEST
 DATA SHEET

REV	N/C	A					
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DATE 12-27-74

PSI PART NO. 80221-1

CCA No. 3739-1008 PSI SERIAL No. 0002

(A) TEST PROCEDURE PARA. No. 6.2.3 DESCRIPTION: TANK, ULLAGE GAS

TEST EQUIPMENT GAUGE ST0339 CALIB DUE 6-6-75

TEST MEDIUM: <u>DISTILLED AND DEIONIZED WATER</u>		
	TEST VALUE	REQUIREMENT
WEIGHT OF WATER	<u>2270 GRAMS</u> <u>5.005 LBS</u>	<u>5 LBS MIN.</u>
PRESSURE AT BLOWDOWN	<u>10</u> PSIG	<u>10 ±2 PSIG</u>
WEIGHT OF WATER AFTER BLOWDOWN	<u>2235 GRAMS</u> <u>4.928 LBS</u>	<u>RECORD</u>
WEIGHT OF WATER RETAINED IN TANK	<u>35 GRAMS</u>	<u>0.2 LBS MAX.</u> <u>(90 GRAMS)</u>

TESTED BY [Signature] PSI
26 DATE 12-27-74 SPECIMEN PASSED [Signature]