

# LEAK TESTING SPECIALISTS, INC.

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Procedure No. MSLT-Preship-C100-AOS

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## HELIUM LEAK TEST REPORT

Revision 02

GENERAL TEST INFORMATION					
Test Report Number (Project Code-Date-Sequential)			5980-16-027-8837-06-23-2016-01		
Procedure Number	MSLT-PRESHIP-C100-AOS	Revision	7292-02		
Test Location	Bellflower	Test Date	June 23, 2016		
Cask Serial No.	AOS-100A-0001	Lid Seal Serial No.:	Metallic Seal is H-309850 Rev. A S/N 007 (re: PO No. AOS-6654)		
Lid Seal Type (Circle One)	Metal Seal	Test Requirement:	Seal Test (Comment No. 1)		
EQUIPMENT					
	Serial #	Cal Due Date/Model	Leak Rate/Range/Cert Record		
Leak Detector Manufacturer	Varian 959M-31	959 MacroTorr Cal Prior To Use	10 <sup>-9</sup> - 10 <sup>-4</sup>		
Instrument Calibrated Leak	CL-He-69	07/20/2018	8.80 x 10 <sup>-8</sup> @ 21.7		
System Calibrated Leak	CL-He-69	07/20/2018	8.80 x 10 <sup>-8</sup> @ 21.7		
Thermometer	TH27	03/27/2017	-300.0 ° To 2470.0 °F		
Pressure/Vacuum Gauge PI-1	Ga-P-15	03/27/2017	0.001-50 psia		
Verification of Helium Supply	Yes / TRI-GAS-HC-LTS Rev LTS-0 (1)				
CALIBRATION DATA					
Smallest measurable unit of MSLD (DIV):		0.2 x 10 <sup>-8</sup>	atm.-cc/sec.		
Temperature of the System Leak Standard (T <sub>R</sub> )		30.8	Degrees C		
System Leak Temperature Corrected Leak Rate (CL <sub>L</sub> )		1.2 x 10 <sup>-7</sup>	atm.-cc/sec.		
Temperature of Metal Components		28.5	Degrees C		
Ambient Air Temperature		30.3	Degrees C		
LID CLOSURE SEAL LEAK TEST					
Reading	Results	Units	Valve Position	CL	V1
M <sub>0</sub>	1.0 x 10 <sup>-8</sup>	atm. cc/sec.	Background	Closed	Open
M <sub>1</sub>	1.0 x 10 <sup>-7</sup>	atm. cc/sec.	Calibrated Leak	Open	Open
Response Time (Dwell - RT)	30	Seconds	NA	NA	NA
M <sub>2</sub>	1.2 x 10 <sup>-8</sup>	atm. cc/sec.	Background	Closed	Open
Clean-up Time (Dwell - CT)	15	Seconds	NA	NA	NA

Torque Wrench ID: TW-03; Cal. Due: Sep. 3, 2016; Range 5-100ft-lbs

Stop Watch ID: SW-04; Cal. Due: Aug. 28, 2016

Pressure Gauge 2 ID: GA-C-19; Cal. Due Oct. 19, 2016; Range -30 inches Hg to 100 psi

Lid Seal Leak Test - Initial Temp: 30.8 degrees C = CL<sub>L</sub> = 1.2 x 10<sup>-7</sup> atm cc/second

Lid Seal Leak Test - Final Temp: 30.8 degrees C = CL<sub>L</sub> = 1.2 x 10<sup>-7</sup> atm cc/second

C:\Users\Tony\Documents\QA e-File 2011\A2 - Client Projects Folder\5980 (Alpha Omega)\5980-16-027-8837 AOS\A4 Test Reports, C of CBellflower, CA June 2016\2016 AOS-100-01 Tape Seal and re-use lid seal (06-28-2016) AOS Comments (07-11-2016).docx

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By: *[Signature]*  
Date: 7-27-16

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<b>Test Report Number (Project Code-Date-Sequential)</b>			5980-16-027-8837-06-23-2016-01		
System Sensitivity (SS <sub>1</sub> )= CL <sub>T</sub> *(DIV) / (M <sub>1</sub> -M <sub>2</sub> )			2.7 x 10 <sup>-9</sup>	Must be greater than 5.0 x 10 <sup>-8</sup>	
Determining Dwell Time for metal seals	CT x 1.5	RT x 1.5	Min. Dwell Time	{Reserved For Elastomeric Seals}	
	30	15	60 Seconds	The Dwell time used for the test is longest response time between CT*1.5, RT*1.5 or 60 second minimum	
Static Pressure Before Backfill (PSIA)		0.114 psia	Pressure After Backfill (PSIA)	17.34 psia	Dwell Time (Seconds) 60 seconds
<b>Reading</b>	<b>Results</b>		<b>Units</b>	<b>Valve Position</b>	<b>CL</b> <b>V1</b>
M <sub>3</sub>	3.4 x 10 <sup>-8</sup>		atm. cc/sec.	Background + any Leakage	Closed      Open
M <sub>4</sub>	1.2 x 10 <sup>-7</sup>		atm. cc/sec.	Leakage + Background + Calibrated Leak	Open      Open
PSCF <sub>1</sub> = CL <sub>T</sub> / (M <sub>1</sub> - M <sub>2</sub> ) =			1.36	NA	NA
FSCF <sub>1</sub> = CL <sub>T</sub> / (M <sub>4</sub> - M <sub>3</sub> ) =			1.40	NA	NA
TQF = PSCF / FSCF =			0.98	The TQF must be between 0.77 ≤ TQF ≤ 1.43	
<b>CALCULATED LEAK RATE Based on Procedure Qualification</b>					
For Elastomer Seals	CLR <sub>1</sub> = FSCF *(M <sub>3</sub> - M <sub>2</sub> ) * xxxx=		NA	The CLR must be ≤ 1 x 10 <sup>-7</sup> atm cc/second	
For Metallic Seals	CLR <sub>1</sub> = FSCF *(M <sub>3</sub> - M <sub>2</sub> ) * 1.05=		3.2 x 10 <sup>-8</sup>	The CLR must be ≤ 1 x 10 <sup>-7</sup> atm cc/second	
<b>SUMMARY LEAK TEST DISPOSITION</b>					
<b>Evaluation Criteria</b>			<b>Acceptable</b>	<b>Comment</b>	
Test Sensitivity: ≥ 5 x 10 <sup>-8</sup> atm.- cc/sec He			Accept	-	
Test Quality Factor: (0.77 ≤ TQF ≤ 1.43)			Accept	-	
Corrected Leak Rate ≤ 1 x 10 <sup>-7</sup> atm.-cc/sec He			Accept	-	
<b>All three of the above criteria are met (test is acceptable)</b>			Accept	-	

Tony Heinz *[Signature]*  
LTS Technician Print/Sign

LT III  
Certification Level

23 June 2016  
Date

(1) Correction to Helium Concentration by LTS  
Paul D Watts *[Signature]*

AOS-QA

07-27-2016

Received by (Client) Print/Sign

Title

Date

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## HELIUM LEAK TEST REPORT

Revision 02

<b>Test Report Number (Project Code-Date-Sequential)</b>	5980-16-027-8837-06-23-2016-02
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DRAIN PORT PLUG CLOSURE					
Reading	Results	Units	Valve Position	CL	V1
R <sub>1</sub>	$1.2 \times 10^{-7}$	atm. cc/sec.	CL + Leakage	Open	Open
R <sub>2</sub>	$4.0 \times 10^{-8}$	atm. cc/sec.	Leak	Closed	Open
R <sub>3</sub>	$1.2 \times 10^{-7}$	atm. cc/sec.	CL + Leakage	Open	Open
System Sensitivity (SS <sub>2</sub> ) = $CL_T \cdot (DIV) / (R_1 - R_2)$			$2.53 \times 10^{-9}$		atm. cc/sec.
Test Pressure			17.4		psia
PSCF <sub>2</sub> = $CL_T / (R_1 - R_2) =$		1.27	FSCF <sub>2</sub> = $CL_T / (R_3 - R_2) =$		1.27
TQF = PSCF / FSCF =		1	The TQF must be between $0.77 \leq TQF \leq 1.43$		
COMBINED CALCULATED LEAK RATE					
CLR <sub>2</sub> = FSCF * R <sub>2</sub> =		$5.1 \times 10^{-8}$	The CLR must be $\leq 1 \times 10^{-7}$ atm cc/second		

SUMMARY LEAK TEST DISPOSITION		
Evaluation Criteria	Acceptable Rejectable	Comment
Test Sensitivity: $\geq 5 \times 10^{-8}$ atm.- cc/sec He	Accept	-
Test Quality Factor: $(0.77 \leq TQF \leq 1.43)$	Accept	-
Corrected Leak Rate $\leq 1 \times 10^{-7}$ atm.-cc/sec He	Accept	-
<b>All three of the above criteria are met (test is acceptable)</b>	Accept	-

AOS-100A-0001

Drain Port Seal Leak Test - Initial Temp: 25.5 degrees C = CL<sub>1</sub> =  $1.0 \times 10^{-7}$  atm cc/second

Drain Port Seal Leak Test - Final Temp: 25.5 degrees C = CL<sub>1</sub> =  $1.0 \times 10^{-7}$  atm cc/second

COMMENT NO. 1

Both the Vent and the Drain Port Plugs were assembled with three full turns of Teflon Tape.

Tony Heinz <i>[Signature]</i>	LT III	23 June 2016
LTS Technician Print/Sign	Certification Level	Date

Paul D Watts <i>[Signature]</i>	AOS-QA	07-27-2016
Received by (Client) Print/Sign	Title	Date

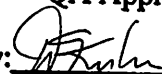
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By:   
Date: 7-27-16

## HELIUM LEAK TEST REPORT

Revision 02

Test Report Number (Project Code-Date-Sequential)	5980-16-027-8837-06-23-2016-03
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### VENT PORT PLUG CLOSURE

Reading	Results	Units	Valve Position	CL	V1
R <sub>1</sub>	1.0 x 10 <sup>-7</sup>	atm. cc/sec.	CL + Leakage	Open	Open
R <sub>2</sub>	2.8 x 10 <sup>-8</sup>	atm. cc/sec.	Leak	Closed	Open
R <sub>3</sub>	1.0 x 10 <sup>-7</sup>	atm. cc/sec.	CL + Leakage	Open	Open
System Sensitivity (SS <sub>2</sub> ) = CL <sub>T</sub> * (DIV) / (R <sub>1</sub> - R <sub>2</sub> )			2.7 x 10 <sup>-9</sup>		atm. cc/sec.
Test Pressure			17.4		psia
PSCF <sub>2</sub> = CL <sub>T</sub> / (R <sub>1</sub> - R <sub>2</sub> ) =		1.36	FSCF <sub>2</sub> = CL <sub>T</sub> / (R <sub>3</sub> - R <sub>2</sub> ) =		1.36
TQF = PSCF / FSCF =		1	The TQF must be between 0.77 ≤ TQF ≤ 1.43		

COMBINED CALCULATED LEAK RATE		
CLR <sub>2</sub> = FSCF * R <sub>2</sub> =	3.8 x 10 <sup>-8</sup>	The CLR must be ≤ 1 x 10 <sup>-7</sup> atm.- cc/second

SUMMARY LEAK TEST DISPOSITION		
Evaluation Criteria	Acceptable Rejectable	Comment
Test Sensitivity: ≥ 5 x 10 <sup>-8</sup> atm.- cc/sec He	Accept	-
Test Quality Factor: (0.77 ≤ TQF ≤ 1.43)	Accept	-
Corrected Leak Rate ≤ 1 x 10 <sup>-7</sup> atm.-cc/sec He	Accept	-
<b>All three of the above criteria are met (test is acceptable)</b>	<b>Accept</b>	<b>-</b>

AOS-100A-0001

Vent Port Seal Leak Test - Initial Temp: 24.5 degrees C = CL<sub>1</sub> = 9.8 x 10<sup>-8</sup> atm cc/second

Vent Port Seal Leak Test - Final Temp: 24.5 degrees C = CL<sub>1</sub> = 9.8 x 10<sup>-8</sup> atm cc/second


**COMMENT NO. 1:**

This helium leak test was performed to determine the future usability of Loctite Product No. 39904 PTFE Thread Sealing Tape (AOS Lot No. N00193) in lieu of Loctite Pipe Thread Sealant, McMaster-Carr PN 45855K43, Lot No. L36BAA0552 (AOS Lot No. N00219), as required by AOS Certification Drawing No. 105E9712 Rev. J Triangle Note 14 (Ref. Detail K, 2X - Items 26 and 28)

**COMMENT NO. 2**

Both the Vent and the Drain Port Plugs were assembled with three full turns of Teflon Tape.

Tony Heinz  LT III Certification Level 23 June 2016 Date

Paul D Watts  AOS-QA Title 07-27-2016 Date

Received by (Client) Print/Sign \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_



Helium Supply Concentration Verification Test Report

Date:	6/21/2016
Client:	AOS
Tri-mix Analyzer serial #:	HEAN-02
Tri-mix verification due date:	03/31/2017
He tank ID:	HE 200IND580 Bottle 946404 AOS Lot N00221
Recorded Helium concentration %:	99.8

CK  
7-12-16

Tony Heinz T-717 LT III 6/21/16  
LTS Technician Print/Sign Certification Level Date

5980-16-027-8837-06-21-2017

Procedure: Tri-Gas-HC-LTS Rev-0

QA Approved

By: CK  
Date: 7/5/16