OCT 13 1998

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 622969

2. To: (Receiving Organization) Packaging Engineering	3. From: (Originating Organization) Packaging Engineering	4. Related EDT No.: NA
5. Proj./Prog./Dept./Div.: 03E00	6. Design Authority/ Design Agent/Cog. Engr.: J. E. Mercado	7. Purchase Order No.: NA
8. Originator Remarks: The attached test report is being submitted for approval and release.		9. Equip./Component No.: NA
		10. System/Bldg./Facility: NA
11. Receiver Remarks: 11A. Design Baseline Document? ☐ Yes ☒ No		12. Major Assm. Dwg. No.: NA
		13. Permit/Permit Application No.: NA
		14. Required Response Date: NA

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	HNF-3516	NA	0	Test Report for PAS-1 Cask Certification for Shipping Payload B	Q	1,2	1	

16. KEY			
Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)
E, S, O, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority									
		Design Agent									
1	/	Cog. Eng.: JE Mercado	<i>J. E. Mercado</i>	10/12/98	H1-15						
1	/	Cog. Mgr.: JG Field	<i>J. G. Field</i>	10/12/98	H1-15						
1	/	QA: MR Turner	<i>M. B. Turner</i>	10/12/98	H1-15						
		Safety:									
1	/	Independent Review:	<i>J. E. Mercado</i>	10/12/98	H1-15						

18. J. E. Mercado Signature of EDT Originator 10/13/98	19. Authorized Representative Date for Receiving Organization	20. J. G. Field Design Authority/ Cognizant Manager 10/14/98	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
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Test Report for PAS-1 Cask Certification for Shipping Payload B

J. E. Mercado

Waste Management Federal Services, Inc., Northwest Operations
Richland, Washington 99352
for Fluor Daniel Hanford, Inc.
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: EDT 622969

UC: 513

Org Code: 03E00

CACN: 103430 COA: EF00

Task Order: GS080003

Project: 772031 Crosswalk: 116

B&R Code:

Total Pages: 156

Key Words: Certificate of Compliance, visual weld inspections, dimensional inspections, dye penetrant examinations, helium leak testing, pressure testing

Abstract: This test report documents the successful inspection and testing to certify two NuPac PAS-1 casks in accordance with U.S. Department of Energy Certificate of Compliance (CoC) USA/9184/B(U). The primary and secondary containment vessels of each cask met the acceptance criteria defined in the CoC and the test plan.

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Janis Cardal 10-13-98
Release Approval Date

Approved for Public Release

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LIST OF TERMS

cm	centimeter
Cogema	Cogema Engineering Corporation
DOE	U.S. Department of Energy
in.	inch
kPa	kilopascals (gage)
L	liter
LLNL	Lawrence Livermore National Laboratory
psig	pounds per square inch, gage
PCV	primary containment vessel
WMNW	Waste Management Federal Services, Inc., Northwest Operations

TEST REPORT FOR PAS-1 CASK CERTIFICATION FOR SHIPPING PAYLOAD B

1.0 INTRODUCTION

The NuPac PAS-1 cask was required to undergo inspection and testing in order to be certified in accordance with U.S. Department of Energy (DOE) Certificate of Compliance USA/9184/B(U) (DOE 1998). The intent of the inspection and testing was to verify that pressurization of the containment vessels will not impair the performance of the cask or damage the welds. This investigation was considered necessary because the cask was not originally designed to carry a payload with the potential to pressurize the containment vessels. Payload B authorizes the transport of up to 4 L of liquid radioactive waste from the Hanford tank farms. This payload does have chemical and radiological properties that could result in gas generation and subsequent pressure increases inside the package.

Casks Serial Numbers 2162-026 and 2162-027 were inspected and tested in the 305 Engineering Testing Laboratory in the 300 Area at the Hanford Site. Waste Management Federal Services, Inc., Northwest Operations (WMNW), Packaging Engineering, was in charge of the testing. Numatec Hanford Corporation directed the operations in the test facility.

2.0 SUMMARY

The testing and inspections were conducted successfully with both the primary and secondary containment vessels of each cask meeting the acceptance criteria defined in DOE (1998) and HNF-2979, *Test Plan for PAS-1 (USA/9184/B[U] DOE Serial Numbers 2162-026 and 2162-027 To Ship Payload B* (Mercado 1998b). No distortion or other anomalies were observed.

A series of inspections was performed to determine the baseline condition of each vessel. These inspections included visual weld inspection, dimensional inspections, and dye penetrant examination of the primary containment vessel (PCV) welds. Both casks were subjected to a 348 kPa gage (50-psig) pressure test, with helium leak testing taking place before and after the pressure test.

3.0 INSPECTIONS AND TESTING

The tests and inspections were conducted in accordance with HNF-3355, *Procedures and Acceptance Criteria for PAS-1 Cask Inspections* (Mercado 1998a) and Mercado (1998b). The test and inspection reports are provided in Appendices A through E. The sequence began on Wednesday, September 9, 1998, and concluded on Thursday, September 17, 1998.

Initial helium leak testing of the secondary containment vessels was unsuccessful, with both casks failing to meet the acceptance criteria. The margin of failure was small, indicating a minor problem with the sealing surfaces. The carbon steel sealing surfaces of the secondary containment vessels were polished by hand with 320-, 400-, and 600-grit sandpaper to remove some visible scratches, and the subsequent tests met the acceptance criteria for leak-tightness.

The bottom welds of the PCVs were dressed using a 180-grit flapper wheel and a 320 blending belt. The inner weld on vessel 2162-027 was ground in two locations approximately 1.27 cm x 0.64 cm (0.5 in. x 0.25 in.) with a 160-grit disk grinder.

The post-pressure leak test of the 2162-026 PCV was unsuccessful. Examination of the sealing surface detected a burr in the area below the o-ring, which had been scratched across the surface. The burr was removed and the surface polished with 400-grit sandpaper to remove some visible scratches. The results of the subsequent leak test were acceptable.

4.0 PERSONNEL

The following personnel were involved in the testing of the PAS-1:

Cognizant Engineer: J. E. Mercado (WMNW)

WMNW Packaging Engineering Manager: J. G. Field

Technical Lead, Mechanical Engineering: R. J. Smith (WMNW)

Chief Engineer, Licensing and Certification: P. C. Ferrell (WMNW)

Chief Mechanical Engineer: S. S. Shiraga (WMNW)

Engineering Testing Laboratory: P. V. Meeuwsen (Numatec Hanford Corporation)

DOE, Richland Operations Office, Traffic Manager: D. W. Claussen

DOE Certification Official: M. E. Wangler (EM-30)

Test witnesses: R. Towell (Eagle Research Group)
E. W. Russell (Lawrence Livermore National Laboratory (LLNL))
J. Hovingh (LLNL)
R. S. Hafner (LLNL)

Quality Control Inspectors:
M. F. Brickey (Waste Management Federal Services of
Hanford, Inc. (WMH))
D. L. Vance (WMH)
S. C. Peterson (DE&S Northwest, Inc.)
B. L. Smith (WMH)

Nondestructive examination:
W. D. Purdy (Cogema Engineering Corporation [Cogema])
B. L. Hopkins (Cogema)
J. K. Keve (Cogema)
W. H. Nelson (Cogema)

Technical experts: C. E. Graves (Fluor Daniel Northwest, Inc.)
T. A. Delucchi (Cogema).

5.0 REFERENCES

- DOE, 1998, *U.S. Department of Energy Certificate of Compliance for Radioactive Materials Packages*, USA/9184/B(U), Rev. 0, U.S. Department of Energy, Washington, D.C.
- Mercado, J. E., 1998a, *Procedures and Acceptance Criteria for PAS-1 Cask Inspections*, HNF-355, Rev. 0, prepared by Waste Management Federal Services, Inc., Northwest Operations for Fluor Daniel Hanford, Inc., Richland, Washington.
- Mercado, J. E., 1998b, *Test Plan for PAS-1 (USA/9184/B[U] DOE Serial Numbers 2162-026 and 2162-027 To Ship Payload B*, HNF-2979, Rev. 0, prepared by Waste Management Federal Services, Inc., Northwest Operations for Fluor Daniel Hanford, Inc., Richland, Washington.

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APPENDIX A
TEST REPORT FOR VISUAL WELD INSPECTIONS

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APPENDIX A: VISUAL WELD INSPECTION REPORT.

POST PRESSURE TEST

PAS-1 Cask Serial Number 2162-026

Company: FDH QA		
Inspector: S.C. PETERSON		
Weld # 1	accept ☒	reject ☐
Weld # 2	accept ☒	reject ☐
Weld # 3	accept ☒	reject ☐
Weld # 4	accept ☒	reject ☐

PAS-1 Cask Serial Number 2162-027

Company: FDH QA		
Inspector: S.C. PETERSON		
Weld # 1	accept ☒	reject ☐
Weld # 2	accept ☒	reject ☐
Weld # 3	accept ☒	reject ☐
Weld # 4	accept ☒	reject ☐

QA signature:

Date:

AWS # 8506015.1

XRP JUNE 2000

APPENDIX A: VISUAL WELD INSPECTION REPORT.

PAS-1 Cask Serial Number 2162-026

Company: <u>FDHQA</u>		
Inspector: <u>S.P. PETERSON</u> <u>FDHQA</u>		
Weld # <u>1</u>	accept ☒	reject ☐
Weld # <u>2</u>	accept ☒	reject ☐
Weld # <u>3</u>	accept ☒	reject ☐
Weld # <u>4</u>	accept ☒	reject ☐

PAS-1 Cask Serial Number 2162-027

Company: <u>FDHQA</u>		
Inspector: <u>S.P. PETERSON</u>		
Weld # <u>1</u>	accept ☒	reject ☐
Weld # <u>2</u>	accept ☒	reject ☐
Weld # <u>3</u>	accept ☒	reject ☐
Weld # <u>4</u>	accept ☒	reject ☐

QA signature: [Signature]Date: 9/14/98

AW5 # 85060151
Exp. June 2000

APPENDIX B
TEST REPORT FOR DIMENSIONAL INSPECTIONS

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Table 1.

Serial number 2162-26Initial Measurements and Inspections
record all dimensions in inches

Base	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.7165	20.5560	18.762	20.5551	19.000	20.570
center	18.926	N/A	18.922	N/A	18.993	N/A
bottom	18.972	20.556	18.962	20.557	18.981	20.559

Lid	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.435	20.585	18.024	20.585	18.025	20.581
center	18.056	N/A	18.045	N/A	18.039	N/A
bottom	18.061	19.170	18.027	19.171	18.031	19.171

Base	distance to square		
Vertical location	0 degrees 120 degrees 240 degrees		
bottom	N/A		
half height			
landing			

BASE NOT SQUARE

Lid	distance to square		
Vertical location	0 degrees 120 degrees 240 degrees		
top	N/A		
half height			
edge			

LID NOT SQUARE

Base	Bottom plate inspection		
	0 degrees 120 degrees 240 degrees		
GAP	.181	(CENTER)	

Lid	Top plate inspection		
	0 degrees 120 degrees 240 degrees		
NO	GAP		

Comments: N/A - NO MEASUREMENT TAKEN TOOLS
NOT AVAILABLE
INSIDE MIC WIRE 710-47-04-019 CAL DWS 12-19-99
CALIPER WIRE 710-15-03-002 CAL DWS 3-26-99
6" DIAL CALIPER 710-15-04-025 CAL DWS 8-3-99

Inspector: Michael F. Buckley SR date: 9-10-98

HNF-3355 Rev. 0

Table 2.

Serial number 2162-26Post-test Measurements and Inspections
record all dimensions in inches

Base	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.976	20.539	18.962	20.532	18.991	20.571
center	18.983	N/A	18.972	N/A	18.982	N/A
bottom	18.973	20.539	18.965	20.560	18.985	20.539

Lid	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.043	20.536	18.036	20.535	18.026	20.535
center	18.036	N/A	18.036	N/A	18.039	N/A
bottom	18.061	19.171	18.079	19.171	18.075	19.170

Base	distance to square		
Vertical location	0 degrees		
bottom	120 degrees		
half height	240 degrees		
landing	N/A		

BASE NOT SQUARE

Lid	distance to square		
Vertical location	0 degrees		
top	120 degrees		
half height	240 degrees		
edge	N/A		

LID NOT SQUARE

Base	Bottom plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
GAP	.181	(CENTER)	

Lid	Top plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
NO	GAP		

Comments: N/A - NO MEASUREMENT TAKEN TOOLS
NOT AVAILABLE.
INSTEAD M.C. MFT# 710-47-04-019 CAL DUE 12-14-99
CALIPER MFT# 710-15-03-002 CAL DUE 3-26-99
6" DIAL CALIPER MFT# 710-15-04-005 CAL DUE 8-3-99

Inspector: Michael B. Bickley date: 9-14-98

ASE ID	INITIAL MEASUREMENT	POST MEASUREMENT	DIFFERENCE
#26			
① TOP	18.9765	18.9765	.000
MIDDLE	18.976	18.983	+.007
BOTTOM	18.972	18.973	+.001
② TOP	18.963	18.962	-.001
MIDDLE	18.972	18.972	.000
BOTTOM	18.962	18.9635	+.0015
③ TOP	19.000	19.001	+.001
MIDDLE	18.993	18.992	-.001
BOTTOM	18.981	18.985	+.004
ID ID #26			
④ TOP	18.0435	18.0435	.000
MIDDLE	18.056	18.056	.000
BOTTOM	18.061	18.061	.000
⑤ TOP	18.024	18.026	+.002
MIDDLE	18.045	18.046	+.001
BOTTOM	18.077	18.079	+.002
⑥ TOP	18.025	18.026	+.001
MIDDLE	18.039	18.039	.000
BOTTOM	18.051	18.0515	+.0005

BASE OD #26	INITIAL MEASUREMENT	POST MEASUREMENT	DIFFERENCE
① TOP	20.560	20.559	-.001
BOTTOM	20.556	20.559	+.003
③ TOP	20.553	20.552	-.001
BOTTOM	20.557	20.560	+.003
⑤ TOP	20.570	20.571	+.001
BOTTOM	20.559	20.559	.000
LID OD #26			
⑦ TOP	20.585	20.586	+.001
BOTTOM	19.170	19.171	+.001
③ TOP	20.585	20.585	.000
BOTTOM	19.171	19.171	.000
⑤ TOP	20.581	20.585	+.004
BOTTOM	19.170	19.170	.000
BASE CENTER GAP BOTTOM	.181	.181	.000

Table 1.

Serial number 2162-27Initial Measurements and Inspections
record all dimensions in inches

Base	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.909	20.561	18.991	20.575	18.940	20.520
center	18.950	N/A	18.958	N/A	18.949	N/A
bottom	18.953	20.561	18.960	20.561	18.951	20.561

Lid	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.032	20.596	18.035	20.597	18.036	20.596
center	18.047	N/A	18.047	N/A	18.049	N/A
bottom	18.060	19.172	18.058	19.172	18.058	19.172

Base	distance to square		
Vertical location	0 degrees		
bottom	120 degrees		
half height	240 degrees		
edge	N/A		

BASE NOT SQUARE

Lid	distance to square		
Vertical location	0 degrees		
top	120 degrees		
half height	240 degrees		
edge	N/A		

LID NOT SQUARE

Base	Bottom plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
	GAP .191 (CENTER)		

Lid	Top plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
	NO GAP		

Comments:
 N/A - NO MEASUREMENT TAKEN *
 INSIDE MIC - mITE # 710-47-04-019
 CAL DUE 12-19-99
 CALIPER mITE # 710-15-03-002 CAL DUE 3-26-99
 6" DIAL CALIPER mITE # 710-15-04-025
 CAL DUE 8-3-99

* TOOLS NOT AVAILABLE

Inspector: Michael F. Brinkley date: 9-10-98

Table 2.

Serial number: 2162-27Post-test Measurements and Inspections
record all dimensions in inches

Base	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.949	20.561	18.994	20.571	18.938	20.587
center	18.956	N/A	18.962	N/A	18.950	N/A
bottom	18.953	20.561	18.962	20.560	18.953	20.561

Lid	ID	OD	ID	OD	ID	OD
Vertical location	0 degrees		120 degrees		240 degrees	
top	18.032	20.576	18.036	20.576	18.034	20.576
center	18.047	N/A	18.047	N/A	18.047	N/A
bottom	18.037	19.170	18.037	19.170	18.035	19.171

Base	distance to square		
Vertical location	0 degrees		
bottom	120 degrees		
half height	240 degrees		
landing	N/A		

BASE NOT SQUARE

Lid	distance to square		
Vertical location	0 degrees		
top	120 degrees		
half height	240 degrees		
edge	N/A		

LID NOT SQUARE

Base	Bottom plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
GAP	.191 (CENTER)		

Lid	Top plate inspection		
	0 degrees		
	120 degrees		
	240 degrees		
NO GAP			

Comments:
 N/A - NO MEASUREMENT TAKEN *
 INSIDE MIC - MITE # 710-47-04-019
 CAL DUE 12-19-99
 CALIPER MITE # 710-15-03-002 CAL DUE 3-26-99
 6" DIAL CALIPER MITE # 710-15-04-025
 CAL DUE - 8-3-99

*TOOLS NOT AVAILABLE

Inspector: Michael F. Bruckey date: 9-14-98

BASE ID	INITIAL MEASUREMENT	POST MEASUREMENT	DIFFERENCE
#27			
① TOP	18.949	18.949	.000
MIDDLE	18.956	18.956	.000
BOTTOM	18.953	18.953	.000
② TOP	18.994	18.994	.000
MIDDLE	18.958	18.962	+ .004
BOTTOM	18.960	18.962	+ .002
③ TOP	18.940	18.938	- .002
MIDDLE	18.949	18.950	+ .001
BOTTOM	18.951	18.953	+ .002
LID ID #27			
① TOP	18.032	18.032	.000
MIDDLE	18.047	18.047	.000
BOTTOM	18.060	18.059	- .001
② TOP	18.035	18.036	+ .001
MIDDLE	18.047	18.047	.000
BOTTOM	18.058	18.057	- .001
③ TOP	18.032	18.034	+ .002
MIDDLE	18.049	18.049	.000
BOTTOM	18.058	18.0575	- .0005

BASE OD	INITIAL MEASUREMENT	POST MEASUREMENT	DIFFERENCE
#27			
Ⓐ TOP	20.561	20.561	.000
BOTTOM	20.561	20.564	+.003
Ⓑ TOP	20.575	20.571	-.004
BOTTOM	20.561	20.560	-.001
Ⓒ TOP	20.560	20.559	-.001
BOTTOM	20.561	20.561	.000
LID OD			
#27			
Ⓐ TOP	20.596	20.596	.000
BOTTOM	19.172	19.170	-.002
Ⓑ TOP	20.597	20.596	-.001
BOTTOM	19.172	19.170	-.002
Ⓒ TOP	20.596	20.596	.000
BOTTOM	19.172	19.171	-.001
BASE CENTER GAP			
BOTTOM	.191	.191	.000

APPENDIX C

TEST REPORT FOR DYE PENETRANT EXAMINATIONS

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A-7320-043 102/981

A-7320-043 102/98

APPENDIX D
TEST REPORT FOR HELIUM LEAK TESTING

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A-6001-492 (02/98)

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 840 MSIN: L6-36 Richland, WA 99352 300 Area 300-E Building Phone: 376-8061 FAX: 376-4945 POC: John R. Keve		
APPROVAL: Originator: <u>John R. Keve</u> Date <u>9/13/98</u> NDE Leak Test Level III <u>John R. Keve</u> Date <u>9/13/98</u> NDE Manager <u>James Krugman</u> Date <u>9/13/98</u>		
Changes from previous version and reason for the changes (attach pages as necessary)		
DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK		
Document No.: COGEMA-SVLT-INS-003.2		Revision No.: 0
Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐		
Key Words: PAS-1, helium, leak testing		
Instructions:		
Distribution: NDE File		Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

COGEMA-SVLT-INS-003.2

Revision 0

September 3, 1998

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number Pre Leak Test
SN 2162-027

Date 9/9/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard.
 Helium Standard Identification 584-40-03-017
 Helium Standard 1.9×10^{-8} atm-cc/sec
 Helium Standard Calibration Expiration 9/23/98
3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/9/98 1040

MSLD Reading 2.4×10^{-8} X Range Factor 500 = MSLD Div. 1200

Background 1×10^{-10} X Range Factor 5 = Backgnd Div. 5

MSLD Div. 1200 - Backgnd Div. 5 = Net Div. 1195

Helium Std 1.9×10^{-8} ÷ Net Div. 1195 =

MSLD Sensitivity 1.6×10^{-11} atm-cc/sec/div

COGEMA-SVLT-ENS-003.2

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time 9/9/98 1417MSLD Reading 5.4×10^{-8} X Range Factor 500 = MSLD Div.Background 1.2×10^{-8} X Range Factor 500 = Backgnd Div.MSLD Div. 2800 - Backgnd Div. 600 = Net Div.MSLD Sensitivity 1.6×10^{-11} X Net Div. 2200 =Primary Vessel and O-ring leakage Rate 3.5×10^{-8} Atm cc/sec

MACH SEN

$$R \ 2.6 \times 10^{-8} \times 500 = 1300$$

$$\frac{BG \ 4 \times 10^{-10} \times 5}{1280} = \frac{20}{1280}$$

$$\frac{1.9 \times 10^{-8}}{1280} = 1.5 \times 10^{-11}$$

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.
 Gage Calibration Identification _____
 Gage Range _____ PSIA
 Gage Calibration Expiration _____
 Gage Reading _____ PSIA
2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.
 Gage Reading _____ PSIA
3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 11.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Net Div. ____ X MSLD Sensitivity ____ atm-cc/sec/div =

Primary Stat-O-Seal Leak Rate ____ atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/10/98 0700MSLD Reading 3.8×10^{-4} X Range Factor 50k = MSLD Div.Background 3.4×10^{-9} X Range Factor 50 = Backgnd Div.MSLD Div. 170k - Backgnd Div. 170 = Net Div.MSLD Sensitivity 1.2×10^{-11} X Net Div. 169930 =Secondary vessel and O-ring leakage Rate 2.0×10^{-6} Atm cc/secMACH SCV. 9/10/98 0715 $2.4 \times 10^{-8} \times 500 = 2000$ $46.7 \times 10^{-9} \times 20 = \frac{350}{1650} \times \frac{1.9 \times 10^{-8}}{1650} = 1.2 \times 10^{-11}$

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading _____ PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1. *MSB*

4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.

5. Evacuate the stat-o-seal area with the MSLD.

6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^9 atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Helium Std ____ ÷ Net Div. ____ =

MSLD Sensitivity ____ atm-cc/sec/div

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Helium Std ____ ÷ Net Div. ____ =

MSLD Sensitivity ____ atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

A-6001-492 (02/88)

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 840 MSIN: L6-36 Richland, WA 99352 300 Area 306-E Building Phone: 376-8061 FAX: 376-4945 POC: John K. Keve		
APPROVAL: Originator: <u>John T. Keve</u> Date <u>9/13/98</u> NDE Leak Test Level III <u>John T. Keve</u> Date <u>9/13/98</u> NDE Manager <u>James Krugman</u> Date <u>9/13/98</u>		
Changes from previous version and reason for the changes (attach pages as necessary)		
DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK		
Document No.: COGEMA-SVLT-INS-003.2		Revision No.: 0
Retention Time:	Non-Permanent ☒	Lifetime ☐
		Project File ☐
Key Words: PAS-1, helium, leak testing		
Instructions:		
Distribution: NDE File		Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number Pre Leak TestS/N 2162-026Date 9/10/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard.
 Helium Standard Identification 584-40-03-017
 Helium Standard 1.9×10^{-8} atm-cc/sec
 Helium Standard Calibration Expiration 9/23/98
3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/10/98 0645MSLD Reading 28×10^{-8} X Range Factor 500 = MSLD Div.Background 1×10^{-10} X Range Factor 5 = Backgnd Div.MSLD Div. 1400 - Backgnd Div. 5 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1395 =MSLD Sensitivity 1.4×10^{-11} atm-cc/sec/div

WC 48615

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time 9/10/98 12:50 PMMSLD Reading 1.6 X Range Factor 8^{500} = MSLD Div.Background 1.4 X Range Factor 8^{500} = Backgnd Div.MSLD Div. 800 - Backgnd Div. 200 = Net Div.MSLD Sensitivity 1.0×10^{-11} X Net Div. 100 =Primary Vessel and O-ring leakage Rate 1×10^{-9} atm-cc/sec

WC 48869

Std. 584-40-03-017 Exp. 9-23-98 9:00 AM

R $3.8 \times 10^{-8} \times 500 = 1900$

$$867 \times 10^{-10} \times 5 = \frac{35}{1865} \frac{1.9 \times 10^{-8}}{1865} = 1.0 \times 10^{-11} \text{ atm-cc/sec. div.}$$

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

N/A for Pre-Leak Test

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.
 Gage Calibration Identification _____
 Gage Range _____ PSIA
 Gage Calibration Expiration _____
 Gage Reading _____ PSIA
2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.
 Gage Reading _____ PSIA
3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Primary Stat-O-Seal Leak Rate atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 - 150 ft-lbs. Repeat the sequence at 300 - 350 ft-lbs with the final torquing being 450 - 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/11/98 0753MSLD Reading 3.4410⁻⁶ X Range Factor 50k = MSLD Div.Background 3.2410⁻⁹ X Range Factor 50 = Backgnd Div.MSLD Div. 170k - Backgnd Div. 160 = Net Div.MSLD Sensitivity 1.2410⁻¹⁰ X Net Div. 169840 =

Secondary vessel and O-ring leakage Rate

9/11/98 WC 486.15 730 AM 584-40-63-017
MAC# SEN 9/23/98

$$2.36 \times 10^{-8} \times 520 = 1800$$

$$\frac{86 - 1.0 \times 10^{-10} \times 5}{1795} = \frac{5}{1795} = 1.1 \times 10^{-11}$$

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.
Gage Reading _____ PSIA
2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.
Gage Reading _____ PSIA
3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time 9/10/98 MSLD WC 78869 @ D07MSLD Reading 3.8 X Range Factor 500 = MSLD Div.Background 5 X Range Factor 5 = Backgnd Div.MSLD Div. 1900 - Backgnd Div. 25 = Net Div.Helium Std 1.9×10^{-8} + Net Div. 1875 =MSLD Sensitivity 1.01×10^{-11} atm-cc/sec/div

machine std
 1.9×10^{-8} atm-cc/cc
 584-70-03-017

close out calibration
 for Primary containment vessel
 and lid seal port

Date and Time 9/11/98 0800 AMMSLD Reading 3.6 X Range Factor 500 = MSLD Div.Background 1×10^{-10} X Range Factor 5 = Backgnd Div.MSLD Div. 1800 - Backgnd Div. 5 = Net Div.Helium Std 1.9×10^{-8} + Net Div. 1795 =MSLD Sensitivity 1.1×10^{-11} atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

NDE LEAK TEST PROCEDURE AND TEST REPORT NON DESTRUCTIVE EXAMINATION 306E BLDG., 300 AREA - TEL. 378-6402										Page 1 of 1 Job No. 98-19			
Requestor J. E. MERCADO			Company WNWN		Project/System/Work Package/Traveler No. PAS-1 CASK S/N 2162-026 Pre-Pressure Test								
MSB 11-15		Bldg. 345 HILL		Area 300		Work Package HNF-2979 N4K4G							
Acceptance Std. 1 X 10⁻⁷ Atmcc/sec.				Section		Para.		Date		☐ NA Dwg. No. GM-20-100D ☐ NA			
TEST CONDITIONS Temperature AMB. Device ID ☒ NA Barometric Pressure AMB. ☐ NA Test Pressure A1 ATM ☐ NA Gas HELIUM ☐ NA Concentration APP. 100% ☐ NA Other ☒ NA Bubble Solution ☒ NA Batch No. _____ Gage 1 584-31-04 ☒ NA Range _____ Calib. Exp. _____ Gage 2 584-31-04 ☒ NA Range _____ Calib. Exp. _____ Relief Valve ☒ NA						TEST EQUIPMENT ☐ NA Manufacturer L H UL100 PLUS Ident. No. WC48615 Mach. Ser. 1.2 x 10-11 Atm-cc/sec/Div Std. No. 584-40-03-017 Std. Leak 1.9 X 10-8 Atm-cc/sec Calib. Exp. 9-23-98 SYSTEM SENSITIVITY ☐ Same as MSD Calib. or: Sensitivity _____ Atm-cc/sec/Div Std. No. _____ Calib. Exp. _____ ADDITIONAL STD. ☒ NA Sensitivity _____ Atm-cc/sec/Div Std. No. _____ Std. Leak _____ Atm-cc/sec Calib. Exp. _____						NCR ☒ NA Cleaning ☒ NA PROCEDURE NO. _____ ☒ NDT-LT-6000 Rev. 4 Appendix A Rev. 3 ☒ Special Tech. No. SVLT-INS-003.2 ☐ Work Inst. _____	
Weld No., Part No., or Serial No. S/N 2162-026						Acc. X		Ref.		No Rel. Ind.		Comments SECONDARY CONTAINMENT VESSEL LID AND SEAL PRE-PRESSURE TEST HE LEAK TEST, LR= 3.8 X 10-8 Atmcc/sec. TESTING SURFACE WAS LAPPED WITH EMORY CLOTH TO SMOOTH SURFACE BLEMISHES), SEE ATTACHED REPORT	
Technician B. L. HOPKINS						Level II		Interpreted by B. L. HOPKINS		LY Level II W. D. PURDY		Reviewed by John T. Kim Date 9-16-98	
Date of Examination 09/15/98						Date 09/15/98

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 840 MSIN: L6-36 Richland, WA 99352 300 Area 306-E Building Phone: 376-8061 FAX: 376-4945 POC: John K. Keve		
APPROVAL:		
Originator: <i>John T. Keve</i>	Date <i>9/13/88</i>	
NDE Leak Test Level III <i>John T. Keve</i>	Date <i>9/13/88</i>	
NDE Manager <i>James Krugman</i>	Date <i>2/24/88</i>	
Changes from previous version and reason for the changes (attach pages as necessary) DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK Document No.: <i>COGEMA-SVLT-INS-003.2</i> Revision No.: <i>0</i> Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐ Key Words: PAS-1, helium, leak testing Instructions: 		
Distribution: NDE File	Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-026 Pre Pressure Test
Sealing Surface Lapped

Date 9/15/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a 1×10^{-8} atm-cc/sec calibrated standard. WC 48615

Helium Standard Identification 584-40-03-017

Helium Standard 1.9×10^{-8} atm-cc/sec

Helium Standard Calibration Expiration 9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/15/98 2:5 PM

MSLD Reading 3.2 X Range Factor 500 = MSLD Div.

Background 2 X Range Factor 5 = Backgnd Div.

MSLD Div. 1600 - Backgnd Div. 10 = Net Div.

Helium Std. 1.9×10^{-8} ÷ Net Div. 1690 =

MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and start-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.MSLD Sensitivity X Net Div. =Primary Vessel and O-ring leakage Rate

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.
 Gage Calibration Identification _____
 Gage Range _____ PSIA
 Gage Calibration Expiration _____
 Gage Reading _____ PSIA
2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.
 Gage Reading *NA* _____ PSIA
3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	<i>NB</i>
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Primary Stat-O-Seal Leak Rate atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/15/98 2:30 PMMSLD Reading 7.2 X Range Factor 500 = MSLD Div.Background 8.6 X Range Factor 50 = Backgnd Div.MSLD Div. 3600 - Backgnd Div. 430 = Net Div.MSLD Sensitivity 1.2×10^{-11} X Net Div. 3170 =Secondary vessel and O-ring leakage Rate 3.8×10^{-8} atm cc/sec

HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading _____ PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.

4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.

5. Evacuate the stat-o-seal area with the MSLD.

6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std + Net Div. =MSLD Sensitivity atm-cc/sec/divDate and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std + Net Div. =MSLD Sensitivity atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

A-6001-492 (02/98)

A-8001-482R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 340 MSIN: L6-36 Richland, WA 99352 300 Area 306-E Building Phone: 376-8061 FAX: 376-4945 POC: John K. Keve		
APPROVAL: Originator: <u>John T. Keve</u> Date <u>9/13/98</u> NDE Leak Test Level III <u>John T. Keve</u> Date <u>9/13/98</u> NDE Manager <u>James Keegan</u> Date <u>9/13/98</u>		
Changes from previous version and reason for the changes (attach pages as necessary)		
DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK		
Document No.: COGEMA-SVLT-INS-003.2		Revision No.: 0
Retention Time: Non-Permanent ☒	Lifetime ☐	Project File ☐
Key Words: PAS-1, helium, leak testing		
Instructions:		
Distribution: NDE File		Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-027 *At Pressure Test*
Sealing Surface Lapped

Date 9/16/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard.

Helium Standard Identification

584-40-03-017

Helium Standard

1.9×10^{-8} atm-cc/sec

Helium Standard Calibration Expiration

9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/16/98 7:45 AM

MSLD Reading 3.2 X Range Factor 500 = MSLD Div.

Background 1 X Range Factor 5 = Backgnd Div.

MSLD Div. 1600 - Backgnd Div. 5 = Net Div.

Helium Std 1.9×10^{-8} ÷ Net Div. 1695 =

MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel. *N/A*

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.MSLD Sensitivity X Net Div. =Primary Vessel and O-ring leakage Rate

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.

Gage Calibration Identification _____

Gage Range _____ PSIA

Gage Calibration Expiration _____

Gage Reading _____ PSIA

2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading NA PSIA

3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Net Div. ____ X MSLD Sensitivity ____ atm-cc/sec/div =

Primary Stat-O-Seal Leak Rate ____ atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/16/98 0800MSLD Reading 1.44×10^{-7} X Range Factor 5000 = MSLD Div.Background 1.24×10^{-7} X Range Factor 50 = Backgnd Div.MSLD Div. 7000 - Backgnd Div. 60 = Net Div.MSLD Sensitivity 1.24×10^{-11} X Net Div. 6940 = 8.3×10^{-8} Secondary vessel and O-ring leakage Rate 8.3×10^{-8} Atm cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading _____ PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time 1 / 1MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/divDate and Time 9/16/98 0810MSLD Reading 3.4×10^{-8} X Range Factor 500 = MSLD Div.Background 2.0×10^{-9} X Range Factor 50 = Backgnd Div.MSLD Div. 1700 - Backgnd Div. 2.7×10^{-2} = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1600 =MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

NDE LEAK TEST PROCEDURE AND TEST REPORT						Job No. 98-19
NON DESTRUCTIVE EXAMINATION 306E BLDG., 300 AREA - TEL. 378-5402						
Requestor J. E. MERCADO		Company WMNW		Project/System/Work Package/Traveler No. PAS-1 CASK S/N 2162-026 Post-Pressure Test		
MSGN 11-15	Bldg. 345 HILL	Area 300	WORK PACKAGE HNF-2979 N4K4G			
Acceptance Std. 1 X 10⁻⁷ Atmcc/sec.			Section	Para.	Date ☐ NA	
					Dwg. No. GM-20-100D ☐ NA	
TEST CONDITIONS			TEST EQUIPMENT ☐ NA		NCR ☒ NA Cleaning ☒ NA	
Temperature AMB. Device ID ☒ NA			Manufacturer L H UL100 PLUS		PROCEDURE NO. ☐ NA ☒ NDT-LT-6000 Rev. 4 Appendix A Rev. 3 ☒ Special Tech. No. SVLT-INS-003.2 ☐ Work Inst. _____	
Barometric Pressure AMB. ☐ NA			Ident. No. WC48615			
Test Pressure 1 ATM ☐ NA			Mach. Sen. 1.3 X 10⁻¹¹ Atm-cc/sec/Div			
Gas HELIUM ☐ NA			Std. No. SB4-40-03 017			
Concentration APP. 100% ☐ NA			Std. Leak 1.9 X 10⁻⁸ Atm-cc/sec			
Other ☒ NA			Calib. Exp. 9-23-98			
Bubble Solution ☒ NA			SYSTEM SENSITIVITY ☒ NA			
Batch No. _____			☐ Same as MSD Calib. or:			
Gage 1 SB4-31-04-003 ☐ NA			Sensitivity _____ Atm-cc/sec/Div			
Range 0-100 PSIA			Std. No. _____			
Calib. Exp. 2-1-99			Std. Leak _____ Atm-cc/sec			
Gage 2 SB4-31-04- ☒ NA			Calib. Exp. _____			
Range _____			ADDITIONAL STD. ☒ NA			
Calib. Exp. _____			Sensitivity _____ Atm-cc/sec/Div			
Relief Valve ☒ NA			Std. No. _____			
			Std. Leak _____ Atm-cc/sec			
			Calib. Exp. _____			
Weld No., Part No., or Serial No.		Acc.	Rej.	No Ret. Inv.		
S/N 2162-026		X		Comments SECONDARY CONTAINMENT VESSEL LID AND SEAL POST-PRESSURE		
				TEST HE LEAK TEST, LR= 2.2 X 10⁻⁹ Atmcc/sec.		
				SEE ATTACHED REPORT		
S/N 2162-026		X		SECONDARY CONTAINMENT VESSEL STAT-0-SEAL POST-PRESSURE		
				TEST HE LEAK TEST, LR= 8.3 X 10⁻⁹ Atmcc/sec.		
				SEE ATTACHED REPORT		
Technician B. L. HOPKINS <i>B. Hopkins</i>		Level II	Interpreted by B. L. HOPKINS <i>B. Hopkins</i>		LT Level II II	
Date of Examination 09/17/98		Date 09/17/98		Reviewed by <i>[Signature]</i> Date 9-17-98

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 940 MSIN: Lc-36 Richland, WA 99352 300 Area 306-E Building Phone: 376-3061 FAX: 376-4945 POC: John K. Keve		
APPROVAL: Originator: <u>John T. Keve</u> Date <u>9/13/98</u> NDE Leak Test Level III <u>John T. Keve</u> Date <u>9/13/98</u> NDE Manager <u>James K. Keve</u> Date <u>9/14/98</u>		
Changes from previous version and reason for the changes (attach pages as necessary)		
DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK		
Document No.: COGEMA-SVLT-INS-003.2		Revision No.: 0
Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐		
Key Words: PAS-1, helium, leak testing		
Instructions:		
Distribution: NDE File		Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-026 Post Pressure TestDate 9/17/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard. WC48615

Helium Standard Identification 584-40-03-017Helium Standard 1.9×10^{-8} atm-cc/secHelium Standard Calibration Expiration 9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/17/98MSLD Reading 3.0 X Range Factor 500 = MSLD Div.Background 1 X Range Factor 5 = Backgnd Div.MSLD Div. 1500 - Backgnd Div. 5 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1495 =MSLD Sensitivity 1.3×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time / /

MSLD Reading X Range Factor = MSLD Div.

Background X Range Factor = Backgnd Div.

MSLD Div. - Backgnd Div. = Net Div.

MSLD Sensitivity X Net Div. =

Primary Vessel and O-ring leakage Rate

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.

Gage Calibration Identification 584-31-04-003

Gage Range 0-100 PSIA

Gage Calibration Expiration 2-1-99

Gage Reading 14.5 PSIA

2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	NA
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Net Div. ____ X MSLD Sensitivity ____ atm-cc/sec/div =

Primary Stat-O-Seal Leak Rate ____ atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/17/98 8:55 AM

MSLD Reading 6.6 X Range Factor 50 = MSLD Div.

Background 3.2 X Range Factor 50 = Backgnd Div.

MSLD Div. 330 - Backgnd Div. 160 = Net Div.

MSLD Sensitivity 1.3×10^{-11} X Net Div. 170 =

Secondary vessel and O-ring leakage Rate 2.2×10^{-9} Atm cc/sec.

HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading 14.5 PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading .04 PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	1.8×10^{-8}
1 Minute	1.6×10^{-8}
2 Minutes	1.6×10^{-8}
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time 9/17/98 10:40 AMMSLD Reading 1.6 X Range Factor 500 = MSLD Div.Background 3.2 X Range Factor 50 = Backgnd Div.MSLD Div. 800 - Backgnd Div. 160 = Net Div.Net Div. 640 X MSLD Sensitivity 1.3×10^{-11} atm-cc/sec/div =Secondary Stat-O Seal Leak Rate 8.3×10^{-9} atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/17/98 10:50 AMMSLD Reading 3.2 X Range Factor 500 = MSLD Div.Background 2 X Range Factor 5 = Backgnd Div.MSLD Div. 1600 - Backgnd Div. 10 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1590 =MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time / /

MSLD Reading X Range Factor = MSLD Div.

Background X Range Factor = Backgnd Div.

MSLD Div. - Backgnd Div. = Net Div.

Helium Std ÷ Net Div. =

MSLD Sensitivity atm-cc/sec/div

NA

Date and Time / /

MSLD Reading X Range Factor = MSLD Div.

Background X Range Factor = Backgnd Div.

MSLD Div. - Backgnd Div. = Net Div.

Helium Std ÷ Net Div. =

MSLD Sensitivity atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

A-6001-492 (02/98)

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering
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APPROVAL:

Originator: John T. Keve Date 9/13/98

NDE Leak Test Level III John T. Keve Date 9/13/98

NDE Manager James K. Keve Date 9/13/98

Changes from previous version and reason for the changes (attach pages as necessary)

DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE
PAS-1 CASK

Document No.: COGEMA-SVLT-INS-003.2

Revision No.: 0

Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐

Key Words: PAS-1, helium, leak testing

Instructions:

Distribution:

NDE File

Mark one of the following:

Distribution Complete: ☐

Distribution by DC: ☐

Partial Distribution by DC: ☒

Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-027 Post Pressure TestDate 9/17/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a 1×10^{-8} atm-cc/sec calibrated standard. WC48869

Helium Standard Identification

584-40-03-017

Helium Standard

 1.4×10^{-8} atm-cc/sec

Helium Standard Calibration Expiration

9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/17/98 8:15 AMMSLD Reading 3.2 X Range Factor 500 = MSLD Div.Background 2 X Range Factor 5 = Backgnd Div.MSLD Div. 1600 - Backgnd Div. 10 = Net Div.Helium Std 1.4×10^{-8} ÷ Net Div. 1590 =MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 – 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

NA

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

MSLD Sensitivity ____ X Net Div. ____ =

Primary Vessel and O-ring leakage Rate _____

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.

Gage Calibration Identification 584-31-04-003

Gage Range 0-100 PSIA

Gage Calibration Expiration 2-1-99

Gage Reading 14.5 PSIA

2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1. *NA*
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	NA
9 Minutes	
10 Minutes	

Date and Time ____/____/____

MSLD Reading ____ X Range Factor ____ = MSLD Div.

Background ____ X Range Factor ____ = Backgnd Div.

MSLD Div. ____ - Backgnd Div. ____ = Net Div.

Net Div. ____ X MSLD Sensitivity ____ atm-cc/sec/div =

Primary Stat-O-Seal Leak Rate ____ atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time 9/17/98 8:45MSLD Reading 4.8 X Range Factor 500 = MSLD Div.Background 2.8 X Range Factor 50 = Backgnd Div.MSLD Div. 2400 - Backgnd Div. 140 = Net Div.MSLD Sensitivity 1.2×10^{-11} X Net Div. 2260 =Secondary vessel and O-ring leakage Rate 2.7×10^{-8} atm cc/sec.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading 14.5 PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading .02 PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	6×10^{-8}
1 Minute	5.6×10^{-8}
2 Minutes	4.4×10^{-8}
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time 9/17/98 9:55 AMMSLD Reading 4.4 X Range Factor 500 = MSLD Div.Background 6.2 X Range Factor 50 = Backgnd Div.MSLD Div. 2200 - Backgnd Div. 310 = Net Div.Net Div. 1890 X MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div =Secondary Stat-O Seal Leak Rate 2.3×10^{-8} atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/17/98 10:10 AMMSLD Reading 3.4 X Range Factor 500 = MSLD Div.Background 4 X Range Factor 5 = Backgnd Div.MSLD Div. 1700 - Backgnd Div. 20 = Net Div.Helium Std. 1.9×10^{-8} ÷ Net Div. 1680 =MSLD Sensitivity 1.1×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/divDate and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

A-6001-492 (02/98)

A-6001-492R (02/98)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

COGEMA Engineering P.O. Box 840 MSIN: L6-36 Richland, WA 99352 300 Area 306-E Building Phone: 376-8061 FAX: 376-4945 POC: John K. Keve		
APPROVAL: Originator: <u>John T. Keve</u> Date <u>2/13/98</u> NDE Leak Test Level III <u>John T. Keve</u> Date <u>2/13/98</u> NDE Manager <u>James K. Keve</u> Date <u>2/13/98</u>		
Changes from previous version and reason for the changes (attach pages as necessary) DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK Document No.: COGEMA-SVLT-INS-003.2 Revision No.: 0 Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐ Key Words: PAS-1, helium, leak testing Instructions:		
Distribution: NDE File	Mark one of the following: Distribution Complete: ☐ Distribution by DC: ☐ Partial Distribution by DC: ☐ Explanation: On as needed basis

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-026 Post Pressure TestDate 9/15/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard. WC 48615

Helium Standard Identification 584-40-03-017Helium Standard 1.9×10^{-8} atm-cc/secHelium Standard Calibration Expiration 9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/15/98 7:30 AMMSLD Reading 3.2 X Range Factor 500 = MSLD Div.Background 1 X Range Factor 5 = Background Div.MSLD Div. 1600 - Background Div. 5 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1595 =MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 - 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time 9/15/98 8:05 AM

MSLD Reading 2.4 X Range Factor 500 = MSLD Div.

Background 1.6 X Range Factor 50 = Backgnd Div.

MSLD Div. 1200 - Backgnd Div. 80 = Net Div.

MSLD Sensitivity 1.2×10^{-11} X Net Div. 1120 =

Primary Vessel and O-ring leakage Rate 1.3×10^{-8} atm cc/sec.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.

Gage Calibration Identification 584-31-04-003

Gage Range 0-100 PSIA

Gage Calibration Expiration 2-1-99

Gage Reading 14.6 PSIA

2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading .02 PSIA

3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	1.2×10^{-7}
1 Minute	2.0×10^{-8}
2 Minutes	7.6×10^{-8}
3 Minutes	
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

End of Test

Date and Time 9/15/98 9:20 AMMSLD Reading 7.6 X Range Factor 500 = MSLD Div.Background 2 X Range Factor 50 = Backgnd Div.MSLD Div. 3800 - Backgnd Div. 100 = Net Div.Net Div. 3700 X MSLD Sensitivity 1.2×10^{-11} atm-cc/sec/div =Primary Stat-O-Seal Leak Rate 4.4×10^{-8} atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.MSLD Sensitivity X Net Div. =Secondary vessel and O-ring leakage Rate

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading _____ PSIA
2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA
3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time 9/15/98 9:30 AM closeoutMSLD Reading 3.4 X Range Factor 500 = MSLD Div.Background 2 X Range Factor 5 = Backgnd Div.MSLD Div. 1700 - Backgnd Div. 10 = Net Div.Helium Std 1.9×10^{-8} + Net Div. 1690 =MSLD Sensitivity 1.1×10^{-11} atm-cc/sec/divDate and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std + Net Div. =MSLD Sensitivity atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Helium Backfill

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

[illegible]

A-6001-492R (02/88)

DOCUMENT APPROVAL/TRANSMITTAL RECORD

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APPROVAL: Originator: <u>John T. Keve</u> Date <u>9/13/98</u> NDE Leak Test Level III <u>John T. Keve</u> Date <u>9/13/98</u> NDE Manager <u>James Krugman</u> Date <u>9/31/98</u>	
Changes from previous version and reason for the changes (attach pages as necessary) DOCUMENT TITLE: HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK Document No.: <i>COGEMA-SVLT-INS-003.2</i> Revision No.: <i>0</i> Retention Time: Non-Permanent ☒ Lifetime ☐ Project File ☐ Key Words: PAS-1, helium, leak testing Instructions: 	
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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

PAS-1 Cask Serial Number 2162-027 Post Pressure TestDate 9/16/98

1.0 SCOPE

This specific procedure addresses the helium leak testing of the vessel, outer O-ring seal, and the stat-o-seal in the primary and secondary PAS-1 cask. This technique shall be used in conjunction with NDT-LT-600Q *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

Helium Mass Spectrometer Leak Detector (MSLD)

1. Operate the MSLD according to the manufacturer's operating manual.
2. Calibrate the MSLD using a $X10^{-8}$ atm-cc/sec calibrated standard. WC 48869

Helium Standard Identification

584-48-03-017

Helium Standard

 1.9×10^{-8} atm-cc/sec

Helium Standard Calibration Expiration

9-23-98

3. The MSLD shall have a machine sensitivity of at least 1×10^{-9} atm-cc/sec/div.

Date and Time 9/16/98 9:40 AMMSLD Reading 3.6 X Range Factor 500 = MSLD Div.Background 4 X Range Factor 5 = Backgnd Div.MSLD Div. 1800 - Backgnd Div. 20 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1780 =MSLD Sensitivity 1.1×10^{-11} atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Primary Containment Vessel (PCV).
3. Torque the bolts in a star pattern to 16 – 18 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the PCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the PCV place helium inside the plastic hood surrounding the body of the cask. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and outer O-ring seal leakage rate for the primary containment vessel.

Date and Time 9/16/98 9:50 AMMSLD Reading 3.2 X Range Factor 500 = MSLD Div.Background 3.2 X Range Factor 500 = Backgnd Div.MSLD Div. 1600 - Backgnd Div. 1600 = Net Div.MSLD Sensitivity X Net Div. 0 =Primary Vessel and O-ring leakage Rate No Detectable Leak

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Primary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 2. Note the atmospheric pressure on the gage.

Gage Calibration Identification	<u>584-31-04-003</u>
Gage Range	<u>0-100</u> PSIA
Gage Calibration Expiration	<u>2/1/99</u>
Gage Reading	<u>14.5</u> PSIA

2. Evacuate the PCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading	<u>14.7</u> PSIA
--------------	------------------

3. Valve the vacuum pump out of the system and backfill the PCV with helium to atmospheric pressure gage reading in step 1.

4. Remove the manifold. Install the stat-o-seal and tighten to the closed position with the test port tool. Reconnect the MSLD to the cask test port.

5. Evacuate the stat-o-seal area with the MSLD.

6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background level established during the PCV test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the PCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	1.6×10^{-7}
1 Minute	2.8×10^{-8}
2 Minutes	4.4×10^{-8}
3 Minutes	4.2×10^{-8}
4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time 9/16/98 1040MSLD Reading 4.2×10^{-8} X Range Factor 500 = MSLD Div.Background 5.2×10^{-9} X Range Factor 50 = Backgnd Div.MSLD Div. 2100 - Backgnd Div. 260 = Net Div.Net Div. 1.0×10^{-11} X MSLD Sensitivity 1840 atm-cc/sec/div =Primary Stat-O-Seal Leak Rate 1.8×10^{-8} atm-cc/sec

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel and Lid Seal

1. Clean and lightly apply a thin coating of Apiezon vacuum grease on the outer O-ring seal.
2. Install the outer O-ring onto the lid and insert the lid onto the body of the Secondary Containment Vessel (SCV).
3. Torque the bolts in a star pattern to 100 – 150 ft-lbs. Repeat the sequence at 300 – 350 ft-lbs with the final torquing being 450 – 500 ft-lbs.
4. Remove the lid test plug(s) and stat-o-seal. Connect the test equipment as depicted in Figure 1.
5. Evacuate the SCV with the MSLD. When the MSLD reaches testing conditions check for leaks around the test fittings. To test the SCV place helium inside the plastic hood surrounding the body of the vessel. Be sure to cut and tape the plastic so the leak test fitting remains outside of the plastic hood. The test duration should be approximately 2 minutes.
6. Determine the vessel and the O-ring seal leakage rate for the secondary containment vessel.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.MSLD Sensitivity X Net Div. =Secondary vessel and O-ring leakage Rate

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Secondary Containment Vessel Stat-O-Seal

1. Connect the test equipment as depicted in Figure 3. Note the atmospheric pressure on the gage.

Gage Reading _____ PSIA

2. Evacuate the SCV with the vacuum pump to less than 0.5 PSIA. Record the gage reading.

Gage Reading _____ PSIA

3. Valve the vacuum pump out of the system and backfill the SCV with helium to the atmospheric pressure gage reading in step 1.
4. Remove the manifold. Install and tighten the stat-o-seal to the closed position with the test port tool. Reconnect the MSLD to the cask test port.
5. Evacuate the stat-o-seal area with the MSLD.
6. When the MSLD switches to the test mode a large helium signal may be present. Ideally, the high helium background should decrease steadily to the background established during the SCV seal test. However, experience has shown that the background level will settle out higher but to an acceptable level. The test duration should be long enough to establish a stable MSLD reading. To be conservative in calculating the leak rate of the vessel the background level established during the SCV test will be subtracted from the MSLD reading. Therefore, the stat-o-seal will probably have a leak rate associated with it, however, the leak rate should be smaller than the acceptance standard.

TIME	MSLD READING
Only use the time necessary to establish a stable reading	MSLD Crossover Into Test Mode
30 Seconds	
1 Minute	
2 Minutes	
3 Minutes

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

4 Minutes	
5 Minutes	
6 Minutes	
7 Minutes	
8 Minutes	
9 Minutes	
10 Minutes	

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Net Div. X MSLD Sensitivity atm-cc/sec/div =Secondary Stat-O Seal Leak Rate atm-cc/sec

7. The MSLD shall have a MSLD sensitivity at the end of the test shall be at least 1×10^{-9} atm-cc/sec/div.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/div

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

8. If the MSLD sensitivity has decreased 35 percent (less sensitive) during a calibration period the seal(s) examined since the last valid calibration period shall be retested.
9. Intermediate calibrations, if necessary.

Date and Time / / MSLD Reading X Range Factor = MSLD Div.Background X Range Factor = Backgnd Div.MSLD Div. - Backgnd Div. = Net Div.Helium Std ÷ Net Div. =MSLD Sensitivity atm-cc/sec/divDate and Time 9/16/98 1050 closeoutMSLD Reading 4.0×10^{-8} X Range Factor 500 = MSLD Div.Background 3×10^{-10} X Range Factor 5 = Backgnd Div.MSLD Div. 2000 - Backgnd Div. 15 = Net Div.Helium Std 1.9×10^{-8} ÷ Net Div. 1985 =MSLD Sensitivity 9.6×10^{-12} atm-cc/sec/div

Acceptance Criteria

Each of the seals leakage rate shall be less than 1×10^{-7} atm-cc/sec (air) or 2.6×10^{-7} atm-cc/sec (helium).

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 1

Primary Vessel and O-ring Seal

Secondary Vessel and O-ring Seal

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 2

Primary Stat-O-Seal

Examination

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HELIUM LEAK TEST QUALIFICATION OF THE PAS-1 CASK

Figure 3

Secondary Stat-O-Seal

Examination

APPENDIX E
TEST REPORT FOR PRESSURE TESTING

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A-6001-492 (02/98)

A-6001-492R (02/98)

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

1.0 SCOPE

This specific procedure addresses the pressure test of the PAS-1 cask's secondary containment vessel (SCV) and the primary containment vessel (PCV). This procedure shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

2.1 Pressure Test Prerequisites

- The gas used as the test gas shall be bottled nitrogen or dry clean air.
- The gages used in the examination shall be in current calibration. The gages should have graduations over a range of about double the intended maximum range, but in no case shall the range be less than one and one-half nor more than four times that pressure.
- A stand-alone pressure relief valve shall be installed in the pressurizing system, however, after the pressurization is completed and during the testing phase the valve maybe valved out of the system. The pressure relief valve shall be actuated at a pressure that is approximately 10 percent greater than the required pressure test.
- The ambient temperature shall be monitored, however the examination will be done in a controlled environment and the test duration is only 10 minutes. If the temperature increases or decreases 5 degrees Fahrenheit contact the NDE Leak Test Level III for direction.

2.2 Installing O-rings and Torquing the Bolts on the Primary Containment Vessel Lid

- Clean, lightly apply Apiezon vacuum grease, and install the outer O-ring seal on the Primary Containment Vessel (PCV) lid.
- Install the lid onto the body of the PCV and assemble the cask with the closure bolts.
- The bolts shall be torqued to 16 - 18 ft.-lbs with a calibrated torque wrench using a star pattern.

2.3 Pressure Test of the Primary Containment Vessel

- Connect the pressure test equipment to the test port as depicted in Figure 1.
- With the test port tool verify that the stat-o-seal is in the open position.
- Verify the valve to the pressure relief valve (PRV) is open.
- Verify the pressure regulator control valve is at its minimum pressure setting.

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

- Verify the vent valve is closed.
 - Pressurize the PCV with nitrogen or dry bottled air to 39.7 psia (25 psi). The pressure shall be increased in steps of 5 psi until the final test pressure of 64.7 psia (50 psi) $\pm$ 0.5 psi is reached.
 - The system pressure shall be stable on the test gages before proceeding.
 - Just prior to the start of the examination the PRV valve may be closed.
 - The pressure test shall last a minimum of 10 minutes with no evidence of pressure loss.
 - Vent the system and remove the test equipment.
- 2.4 Installing O-rings and Torquing the Bolts on the Secondary Containment Vessel Lid
- Clean, lightly apply Apiezon vacuum grease, and install the outer O-ring seal on the Secondary Containment Vessel (SCV) lid.
 - Install the lid onto the body of the SCV and assemble the cask with the closure bolts.
 - The bolts shall be torqued to 100 to 150 ft-lbs with a calibrated torque wrench using a star pattern. The sequence shall be repeated for 300 to 350 ft-lbs with the final torque being 450 to 500 ft-lbs.
- 2.5 Pressure Test of the Secondary Containment Vessel
- Connect the pressure test equipment to the test port as depicted in Figure 1.
 - With the test port tool verify that the stat-o-seal is in the open position.
 - Verify the valve to the pressure relief valve (PRV) is open.
 - Verify the pressure regulator control valve is at its minimum pressure setting.
 - Verify the vent valve is closed.
 - Pressurize the SCV with nitrogen or dry bottled air to 39.7 psia (25 psi). The pressure shall be increased in steps of 5 psi until the final test pressure of 64.7 psia (50 psi) $\pm$ 0.5 psi is reached.
 - The system pressure shall be stable on the test gages before proceeding.
 - Just prior to the start of the examination the PRV valve may be closed.
 - The pressure test shall last a minimum of 10 minutes with no evidence of pressure loss.
 - Vent the system and remove the test equipment.

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

Figure 1

Primary and Secondary
Containment Vessel
Pressure Test

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

1.0 SCOPE

This specific procedure addresses the pressure test of the PAS-1 cask's secondary containment vessel (SCV) and the primary containment vessel (PCV). This procedure shall be used in conjunction with NDT-LT-6000 *General Leak Test Examination Procedure*.

2.0 INSTRUCTIONS

2.1 Pressure Test Prerequisites

- The gas used as the test gas shall be bottled nitrogen or dry clean air.
- The gages used in the examination shall be in current calibration. The gages should have graduations over a range of about double the intended maximum range, but in no case shall the range be less than one and one-half nor more than four times that pressure.
- A stand-alone pressure relief valve shall be installed in the pressurizing system, however, after the pressurization is completed and during the testing phase the valve may be valved out of the system. The pressure relief valve shall be actuated at a pressure that is approximately 10 percent greater than the required pressure test.
- The ambient temperature shall be monitored, however the examination will be done in a controlled environment and the test duration is only 10 minutes. If the temperature increases or decreases 5 degrees Fahrenheit contact the NDE Leak Test Level III for direction.

2.2 Installing O-rings and Torquing the Bolts on the Primary Containment Vessel Lid

- Clean, lightly apply Apiezon vacuum grease, and install the outer O-ring seal on the Primary Containment Vessel (PCV) lid.
- Install the lid onto the body of the PCV and assemble the cask with the closure bolts.
- The bolts shall be torqued to 16 - 18 ft-lbs with a calibrated torque wrench using a star pattern.

2.3 Pressure Test of the Primary Containment Vessel

- Connect the pressure test equipment to the test port as depicted in Figure 1.
- With the test port tool verify that the stat-o-seal is in the open position.
- Verify the valve to the pressure relief valve (PRV) is open.
- Verify the pressure regulator control valve is at its minimum pressure setting.

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

- Verify the vent valve is closed.
 - Pressurize the PCV with nitrogen or dry bottled air to 39.7 psia (25 psi). The pressure shall be increased in steps of 5 psi until the final test pressure of 64.7 psia (50 psi) $\pm$ 0.5 psi is reached.
 - The system pressure shall be stable on the test gages before proceeding.
 - Just prior to the start of the examination the PRV valve may be closed.
 - The pressure test shall last a minimum of 10 minutes with no evidence of pressure loss.
 - Vent the system and remove the test equipment.
- 2.4 Installing O-rings and Torquing the Bolts on the Secondary Containment Vessel Lid
- Clean, lightly apply Apiezon vacuum grease, and install the outer O-ring seal on the Secondary Containment Vessel (SCV) lid.
 - Install the lid onto the body of the SCV and assemble the cask with the closure bolts.
 - The bolts shall be torqued to 100 to 150 ft-lbs with a calibrated torque wrench using a star pattern. The sequence shall be repeated for 300 to 350 ft-lbs with the final torque being 450 to 500 ft-lbs.
- 2.5 Pressure Test of the Secondary Containment Vessel
- Connect the pressure test equipment to the test port as depicted in Figure 1.
 - With the test port tool verify that the stat-o-seal is in the open position.
 - Verify the valve to the pressure relief valve (PRV) is open.
 - Verify the pressure regulator control valve is at its minimum pressure setting.
 - Verify the vent valve is closed.
 - Pressurize the SCV with nitrogen or dry bottled air to 39.7 psia (25 psi). The pressure shall be increased in steps of 5 psi until the final test pressure of 64.7 psia (50 psi) $\pm$ 0.5 psi is reached.
 - The system pressure shall be stable on the test gages before proceeding.
 - Just prior to the start of the examination the PRV valve may be closed.
 - The pressure test shall last a minimum of 10 minutes with no evidence of pressure loss.
 - Vent the system and remove the test equipment.

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PAS-1 PRESSURE TEST SPECIFIC PROCEDURE

Figure 1

**Primary and Secondary
Containment Vessel
Pressure Test**

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