

Contract No:

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**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE**

USQ Screening required when performed in a nuclear facility

1.0 PURPOSE

Provide step-by-step instructions for the annual helium leak test certification and maintenance of the 9975 Shipping Package.

2.0 SCOPE

- 2.1 This procedure applies to the annual helium leak test performed on the 9975 Shipping Package. The 9975 Shipping Package containment vessels must have both passed a leak test within the 12 Months prior to use. (SARP 8.2.2.2)
- 2.2 This procedure provides instructions for performing leak tests to the body, the outer O-Ring seal, the high pressure plug seal of the 9975 containment vessels, and completion of pre-authorized rework.
- 2.3 Attachments 1 and 2 may be performed before the leak testing activities described in Section 5.0, below.
- 2.4 If maintenance and testing is done in an SRNL facility, the High Pressure Lab Specialists may perform any or all of the following steps:
- Remove the containment vessels from the drums and remove PCV from the SCV
 - Remove the cone seals from the containment vessels
 - At the conclusion of the test place the tested containment vessels back in the drum.
- 2.5 If disassembly of the shipping package is **NOT** done by R&D Engineering, the facility personnel will perform the following steps in preparation for having the High Pressure Lab Specialists perform the test:
- Remove the containment vessels from the drums and remove PCV from the SCV
 - Remove the cone seals from the containment vessels
 - At the conclusion of the test place the tested containment vessels back in the drum.
- 2.6 Test includes: (See Figure 1 for a Cross-Sectional view of a containment vessel) R&D Engineering will do the following steps:
- Clean, inspect and lubricate the containment vessel sealing surfaces and cone seal assemblies.
 - Remove and destroy both O-Rings from each cone seal.
 - Install a new O-Ring in the outer O-Ring groove of each cone seal.
 - Pump the air out of the inside of the containment vessel with a vacuum pump and backfill with helium.
 - Torque the containment vessel lid and the high pressure plug closed.
 - Place a bell jar around the outside of the containment vessel and then evacuate the bell jar.
 - Connect a helium leak detector to the bell jar and read the leak detector response. Helium that leaks out of the containment vessel will be detected by the leak detector.

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R&D Engineering will use the leak detector response to calculate the leakage rate of the containment vessel body, outer O-Ring seal and the high pressure plug seal.

- Install a new O-Ring in the inner O-Ring groove of each lid.

2.7 Acceptance Criteria

2.7.1 Per ANSI N 14.5 and the 9975 SARP, the Maximum Allowable Leak Rate is $<1 \times 10^{-7}$ ref cc/sec air ($<2 \times 10^{-7}$ ref cc/sec helium) with a sensitivity of 5×10^{-8} ref cc/sec at 1 atmosphere differential pressure (9975 SARP 8.1.3).

2.7.2 If a Shipping Package Containment Vessel does not pass the annual leak test or is found to be damaged or defective, contact the 9975 Design Authority Engineer. An NCR dispositioned by the 9975 Design Authority Engineer and the 9975 Design Agency may be required before any further testing is performed. The following items are authorized to be directly replaced without an NCR. The item(s) replacement shall be documented in this procedure.

(1) On the cone seal assembly of the containment vessels, direct replacement of:

- O-Rings
- $\frac{1}{4}$ " high pressure plugs and/or gland nuts.
- Snap rings

(2) On the drum assemblies, direct replacement of:

- Drum lid closure bolts and/or nuts.
- Screws for the aluminum cover plate.
- Caplugs

Note: Obtain these parts from the 9975 Program Manager.

2.7.3 Except for preauthorized rework, discrepant conditions for a Shipping Package Containment Vessel shall be documented with an NCR dispositioned by the 9975 Design Authority Engineer and the 9975 Design Agency before any repairs, further processing or further testing is performed. However, Conditional Released items may be further processed in accordance with SRS Manual^[7.12], QAP 15-1 restrictions. The following items are authorized to be reworked without an NCR. The rework conditions shall be documented in this procedure.

(1) Coatings and stains may be removed with approved cleaners, Scotch-Brite pads or fine grit sandpaper. Reworked areas that cannot return the affected surface to a metal clean condition shall be addressed as nonconforming.

(2) Minor scratches on the sealing surfaces that can be redressed by approved fine abrasives may be removed using Scotch-Brite pads or fine grit sand paper. Rework of surface scratches in sealing surfaces shall be proven by an acceptable leak test as described in this procedure. Sharp edged or pointed dents shall not be reworked and addressed as nonconforming.

(3) Cone seal threads may be cleaned with an approved cleaner and conditioned to remove burrs or other material. Re-threading is not allowed and shall be addressed as nonconforming. Rework of cone seal threads shall be proven by an acceptable leak test per this procedure.

(4) Drum lid bolts may be cleaned with a wire brush and lubricated with Crown 8060 Dry Moly Lube. Drum lid nuts may be chased.

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(5) Containment vessel scribe lines may be reworked as described in Attachment 3 of this procedure.

(6) Minor surface rust may be removed by approved cleaners, emery cloth, wire brush or Scotch-Brite pads. Flaking rust or pitting shall be addressed as nonconforming. Document rework of rust areas in Attachment 2 of this procedure.

(7) Delaminated Celotex may be reworked by using Elmer's Professional Carpenters Wood Glue or an approved equal. A rework using glue must be allowed to air out for at least one week outside of the package prior to assembly to prevent lead carbonate formation. Document rework in Attachment 1 of this procedure on Form L9.4-10500-3, Comments Section.

(8) If the average axial distance between the top of the air shield and the drum flange exceeds one inch, or if the four measurements are NOT within 5/16" (0.31") of each other, then the Insulation Assembly may be replaced with a new insulation assembly per Reference 7.25.

2.7.4 Raised surfaces on cone-seal components resulting from vibro-etchings shall be handled and documented in Attachment 4 of this procedure. (Ref. 7.11)

2.8 Terms and Definitions

2.8.1 For High Pressure Lab general terms and definitions see Procedure L9.4-10001

2.8.2 Final Calibration: The first calibration of the helium leak test system that is done after the leak test of the containment vessel.

2.8.3 Helium Saturation: A condition where helium migrates through the O-Ring material. Helium saturation can cause an unacceptable helium background for the leak test.

2.8.4 Peer Reviewer: An individual who is task qualified and who did not accomplish the task to be verified, but may have been involved in the performance of the work activity.

2.8.5 PCV: Primary Containment Vessel

2.8.6 SCV: Secondary Containment Vessel

2.8.7 ref cc/sec: cubic centimeters per second at reference temperature and pressure. Per ANSI N 14.5, reference temperature is 25°F and reference pressure is atmospheric pressure

2.8.8 Sensitivity: The minimum leakage rate that the procedure is capable of detecting (Ref. 7.6). For this procedure, sensitivity is expressed as ref cc/sec/div, where "div" is a division on the leak detector.

2.8.9 Division: 1/10th of the leak detector's full-scale meter reading for the leak detector's most sensitive range. For example, a division for a leak detector that goes down to the 10⁻⁹ ref cc/sec range would be "1" on the 10⁻⁹ range.

2.8.10 Rework – the process by which an item is made to conform to original requirements by completion or correction. (1Q, Appendix A^[7.12])

2.8.11 Repair - the process of restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirements. A technical justification is required, that is, a statement defining the basis for the proposed course of action. This basis must be founded on statements of fact derived from calculations, evaluations, codes, standards, documented history, or other technical sources. Sufficient detail must exist to allow a peer to confirm the validity of the statement. (1Q, Appendix A^[7.12])

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2.9 Responsibilities

2.9.1 For High Pressure Lab general responsibilities see Procedure L9.4-10001

2.9.2 Customer responsibilities:

- Supply the containment vessel along with a written work request to R&D Engineering.
- Arrange for removal of any Tamper Indicating Devices (TID's) from the shipping drums prior to leak testing. and the installation of new TID seals, as required, in their facility at the completion of maintenance and testing (Ref. 7.14).
- If the maintenance and testing is done in SRNL, TID removal and installation at the completion of maintenance and testing may be done by SRNL personnel who have had TID seal training using the appropriate procedure.
- Provide a temperature controlled space in a regulated area for R&D Engineering to perform the leak test.
- Containment vessels that do not have a history of radioactive service may be tested in the Bldg 723-A High Pressure Lab if this is agreeable to R&D Engineering.
- Remove the Secondary Containment Vessel (SCV) from the drum and remove the Primary Containment Vessel (PCV) from the Secondary Containment Vessel (SCV), unless otherwise agreed to by the High Pressure Laboratory Lead Specialist.
- If maintenance and testing is done in SRNL, removal of the containment vessels from the drum and removal of the PCV from the SCV will be done by R&D Engineering instead of by the customer.

2.9.3 The High Pressure Laboratory Lead Specialist shall:

- Provide Leak Test personnel with the following information:
 - Job Number
 - Customer
 - Test Engineer
 - Activity Code and TWC
 - Building Number where the containment vessels will be used
 - Number of 9975 drums to be tested
- Provide a Peer Reviewer to verify that the datasheets are correctly completed and that hand calculations are correct.
- Supply two individually wrapped replacement O-rings for each containment vessel plus several extra O-rings in the event that retesting is needed. These O-rings shall meet the requirements as described in this procedure.
- Ensure Leak Test personnel are currently certified per requirements of Manual D2, NDEP 2.1.

2.9.4 Any and all organizations involved in the maintenance and testing of the 9975 Shipping Package shall maintain a sufficient housekeeping program in order to keep all surfaces as free as practicable of any lead contamination.

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3.0 PRECAUTIONS/LIMITATIONS

- 3.1 All leak testing shall be performed by certified Level II or Level III Leak Test Personnel or by Leak Test Trainees or Level I Personnel under the direct supervision of a Level II or Level III Leak Tester.
- 3.2 Only personnel certified to Level II or Level III may interpret test results or sign data sheets or test reports as the leak tester.
- 3.3 For previously used containment vessels, this test must be performed in an area designated by the Area RCO. Past experience has shown that the shipping containment vessels may carry radioactive contamination in inaccessible areas that are not detectable until disassembled.
- 3.4 Wear Personnel Protective Equipment as required by the facility where the work is being performed.
- 3.5 Safety Shoes are required while handling containment vessels.
- 3.6 Use proper lifting technique when lifting containment vessels. If a hoist is used to move the containment vessels:
 - 3.6.1 The person performing the lift must have current incidental rigger training.
 - 3.6.2 Personnel near the lift must wear a hard hat.
- 3.7 If any package components are impaired or unsatisfactory, notify Supervision (and the Design Authority as necessary) to resolve the issue.
- 3.8 The exterior of the lead shielding assembly located inside the 9975 drum is un-encapsulated lead (the interior is lined with stainless steel). Past experience has shown that lead carbonate has formed on this lead and flaking of the material when removing/replacing the 9975 upper Celotex assembly is possible. Industrial Hygiene has established administrative controls for working with/handling the 9975s – personal protective equipment, hygiene practices, and work and housekeeping practices to protect personnel from exposure.



The health effects of lead are Inhalation symptoms due to exposure from lead include weakness of the body and insomnia. Contact or ingestion of lead can cause malnutrition, weight loss, abdominal pain, anemia, and tremors. The affected target organs include the central nervous system, kidneys, blood, and gastrointestinal tract. Lead may present a reproductive hazard potential. Lead poisoning can cause permanent damage to the brain and many other organs and causes reduced intelligence quotient and behavioral problems.

- 3.9 9975 Shipping Package conditions that are not addressed by this procedure or approved design documents (drawings, DCFs, etc.) shall be documented per SRS Manual 1Q, QAP 15-1, Control of Nonconforming Items.

4.0 PREREQUISITE ACTIONS

- 4.1 Obtain the latest revisions of the following forms from Document Control record test data on:
 - 4.1.1 Form L9.4-10500-1 "Calibration and Helium Leak Test Data Sheet"
 - 4.1.2 Form L9.4-10500-2 "Helium Leak Detector Calibration Log"
 - 4.1.3 L9.4-10500-3" Shipping Package Annual Maintenance Data Form"
 - 4.2 Ensure that Building Operations has obtained entry authorization for the High Pressure Lab Specialists who will be performing the testing.
 - 4.3 At the beginning of the work shift, obtain the permission of the Shift Operations Manager (SOM) to perform leak testing. Request the SOM to sign and date the top of Form L9.4-10500-3.
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- 4.4 If the shipping containment vessels that will be leak tested have a history of radioactive service, then contact RCO for assistance during testing.
 - 4.5 **Required Instrumentation & Equipment**
 - 4.5.1 M&TE calibrated standard helium leak with a leakage rate between 1×10^{-8} and 5×10^{-7} ref cc he /sec.
 - 4.5.2 Helium mass spectrometer leak detector with sensitivity of 1×10^{-8} ref cc/sec/division of helium or better.
 - 4.5.3 M&TE Calibrated thermometer graduated in $^{\circ}\text{C}$, capable of reading room temperature to $\pm .5^{\circ}\text{C}$.
 - 4.5.4 M&TE calibrated absolute pressure transducer, $\pm .25$ psi accuracy or better for pressures ranging from 0 to 20 psia.
 - 4.5.5 Helium gas cylinder, 99.9% minimum purity, Stores No. 32-534.00 labeled UN-1046.
 - 4.5.6 Straps, clamps, etc needed to tie down the helium gas cylinder.
 - 4.5.7 Regulator/Relief Valve with (nominal) 25 psig set pressure, for helium cylinder
 - 4.5.8 Helium sniffer probe (may be needed for leak location)
 - 4.5.9 Bell Jar and leak test stand (See Figure 2A or 2B)
 - 4.5.10 Calibrated torque wrench (digital or dial readout), 30 to 150 foot pound range, $\pm 1\%$ of reading uncertainty. (for applying closure torque to PCV and SCV cone seal nut)
 - 4.5.11 Calibrated torque wrench (digital or dial readout), 0 to 50 foot pound range, $\pm 2\%$ of reading uncertainty (for applying closure torque to the high pressure plug)
 - 4.5.12 Torque wrench adapter
 - 4.5.13 Lid lifting handle
 - 4.5.14 Support Stand Weldment
 - 4.5.15 Socket Extension
 - 4.5.16 Teflon or aluminum spacer
 - 4.5.17 Krytox grade 240AC lubricant, Stores No. 32-24983.00, SRS MSDS No. 8815
 - 4.5.18 Silicone vacuum grease, Dow Corning, Stores No. 32-24984.00, SRS MSDS No. 6381
 - 4.5.19 Snap ring removal tool
 - 4.5.20 Ratchet wrench with 9/16" socket
 - 4.5.21 Isopropyl alcohol, Stores No. 6-850.00, MSDS No. 6733 or Ethyl alcohol, Stores No. 6- 810.00, MSDS 11565-1
 - 4.5.22 Stopwatch and wall clock or watch (for time of day)
 - 4.5.23 Vortex[®] cleaning solution (Optional), MSDS #23822-1
 - 4.5.24 Cotton tipped applicators
 - 4.5.25 Lint-free cloths, Stores No. 23-16215.00
 - 4.5.26 6 inch steel ruler with 1/16" graduations (or finer) for measuring the gap between the Air Shield and the inside of the drum.
 - 4.5.27 Lead use only gloves.
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- 4.5.28 HEPA filtered vacuum cleaner.
- 4.5.29 Calibrated caliper, capable of reading ½ inch in 0.001 inch increments, for measuring the thickness of lead shielding.
- 4.5.30 Set of 4 9975 PCV go/no-go gauges made per EES Development Drawing EES 22621-R1-021. These gauges are used to determine the inner diameter of a PCV.
- 4.5.31 Elmer's Professional Carpenters Wood Glue or an approved equal
- 4.5.32 Fine-grit sandpaper, 300 to 600 grit.
- 4.5.33 Wire brush.
- 4.5.34 Crown 8060, Dry Moly Lubricant (Stores Item No. 22-1460.00)
- 4.5.35 Rotary tool and flapper wheel, 100 to 200 grit.
- 4.5.36 O-ring removal tool, made of a soft material that will not scratch stainless steel. An example is MSC Part Number 09270059.
- 4.5.37 Slug, to take up volume in an SCV, typically a round cylinder made of metal or plastic, approximately 19 ¼" long x 5" diameter.
- 4.5.38 Slug, to take up volume in a PCV, typically a round cylinder made of metal or plastic, approximately 14 ¼" long x 4" diameter.
- 4.5.39 MK-II RFID tag (Optional; if requested and provided by the customer)

4.6 Replacement Parts

Obtain needed replacement parts from the 9975 Program Manager to maintain proper Quality Assurance. Note what parts, other than O-rings, were replaced in the Comments Section of the Leak Test Data Sheet.

- 4.6.1 O-rings for containment vessel lids: 2 new O-rings for each containment vessel:
 - A. The cure date for the new O-rings must be less than 20 years before this annual leak test date.
 - B. The O-rings must be stored in B-Level storage or higher while in storage prior to being used for this procedure.
 - C. SCV O-ring, Part Number 2-252-V(0)835-75 or V 0835 M83485-252 or VM835 M83485 2-252 or 2-252 VM835-75
 - D. PCV O-ring, Part Number 2-244-V(0)835-75 or V 0835 M83485-244 or VM835 M83485-244 or 2-244 VM835-75
- 4.6.2 ¼" high pressure plug, PPI Catalog No. P-110-60, SST or P-110-034-60.
- 4.6.3 ¼" high pressure gland nuts, PPI Catalog No. P-130-60, SST, or P-130-246-60.
- 4.6.4 Snap rings, Waldes TRUARC No. 5108-125
- 4.6.5 Drum lid closure bolt, SRS Drawing R-R2-F-0025, Item 3
- 4.6.6 Bolt for the aluminum cover plate, ¼-20UNC-2A X .75 LG, stainless steel, hex head bolt, ASME SA-320, Grade B8, Class 1 (SRS Drawing R-R2-F-0026, Item 12)
- 4.6.7 Caplug®, BP ½"

- 4.7 All sections / data blocks in the Attachments which are not applicable in the performance of this procedure shall be marked N/A.
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5.0 PERFORMANCE SECTIONS**5.1 Preliminary Actions**

- 5.1.1 **ENSURE** that the Pre-use torque tester checks of the torque wrenches have been performed this shift **AND** the results were within the following ranges:
- A. 0 to 50 ft. lb range torque wrench:
 - While the torque wrench exerts between 31.5 and 33.5 ft. lbs., the Torque Tester reading is within 1 ft. lb of the torque wrench reading.
 - B. 30 to 150 ft. lb range torque wrench:
 - While the torque wrench exerts between 51.5 and 53.5 ft. lbs., the Torque Tester reading is within 1 ft. lb of the torque wrench reading.
 - While the torque wrench exerts between 102.0 and 103.0 ft. lbs., the Torque Tester reading is within 1.5 ft. lb of the torque wrench reading.
 - C. **INITIAL** on Form L9.4-10500-3 indicating torque wrenches are acceptable.
- 5.1.2 **ENSURE** the Pressure Transducer Readout is on.
- 5.1.3 **ENSURE** the helium leak detector is on.
- 5.1.4 **PERFORM** an instrument calibration on the helium leak detector per manufacturer's instructions.
- 5.1.5 **ENSURE** that the end of the helium backfill manifold that normally connects to the top of the test canister is plugged.
- 5.1.6 **ENSURE** the Vacuum/Helium Valve is in the "HE" position.
- 5.1.7 **ENSURE** Valve V4 is CLOSED.
- 5.1.8 **OPEN** the helium cylinder valve.
- 5.1.9 **ADJUST** the helium gas regulator until the Pressure Transducer Readout reads between 17 and 19.7 psia.
- 5.1.10 **TURN** the Vacuum/Helium Valve to the "CLOSED" position.
- 5.1.11 **OPEN** Valve V4 **AND WAIT** for the Pressure Transducer Readout reading to go below 15 psia.
- 5.1.12 **ENSURE** the helium backfill manifold is unobstructed by performing the following:
- A. **REMOVE** the plug from the end of the helium backfill manifold.
 - B. **CLOSE** Valve V4.
 - C. **POSITION** the Vacuum/Helium Valve momentarily to the "HE" position **AND ENSURE** that helium is flowing out of the end of the manifold.
 - D. **TURN** the Vacuum/Helium Valve to the "CLOSED" position.
- 5.1.13 **ENSURE** the helium leak detector is connected to the test stand as shown in either Figure 2A or Figure 2B.
- 5.1.14 **ENSURE** Valves V1, V2 and V3 are CLOSED.
- 5.1.15 **ENSURE** vacuum pump(s) is/are ON.
- 5.1.16 **ENSURE** the electronic thermometer is ON.
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5.2 Helium Leak Test System Calibration

NOTE: If the leak test system is configured like Figure 2B, **THEN PERFORM** this calibration on the test stand for the SCV only, because it has the greatest volume.

5.2.1 **ENSURE** M&TE data and the test date have been recorded on Form L9.4-10500-2.

5.2.2 **ENSURE** that there is no containment vessel on the leak test stand.

5.2.3 **ENSURE** Valve V3 is CLOSED.

5.2.4 **ENSURE** Valve V2 is OPEN.

5.2.5 **ENSURE** the Leak Standard Valve is OPEN.

5.2.6 **ENSURE** the helium leak standard is installed in the test system as shown in either Figure 2A or Figure 2B.

5.2.7 **CLOSE** Valve V2.

5.2.8 **OPEN** Valve V3.

5.2.9 **INSTALL** the bell jar on the leak test stand.

5.2.10 **ENSURE** Valve V1 is OPEN.

5.2.11 **ENSURE** the helium leak detector is in the START mode.

5.2.12 **ENSURE** the helium leak detector is in the TEST mode.

5.2.13 **WAIT** for the helium leak detector to reach a steady state background reading in the 10^{-8} cc/sec range.

A. **ADJUST** the helium leak detector zero adjust as necessary to obtain a reading of at least 1 division background on the leak detector.

5.2.14 **CLOSE** Valve V3.

5.2.15 **OPEN** Valve V2, **AND WAIT** for the helium leak detector to reach a steady state Standard Reading.

5.2.16 **RECORD** the Time of Day, Standard Reading, and Room Temperature on Form L9.4-10500-2.

5.2.17 **CLOSE** Valve V2.

5.2.18 **WAIT** for the helium leak detector to reach a steady state background reading in the 10^{-8} cc/sec range.

5.2.19 **RECORD** the Background Reading on Form L9.4-10500-2.

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NOTE: For the initial calibration, perform only Steps 5.2.20.A, and 5.2.20.D

5.2.20 **COMPARE** the present calibration with the previous calibration by doing the following:

- A. **CALCULATE** the Response, C, by subtracting the Background Reading from the Standard Reading, $C = A - B$ **AND RECORD** on Form L9.4-10500-2.
- B. **CALCULATE** the Response Ratio by dividing the current response by the previous response and multiplying by 100%; **RECORD** on Form L9.4-10500-2.
- C. **RECORD** whether or not the Response Ratio is greater than 65% on Form L9.4-10500-2.
- D. **IF** the Response Ratio is greater than or equal to 65%, **THEN** all of the containers that were tested between these two calibrations **ARE** valid.
- E. **IF** the Response Ratio is less than 65%, **THEN** all of the containers that were tested between these two are **NOT** valid.

5.2.21 **ACTIVATE** the vent mode on the helium leak detector.

5.2.22 **REMOVE** the bell jar from the leak test stand.

5.2.23 **CLOSE** Valve V1.

5.2.24 **OPEN** Valve V2.

5.2.25 **REMOVE** or **ISOLATE** the helium leak standard from the manifold. If the helium leak standard is removed from the manifold, replace it with a vacuum plug.

5.2.26 **CLOSE** Valve V2.

5.2.27 **OPEN** Valve V3.

5.3 **Leak Test of Outer O-Ring Seal, Containment Vessel Body and Test Port Plug**

NOTE: The Leak Test Specialist may perform Section 5.2 more often if deemed necessary.

5.3.1 **ENSURE** that Section 5.2, "Helium Leak Test System Calibration", has been performed in the past 5 hours by reviewing Form L9.4-10500-2.

5.3.2 **ENSURE** both the PCV and SCV have been prepared for leak testing per Attachments 1 and 2.

5.3.3 **ENSURE** the containment vessel Serial Number, Test Date, and Leak Tester's Name have been recorded on the Helium Leak Test Data Sheet, Form L9.4-10500-1.

5.3.4 **RECORD** the containment vessel Serial Number on Form L9.4-10500-2 under the most recent calibration data.

- Example: 01111P, where "P" indicates a PCV and "S" would indicate an SCV

5.3.5 **RECORD** the First Standard Reading and the First Standard Background from the most recent Calibration of Helium Leak Test System (Section 5.2) on Form L9.4-10500-1.

5.3.6 **ENSURE** that the containment vessel support stand is set up for the appropriate containment vessel.

5.3.7 **ENSURE** the containment vessel is in the anti-rotation stand.

5.3.8 **TORQUE** the cone seal closed per the following torque values: (SARP 8.1.3)

PCV: 51.5 to 53.5 ft. lbs.

SCV: 101.5 to 103.5 ft lbs.

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- 5.3.9 **MEASURE** the distance between the radial line scribed across the top of the cone seal nut and the radial line scribed on the top of the containment vessel body. (SARP 7.2.2.8)
- A. On Form L9.4-10500-3, **RECORD** whether or not the distance between the scribe lines is equal to or less than 1 inch **AND INITIAL**.
 - B. **IF** this distance is equal to or less than 1 inch, **THEN GO TO** Step 5.3.12.
 - C. **IF** this distance is greater than 1 inch, **THEN**:
 - 1. **REMOVE** the cone seal using the ratchet and special cone seal nut socket.
 - 2. **VERIFY** that there are no obstructions on the thread surfaces of the cone seal nut and the CV body.
 - 3. **VERIFY** that there is no interference between the cone seal and the CV packing and/or spacer material. (SARP 7.2.28)
 - 4. **CAREFULLY PLACE** the cone seal on the containment vessel using care to ensure the male and female threads are not cross-threaded and hand tighten.
 - 5. **TORQUE** the cone seal closed per the following torque values: (SARP 8.1.3)
 - PCV: 51.5 to 53.5 ft. lbs.
 - SCV: 101.5 to 103.5 ft lbs.
 - 6. **MEASURE** the distance between the radial line scribed across the top of the cone seal nut and the radial line scribed on the top of the containment vessel body. (SARP 8.2.2.2).
 - IF** this distance is equal to or less than 1 inch, **THEN GO TO** Step 5.3.12.
 - IF** the scribe line distance is greater than 1" (inch) after the second attempt, **THEN** perform the steps in Attachment 3.
- 5.3.10 **IF** the containment vessel has a serial number between 6001 through 6511, **THEN PERFORM** the following:
- A. **TORQUE** the gland nut closed to between 31.5 to 33.5 ft. lbs (SARP 8.1.3).
 - B. **USE** a straight-edge to **VERIFY** that the gland nut does not protrude above the top of the cone seal nut.
 - C. On Form L9.4-10500-3, **RECORD** whether or not the gland nut protrudes above the cone seal nut.
 - D. **IF** the gland nut **DOES** protrude above the cone seal nut **THEN REPLACE** the gland nut and the high pressure plug **AND REPEAT** this step.
 - IF** the new gland nut protrudes above the cones seal nut, **THEN NOTIFY** the design authority engineer.
- 5.3.11 **IF** the containment vessel serial number is outside of the range cited in Step 5.3.10, **THEN CIRCLE** "N/A" on Form L9.4-10500-3.
- NOTE:** The ¼" high pressure plug and gland nut will be separated from the containment vessel during the leak test, but they must be reinstalled in the same containment vessel.
- 5.3.12 **REMOVE** the 1/4" high pressure plug from the top of the cone seal.
- 5.3.13 **CONNECT** the helium backfill manifold in the test port in the lid.
- 5.3.14 **TURN** the cone seal nut counterclockwise ¼ to 1 turn, visual.
-

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- 5.3.15 **ENSURE** Valve V4 is CLOSED.
- 5.3.16 **TURN** the Vacuum/Helium Valve to the "VAC" position to pump the air out of the inside of the containment vessel.
- 5.3.17 After waiting at least 3 minutes, **TURN** the Vacuum/Helium Valve to the "CLOSED" position.
- A. **IF** the Pressure Transducer Reading is equal to or greater than 0.5 psia, **THEN PERFORM** the following steps:
1. **TURN** the Vacuum/Helium Valve to the "VAC" position.
 2. **WAIT** between 3 and 5 minutes.
 3. **REPEAT** Step 5.3.17.
- B. **IF** the Pressure Transducer Reading is less than 0.5 psia, **THEN PROCEED** to the next step.

NOTE: Steps 5.3.18 through 5.3.30 are time dependent and must be done in quick succession to complete the leak test before helium permeates through the outer O-Ring seal.

- 5.3.18 **TURN** the Vacuum/Helium Valve to "HE" to begin filling the containment vessel with helium.
- 5.3.19 **WHEN** the Pressure Transducer Readout reading exceeds 10 psia, **IMMEDIATELY TURN** the Vacuum/Helium Valve to "CLOSED".
- A. **IF** the Pressure Transducer Reading does not drop below 10 psia, the gas path to the inside of the PCV is blocked.
1. **DISCONTINUE** the test and notify the 9975 Design Authority Engineer of the blockage.
- B. **IF** the Pressure Transducer Reading drops below 10 psia, **THEN TURN** the Vacuum/Helium Valve to "HE" to continue filling the containment vessel with helium.
- 5.3.20 **WHEN** the Pressure Transducer Readout reads between 17 and 19.7 psia, **TURN** the Vacuum/Helium Valve to "CLOSED".
- A. **IF** the Pressure Transducer Reading drops below 17 psia, **THEN PERFORM** the following steps:
1. **TURN** the Vacuum/Helium Valve to the "HE" position.
 2. **REPEAT** Step 5.3.20.
- B. **IF** the Pressure Transducer Reading is between 17 and 19.7 psia, **THEN PROCEED** to the next step.
- 5.3.21 **TORQUE** the cone seal nut per the following torque values: (SARP 8.1.3)
- PCV: 51.5 to 53.5 ft. lbs.
- SCV: 101.5 to 103.5 ft. lbs.
- 5.3.22 **DISCONNECT** the helium manifold from the containment vessel **AND REINSTALL** the high pressure plug and gland nut in the containment vessel's test port
- 5.3.23 **TORQUE** the gland nut closed to between 31.5 to 33.5 ft. lbs (SARP 8.1.3).
- 5.3.24 **ENSURE** the containment vessel is on the test stand, right side up.
- 5.3.25 **PLACE** the bell jar over the containment vessel.
-

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- 5.3.26 **OPEN** Valve V2 to begin pumping a vacuum on the bell jar.
 - 5.3.27 **PUT** the helium leak detector in the START mode.
 - 5.3.28 **OPEN** Valve V1.
 - 5.3.29 **ENSURE** the helium leak detector is in the TEST mode.
 - 5.3.30 **CLOSE** Valve V2.
 - 5.3.31 **IF** the leak detector reading does **NOT** go below 2×10^{-7} cc/sec, **THEN PERFORM** the following:
 - A. **RECORD** observations in the Comments section of Form L9.4-10500-1
 - B. **GO** to Step 5.3.33.
 - 5.3.32 **WHEN** the leak detector reading goes below 2×10^{-7} cc/sec, **WAIT** one minute, **AND THEN RECORD** the helium leak detector reading on Form L9.4-10500-1.
 - 5.3.33 **ACTIVATE** the "VENT" mode on the helium leak detector.
 - 5.3.34 **REMOVE** the bell jar from the leak test stand.
 - 5.3.35 **REPEAT** Steps 5.3.1 through 5.3.34 for the second containment vessel of the shipping container.
 - 5.3.36 **REPEAT** Steps 5.3.1 through 5.3.35 for the containment vessels of additional shipping containers to be tested this shift.
 - 5.3.37 **WHEN** testing of containment vessels is complete for this shift, **THEN PERFORM** a Calibration per Section 5.2.
 - A. **RECORD** the Final Standard Reading, the Final Background Reading and Room Temperature from Form L9.4-10500-2 onto Form L9.4-10500-1.
 - 5.3.38 **INSTALL** inner O-Rings on PCV and SCV Cone Seals per Attachment 5.
- NOTE:** If the annual maintenance is **NOT** done by SRNL, Step 5.3.39 may be performed by facility personnel.
- 5.3.39 **INSTALL** PCV/SCV in drum per Attachment 6.
 - 5.3.40 **GENERATE** a data sheet(s) for containment vessels tested using the High Pressure Lab Database program per L9.4-10100 "Pressure Test/Leak Test Procedure"
 - A. **USE** the First Standard Background in Form L9.4-10500-2 as the Leak Test Background for both the PCV and the SCV.
 - B. **ENTER** 98% for helium concentration on the computer.
 - C. **ENSURE** that the preliminary and final test sensitivities are equal to or less than 5×10^{-8} cc he/sec/div. **IF** either test sensitivity is greater than 5×10^{-8} cc he/sec/div, **THEN** the leak test results are invalid and the leak test must be repeated.
 - D. In the comments section of the data sheet(s) **NOTE** any parts that were replaced on the PCV or on the SCV.
 - 5.3.41 **ATTACH** the printed datasheet(s) to the corresponding Form L9.4-10500-3.
 - 5.3.42 **INSTALL** Shipping Package Annual Leak Test Label per Attachment 7.

6.0 RECORDS

Forms L9.4-10500-1 and L9.5-10500-2 will have data that the leak test specialist transcribes to the computerized leak test data sheet per Ref. 7.3. Once the leak test specialist and the reviewer have

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ensured that the data has been correctly transcribed, these two forms may be discarded. The completed Form L9.4-10500-3 and the computerized leak test data sheet shall be transmitted to the site records management system (EDWS) identifying the package serial number as SN:9975-0xxxx in the SSC transmittal field, the RSM Tracking Number shall be 10062 and the Document ID transmittal field should be filled in with a package number. The package number will be made up of the following information and recorded on the cover page of Attachment 1:

EES – AM – (DATE) – 9975 - (SERIAL NUMBER)

The date will be made up of eight numbers, the first two are the month of the year, the second two are the day of the month and the last four are the year.

Example: Serial number 5446 is completed on 09 January, 2006.

The package number will be: EES – AM – 01092006 – 9975 - 05446

7.0 REFERENCES

- 7.1 WSRC-SA-2002-00008, Revision 0, "Safety Analysis Report for Packaging Model 9975, Chapter 8, December 2003.
 - 7.2 Certificate of Compliance for Model 9975-96 Shipping Package, Revision 10.
 - 7.3 Procedure L9.4-10100, "Proof/Leak Test Procedure".
 - 7.4 Procedure L9.4-10001, High Pressure Lab Procedure Terms, Definitions, Qualifications and Responsibilities.
 - 7.5 Procedure L9.4-10000, High Pressure Lab Safety Procedures
 - 7.6 ANSI N 14.5-1997, "American National Standard for Radioactive Materials - Leakage Tests on Packages for Shipment".
 - 7.7 S-SARA-G-00001, SARP Model 9975 Addendum 1, Revision 1
 - 7.8 EES Development Drawing EES-22621-R1-021, "9975 Primary Containment Vessel (PCV) Go/No-Go Gages, Assembly & Details".
 - 7.9 Nonconformance Report 2008-NCR-29-0010 (Vibro-Etch Marking on 9975 Cone Seals)
 - 7.10 Design Change Form, M-DCF-A-01003, "9975 Cone-Seal Vibro-Etch Marking Repair"
 - 7.11 Problem Report, STAR item 2008-CTS-003932, "Vibro-Etching On 9975 Packaging"
 - 7.12 Problem Report, STAR item 2008-CTS-009314, "9975 Annual Maintenance Independent Inspection"
 - 7.13 SRS 1Q "Quality Assurance Manual"
 - 7.14 SOP-KAD-103K, "Receipt, Storage and Shipment of Empty Containers in Assembly, MBA and KAD"
 - 7.15 Certificate of Compliance for Model 9975-85 Shipping Package, Revision 30.
 - 7.16 Guide to the RFID Monitoring System Rev. 1; Part II – Operating Procedures II-7, PC-10-00-04 Procedure for Installing and Removing the MK-II RFID Tag (Model 9975 Package)
 - 7.17 S-SARA-G-00008, Rev. 0, "Safety Analysis Report For Packaging, Model 9975, Addendum, Justification for Use of the Radio Frequency Identification (RFID) System".
 - 7.18 S-SARP-G-00003, Rev. 2, "Safety Analysis Report for Packaging, Model 9975, B(M)F-96"
 - 7.19 M-CLC-A-00380, Rev. 0, "Thermal Evaluation of the 9975 Package O-Ring Under Varying Thermal Loading and Storage Ambient Temperature Conditions for RFIC Implementation"
 - 7.20 Form L9.4-10500-1 "Calibration and Helium Leak Test Data Sheet"
-

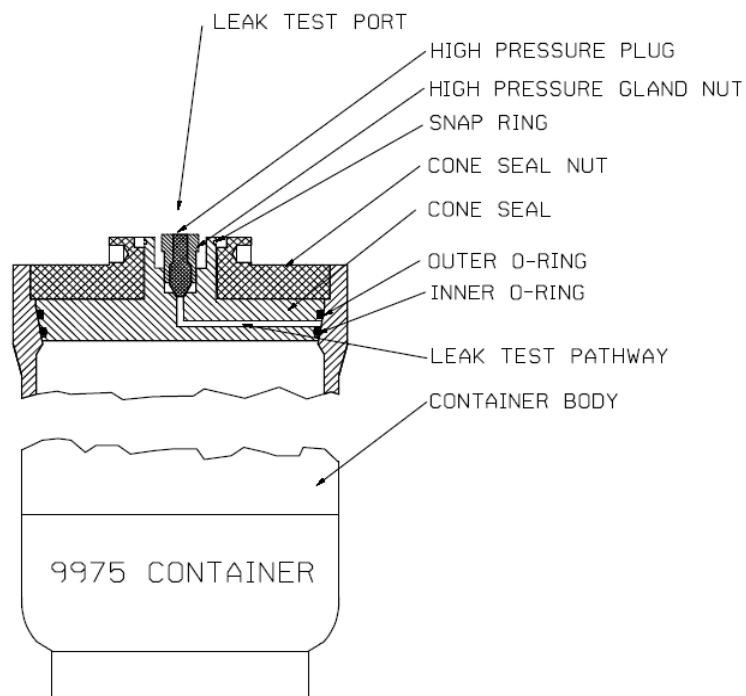
**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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- 7.21 Form L9.4-10500-2 "Leak Detector Calibration Log"
- 7.22 Form L9.4-10500-3 "Shipping Package Annual Maintenance Data Form"
- 7.23 NCR #2008-NCR-29-0020, "Indeterminate 9975 Shipping Package SCV/PCV Gland Nut Ports"
- 7.24 M-DCF-K-00549, Rev. 0, "Model 9975-85 Upgrade to Model 9975-96"
- 7.25 SRNL Procedure L9.4-10518, Latest Revision, "Replacing the Insulation Assembly In the 9975 Shipping Package"

8.0 ATTACHMENTS

- 8.1 Attachment 1, Shipping Package Containment Vessel Removal Instructions
 - 8.2 Attachment 2, Preparation of Containment Vessels for Annual Maintenance
 - 8.3 Attachment 3, Reworking Containment Vessel Scribe Lines
 - 8.4 Attachment 4, Repairing Vibro-etched Cone Seal Nut/Plug Contact Surface
 - 8.5 Attachment 5, Reassembly of Cone Seals After Leak Testing
 - 8.6 Attachment 6, Shipping Container Vessel Installation Instructions
 - 8.7 Attachment 7, 9975 Shipping Package Annual Leak Test Labeling
-

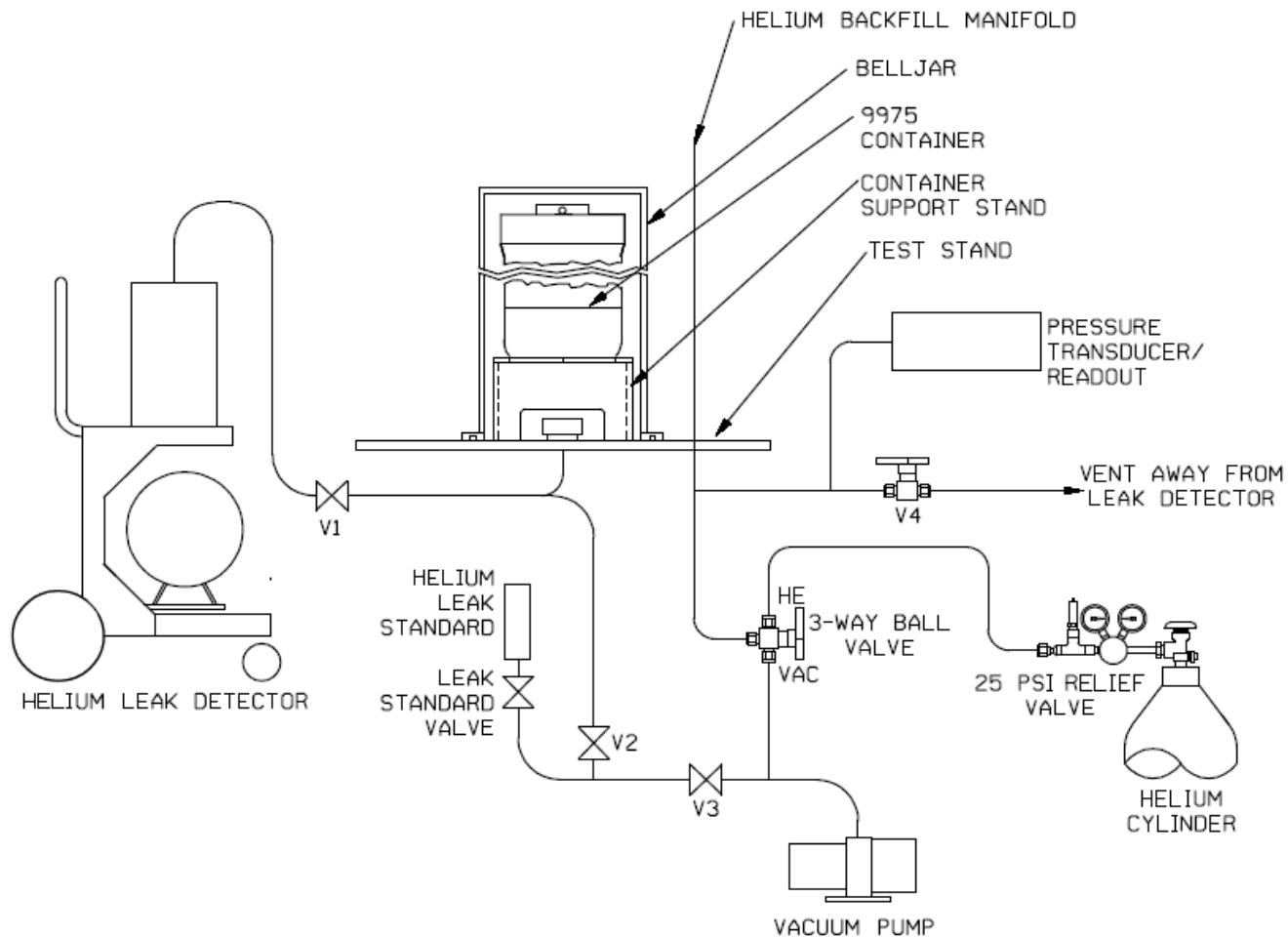
Figure 1
Containment Vessel Cross-Section



NOTE: THE CONE SEAL NUT AND CONE SEAL
COMPRISE THE LID ASSEMBLY

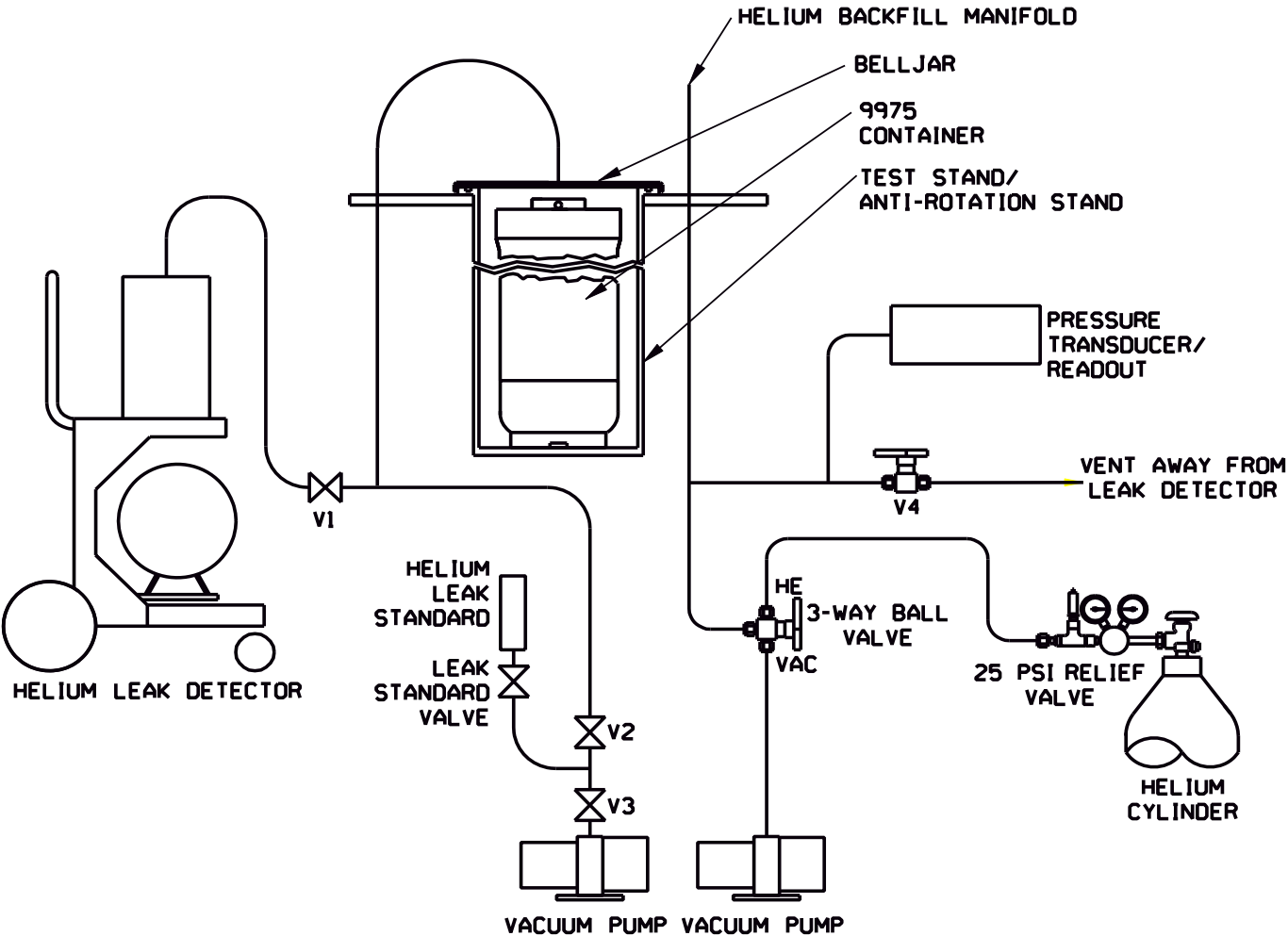
**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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Figure 2A
Helium Leak Test Schematic, Test Setup A



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Figure 2B
Helium Leak Test Schematic, Test Setup B



**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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- NOTE 1:** SRS Contamination Limits for any surface of Shipping Package are 20 dpm/100 cm² Alpha and 200 dpm/100 cm² Beta/Gamma. SARP Contamination Limits for any surface of Shipping Package are 20 dpm/100 cm² Alpha and 1000 dpm/100 cm² Beta/Gamma per 10 CFR 835, Appendix D.
- NOTE 2:** Operations is responsible for removing TID seals on shipping containers before leak testing, and installing TID seals on the shipping containers when leak testing is complete. If leak testing will be performed in Building 723-A High Pressure Lab, then SRNL personnel with TID training will remove TID seals when the shipping containers are delivered for leak testing and they will install TID seals when the shipping containers are reassembled after leak testing.
- NOTE 3:** Note any discrepancies, not otherwise identified, in the comments section at the end of Form L9.4-10500-3.
- NOTE 4:** The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

REMOVAL OF CONTAINMENT VESSELS FROM DRUMS

- 1.0 **IF** the drum identification plate reads "USA/9975/B(M)F-85" **THEN**

DETERMINE if the customer wants to upgrade the drum to "USA/9975/B(M)F-96"

ATTACH an e:mail of the customer's response to FORM L9.4-10500-3

IF the customer wants to upgrade the drum to read "USA/9975/B(M)F-96" **THEN SEND** the drum to Maintenance to change the identification plate to read "USA/9975/B(M)F-96" per M-DCF-K-00549.



- 2.0 **VERIFY** that the drum label has a trefoil on it.

2.1 **IF** the drum does NOT have a trefoil on it, **THEN:**

- A. **SET** the drum aside
- B. **NOTIFY** the Facility Manager to issue a work request to install a trefoil on the drum.
- C. **END** this procedure.

- 3.0 **RECORD** the record number in the form of EES – AM – (DATE) – (SERIAL NUMBER), on Form L9.4-10500-3.

- 4.0 **RECORD** the Specialist's name along with today's date on Form L9.4-10500-3.

- 5.0 **IF** the shipping package has a TID seal, **CONTACT** the appropriate group to have the seal removed before proceeding. (See Note 2)

- 6.0 **RECORD** the 9975 Shipping Package Number on Form L9.4-10500-3 .

- 7.0 **VERIFY** that the drum (top, bottom, side) is not breached by holes or by cracks. Request assistance in carefully tipping the drum in order to inspect the bottom of the drum. Sharp edged or pointed dents that may breach the drum are not acceptable. (SARP 7.5.2) *Sign*

- 8.0 **IF** the shipping package is identified as radioactive material (has radiological label, tag or marking) or has an unknown or suspect radiological history, **THEN REQUEST** RCO to perform a survey of the exterior

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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surfaces of the drum and **VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1)

8.1 **RCO: INDICATE** on Form L9.4-10500-3 whether or not a Survey is required.

*Sign***ATTACHMENT 1****SHIPPING PACKAGE CONTAINMENT VESSEL REMOVAL INSTRUCTIONS**

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9.0 **IF** the shipping package has a RFID Tag attached to it, **THEN PERFORM** the following steps:

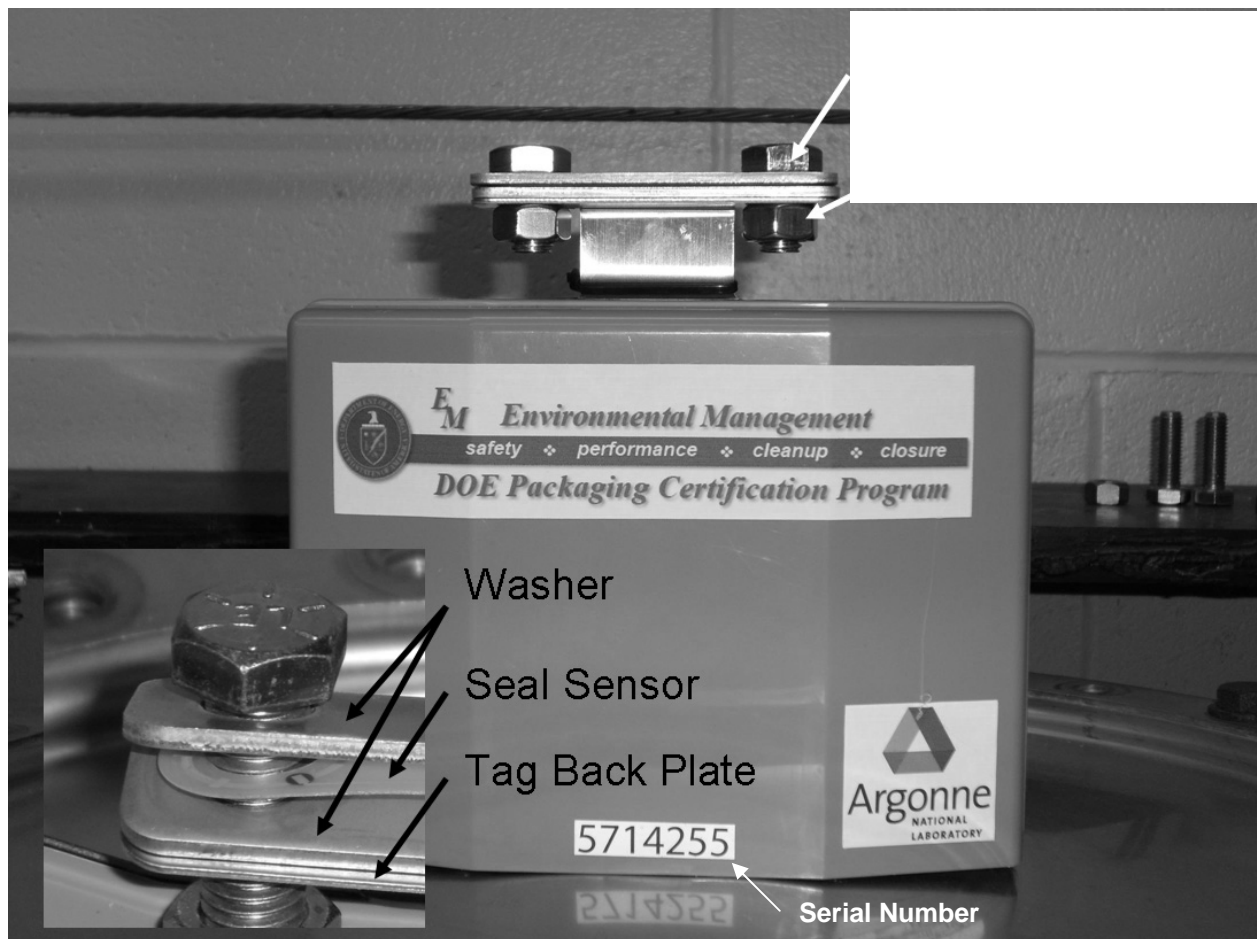
9.1 **RECORD** the serial number of the RFID Tag on Form L9.4-10500-3 .

9.2 **REMOVE** the two bolts and nuts that hold the tag on the package. Use these in the following removal steps.

9.3 **REMOVE** the seal sensor washers, seal sensor, and tag all at once.

9.4 **INSPECT** the seal sensor washers, seal sensor, and tag to ensure they are not damaged.

9.5 **ATTACH** the two extended length bolts (1.5 inches long) and nuts to hold the seal sensor washer, seal sensor, and tag together, **AND PLACE** the tag with other drum parts



MK-II RFID tag (front view). Insert shows seal sensor and washers details.

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- 10.0 **REMOVE** the lid closure bolts. **SEGREGATE** and **CONTROL** them.
 - 10.1 **ENSURE** the threads have not been damaged on the bolts and nuts.
- 11.0 **REMOVE** the shipping package lid.

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- 12.0 **IF** a survey was required in Step 8.1, **THEN REQUEST** RCO perform a survey of the accessible internal components of the drum as the drum is opened **AND VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1) *Sign*
- 13.0 **REMOVE** the thermal blanket.
- 14.0 **VERIFY** the axial distance between the top of the air shield and the drum flange does not exceed one inch. (SARP 7.2.1.11)
- 14.1 **MEASURE** the distance between the Air Shield and the drum flange near the drum wall in 4 places, 90-degrees apart from each other, **AND RECORD** the measurements on Form L9.4-10500-3.
- 14.2 **CALCULATE** the average of the four measurements, **AND RECORD** the average on Form L9.4-10500-3
- 14.3 **INDICATE** whether or not the average axial distance is less than or equal to 1 inch on Form L9.4-10500-3. *Sign*
- IF** the average is greater than 1 inch, **THEN REPLACE** the Insulation Assembly with a new one per Reference 7.25.
- RECORD** REWORK in comments section of Form L9.4-10500-3
- 14.4 **INDICATE** whether or not the four measurements are within 5/16" (0.31") of each other. *Sign*
- IF** the four measurements are **NOT** within 5/16" (0.31") of each other, **THEN REPLACE** the Insulation Assembly with a new one per Reference 7.25.
- RECORD** REWORK in comments section of Form L9.4-10500-3
- 15.0 **REMOVE** the Celotex top subassembly.
- 15.1 Visually **VERIFY** the Celotex top subassembly is intact. (Not broken or damaged). (SARP 8.2.3) *Sign*
- 15.2 **VERIFY** that there are no signs of advanced mold or wet Celotex.
- IF** there is evidence of advanced mold or wet Celotex, **THEN CONTACT** the Design Authority. *Sign*
- 15.3 **IF** Celotex is delaminated, **THEN STOP** and **REWORK** in accordance with section 2.7.3 (7). *Sign*
- RECORD** REWORK in comments section of Form L9.4-10500-3
- 16.0 **IF** a survey was required in Step 8.1, **THEN REQUEST** RCO perform a survey of the accessible internal components of the drum as the drum is opened **AND VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1) *Sign*
- 17.0 Visually **VERIFY** to the extent possible the lower Celotex insulation is not broken or damaged.
- 17.1 **IF** the lower Celotex insulation is broken or damaged, **THEN STOP** and **REWORK** in accordance with section 2.7.3 (7). **RECORD** rework in the comments section of Form L9.4-10500-3.

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NOTE: Un-encapsulated lead can be found on the inside of the 9975 drum. Past experience has shown that lead carbonate has formed on this lead and caused flaking of the material when removing/replacing the 9975 upper Celotex lid. To reduce lead exposure when working with/handling the 9975s:

- Notify area Industrial Hygiene prior to work (IH may perform sampling)
- Wear safety glasses and any type disposable gloves
- Ask Facility GCO for guidance on disposal of gloves and lead contaminated equipment
- Limit the physical handling of the lead containers
- Limit activities that would create airborne lead (sweeping, use of compressed air, etc)
- Request Operations to housekeep with a HEPA filtered vacuum cleaner to contain the lead carbonate flakes
- Practice good personal hygiene after task (thoroughly wash hands and face prior to eating, drinking, smoking, or apply cosmetics)

18.0 **INSPECT** the upper exposed section of the lead shield subassembly to determine if lead carbonate (a white coating on the lead) is present. (SARP F96 7.2.1.12)

NOTE: The 9975-85 with exposed lead shielding cannot be used beyond 3/1/2018.

18.1 **INDICATE** on Form L9.4-10500-3 whether or not lead carbonate is present.

Sign

NOTE: IF lead carbonate flaking is observed, THEN STOP and perform housekeeping with a HEPA filtered vacuum cleaner or wet wipes.

19.0 **REMOVE** the four bolts and the aluminum cover plate.

20.0 **IF** a survey was required in Step 8.1, **THEN REQUEST** RCO perform a survey of the aluminum cover plate and surrounding surfaces, **AND VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1)

Sign

CAUTION: Be cautious when working near the hoisted load to prevent injury in the event the load inadvertently falls.

21.0 **SLOWLY LIFT** the SCV from the drum using the lifting tool.

22.0 **IF** a survey was required in Step 8.1, **THEN REQUEST** RCO to perform a survey of the SCV, **AND VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1)

Sign

23.0 **DETERMINE** if the serial number on the SCV body and cone seal nut agree.

24.0 **IF** a discrepancy exists, **CONTACT** the containment vessel 9975 Design Authority Engineer for a path forward determination.

25.0 **PLACE** the SCV in the anti-rotation stand.

26.0 **IF** present, **REMOVE** debris from the top of the SCV using a lint-free cloth.

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27.0 IF "No" was circled in Step 18.1 of this Attachment, **THEN PROCEED TO** Step 28.0.

IF "Yes" was circled in Step 18.1 of this Attachment, **THEN MEASURE** the wall thickness in four locations using a caliper. **RECORD** the measurements and caliper calibration data on Form L9.4-10500-3 .

IF lead thickness is less than 0.510" in any location, **STOP** and contact the 9975 Design Authority Engineer. *Sign*

28.0 **ENSURE** the test port plug is loose.

29.0 IF a survey was required in Step 8.1, **THEN REQUEST** RCO to survey the cone seal surfaces and the inside of the SCV when the SCV is opened. (SARP 7.5.1) *Sign*

30.0 **OPEN** the SCV **AND** carefully **PLACE** the SCV cone seal assembly in a secure location.

31.0 IF a survey was required in Step 8.1, **THEN VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1) *Sign*

32.0 **REMOVE** the impact absorber from the SCV.

CAUTION: Damage to the SCV threads will result in the SCV not sealing and failing the leak test. Extra care shall be taken to protect the SCV threads when removing the PCV. A protective sleeve may be used to shield the threads during PCV removal if it is available.

33.0 **SLOWLY LIFT** the PCV from the SCV using the lifting tool.

34.0 **DETERMINE** if the serial number on the PCV body and cone seal nut agrees. IF a discrepancy exists, **CONTACT** the containment vessel 9975 Design Authority Engineer for a path forward determination.

35.0 IF a survey was required in Step 8.1, **THEN REQUEST** RCO to survey the outside of the PCV and the inside of the SCV, **AND VERIFY** the surfaces on the outside of the PCV and the inside of the SCV do not exceed the contamination limits established in Note 1. (SARP 7.5.1) *Sign*

36.0 **PLACE** the PCV in the anti-rotation stand.

37.0 **VERIFY** that the serial numbers of the Drum, the SCV and the PCV match.

IF a discrepancy exists, **CONTACT** the containment vessel 9975 Design Authority Engineer for a path forward determination.

38.0 IF present, **REMOVE** debris from the top of the PCV using a lint-free cloth.

39.0 **ENSURE** the test port plug is loose.

40.0 IF a survey was required in Step 8.1, **THEN REQUEST** RCO perform a survey of the inside of the PCV when it is opened. (SARP 7.5.1) *Sign*

41.0 **OPEN** the PCV **AND** carefully **PLACE** the PCV cone seal in a secure location.

42.0 IF a survey was required in Step 8.1, **THEN VERIFY** the surfaces do not exceed the contamination limits established in Note 1. (SARP 7.5.1) *Sign*

43.0 IF a PCV sleeve or 3013 spacer is present, **THEN REMOVE** it from the PCV.

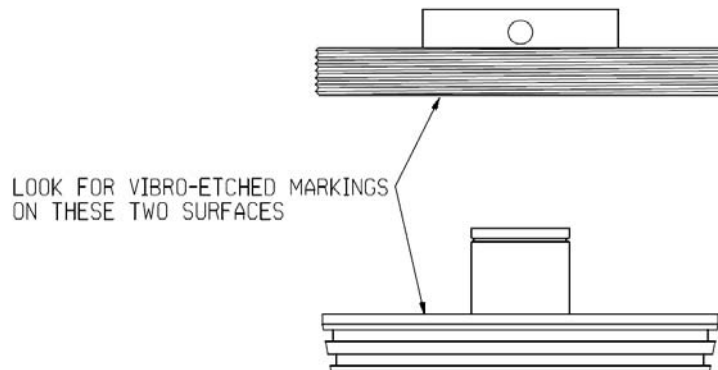
44.0 **VACUUM CLEAN** the insides of the drum and containment vessels.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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(Page 1 of 3)

NOTE: The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

- 1.0 **IF** a survey was required in Step 8.1 of Attachment 1, **THEN**:
 - 1.1 **CONTACT** RCO prior to disassembly of the PCV and SCV cone seal and cone seal nut surfaces.
SRS Contamination Limits for any surface of Shipping Package are 20 dpm/100 cm² Alpha and 200 dpm/100 cm² Beta/Gamma
SARP Contamination Limits for any surface of Shipping Package are 20 dpm/100 cm² Alpha and 1000 dpm/100 cm² Beta/Gamma per 10 CFR 835, Appendix D. *Sign*
 - 1.2 **ASK** RCO for guidance on disposal of waste materials (wipes, rags, etc.) resulting from leak testing.
- 2.0 **REMOVE** both O-rings from the cone seals using a brass O-ring removal tool, **THEN CUT** the old O-rings **AND DISCARD** them.
- 3.0 **REMOVE** the snap rings from the top of the cone seals **AND DISASSEMBLE** the cone seals.
- 4.0 **IF** a survey was required in Step 8.1 of Attachment 1, **THEN REQUEST** RCO to survey the surfaces of the cone seal and cone seal nut that are uncovered during disassembly. **VERIFY** that these survey results are less than the limits established in NOTE 1. (SARP 7.5.1) *Sign*
- 5.0 **INSPECT** the cone seal nut/plug contact surfaces for vibro-etched markings.



- 5.1 **IF NO** Vibro-etched markings are present on the cone seal nut/plug contact surface, **OR IF** vibro-etched markings do not have edges that stick out above the surface, **THEN PROCEED** to step 6.0.
- 5.2 **IF** vibro-etched markings are present on the cone seal nut/plug contact surfaces, **THEN COMPLETE** Attachment 4 of this procedure.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
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(Page 2 of 3)

- 6.0 **CLEAN** all **sealing** surfaces and O-ring grooves of the cone seal, the external threads on the cone seal nut, and the sealing surface and threaded surfaces on the body of the containment vessel with one of the following cleaning methods: (SARP 7.2.1.19) *Sign*
- **SCRUB** with alcohol and a lint-free cloth.
 - **SCRUB** with Vortex® cleaning solvent, **AND THEN WIPE** with a lint-free cloth and alcohol.
- 7.0 Visually **INSPECT** the cleaned sealing surfaces with a bright light for gouges, nicks, cuts, cracks, or scratches that could affect containment performance. (SARP F85 7.2.1.20, SARP F96 7.2.1.19) *Sign*
- 7.1 **IF** any defects are observed, **THEN**:
- A. **REWORK** the defects as described in section 2.7.3 of this procedure.
 - B. **RECORD** a description of defects and the rework that was performed in the Comments Section of Form L9.4-10500-3 .
 - C. **PROCEED** to Step 8.0.
- 7.2 **IF** the defects cannot be reworked, **THEN CONTACT** the containment vessel 9975 Design Authority Engineer for a path forward determination.
- 8.0 **LUBRICATE** the surface between the cone seal nut and cone seal plug with a thin film of Krytox grade 240AC lubricant. (SARP F85 7.2.1.24, SARP F96 7.2.1.23)
- 9.0 **REASSEMBLE** the cone seal and the cone seal nut using the snap ring.
- 10.0 **VERIFY** the cone-seal has been assembled and lubricated correctly and that it operates as intended as evidenced by free turning between the cone-seal nut and plug. (SARP F85 7.2.1.25, SARP F96 7.2.1.24, and SARP 8.2.4.1) *Sign*
- 11.0 **VERIFY** the new O-rings are the appropriate age, based on the O-Ring's cure date. (SARP 8.2.4.2)
- If the cure date is listed as a certain quarter of the year, assume that the cure date is the first day of that quarter.
 - The age must be less than 20 years old. *Sign*
- 12.0 **IF** the O-rings are less than 20 years old, **PROCEED** to Step 15, **IF NOT THEN PERFORM** the following on the O-ring older than 20 years:
- 12.1 **CUT** the O-ring in half **AND DISCARD** it.
- 12.2 **REPEAT** Step 11.0 with a new O-Ring
-

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 2****PREPARATION OF CONTAINMENT VESSELS FOR ANNUAL MAINTENANCE**

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13.0 **VISUALLY INSPECT** the new SCV and PCV O-Rings.

- The O-ring surface should be smooth, uniform and free of visible defects such as gouges, nicks, cuts, cracks, or scratches that could affect containment performance. (SARP 8.2.4.1) *Sign*

13.1 **IF NO** defects are observed that could affect containment performance, **PROCEED** to Step 14.0, **IF** defects are observed, **THEN PERFORM** the following on the damaged O-ring:

- **CUT** the O-ring in half **AND DISCARD** it.
- **RETURN TO** Step 11.0 with a new O-Ring

14.0 **RECORD** the O-ring data on Form L9.4-10500-3 : (SARP F85 8.2.4.2, SARP F96 8.2.4.3)

NOTE 1: The Manufacturer's part number may have a (0) between the V and the 8 depending on the date of manufacture.

NOTE 2: Initialing the following three steps may be completed after the O-rings have been installed.

15.0 **PUT** a very thin coating of silicone vacuum grease on the new O-rings. (SARP F85 8.2.4.2, SARP F96 8.2.4.3 and SARP 7.2.1.21) *Sign*

16.0 **INSTALL** the new O-Ring in the outer O-ring groove in the cone seal. (SARP F85 8.2.4.2 and SARP f96 8.2.4.3) *Sign*

17.0 **LUBRICATE** the threaded surfaces of the cone seal nut with a thin film of Krytox grade 240AC lubricant. (SARP 7.2.1.23, SARP F85 8.2.4.1, SARP F96 8.2.4.2) *Sign*

18.0 **ENSURE** the honeycomb spacer is in the bottom of the containment vessel with the flat side up.

CAUTION Damage to the containment vessel threads may result in the containment vessel not sealing and failing the leak test. Extra care shall be taken to protect the PCV and SCV threads.

19.0 **INSERT** the slug into the containment vessel.

20.0 **CAREFULLY PLACE** the cone seal on the containment vessel using care to ensure the male and female threads are not cross-threaded and hand tighten.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE**

ATTACHMENT 3**REWORKING CONTAINMENT VESSEL SCRIBE LINES**

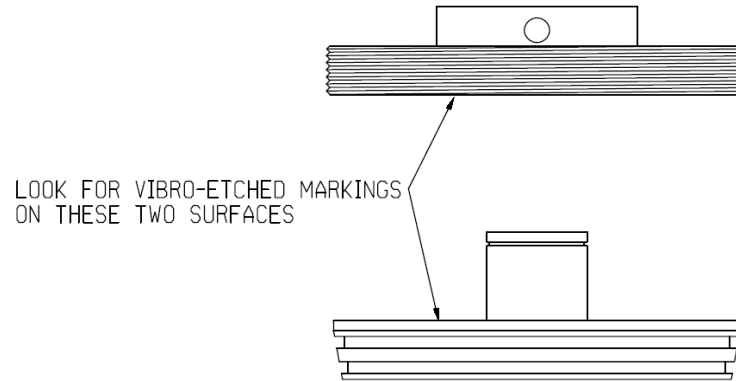
(Page 1 of 1)

NOTE: The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

- 1.0 **CIRCLE** which containment vessel(s) is/are to be corrected on Form L9.4-10500-3.
 - 2.0 **BUFF OUT** the existing scribe line on the containment vessel with a rotary tool and a small flapper wheel.
 - 3.0 **WIPE** down the top of the containment vessel with a clean, lint free cloth and optional alcohol to remove debris.
 - 4.0 **OPEN** the containment vessel **AND WIPE DOWN** the containment vessel body cone seal sealing surfaces with a clean lint free cloth to remove debris.
 - 5.0 **REMOVE** the outer O-Ring with a brass O-Ring removal tool **AND PLACE** the O-Ring on a clean, lint free cloth.
 - 6.0 **WIPE DOWN** the cone seal sealing surfaces with a clean lint free cloth to remove debris.
 - 7.0 **CAREFULLY PLACE** the cone seal on the containment vessel using care to ensure the male and female threads are not cross-threaded and hand tighten.
 - 8.0 **TORQUE** the cone seal closed per the following torque values: (SARP 7.2.2.7 and 7.2.3.6) *Sign*
 - PCV: 51.5 to 53.5 ft. lbs.
 - SCV: 101.5 to 103.5 ft lbs.
 - 9.0 **EXTEND** the existing scribe line on the cone seal nut onto the top of the containment vessel body, using a metal scribe and a straightedge.
 - 10.0 **OPEN** the containment vessel.
 - 11.0 **REINSTALL** the outer O-Ring on the cone seal.
 - 12.0 **CAREFULLY PLACE** the cone seal on the containment vessel using care to ensure the male and female threads are not cross-threaded and hand tighten.
 - 13.0 **TORQUE** the cone seal closed per the following torque values: (SARP 7.2.2.7 and 7.2.3.6) *Sign*
 - PCV: 51.5 to 53.5 ft. lbs.
 - SCV: 101.5 to 103.5 ft lbs.
 - 14.0 **VERIFY** the radial line scribed across the top of the cone seal nut is within one inch of the radial line scribed on the top of the containment vessel. (SARP 7.2.2.8) *Sign*
 - 15.0 The containment vessel is ready for testing.
-

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 4****VIBRO-ETCHED CONE SEAL NUT/PLUG CONTACT SURFACE (Reference 7.10)**

NOTE 1: The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.



- 1.0 **CIRCLE** which containment vessel(s) is/are to be corrected on Form L9.4-10500-3 .
- 2.0 **REMOVE** the raised edge of the Vibro-etched markings on the nut/plug contact surfaces. Use fine grit abrasives to carefully remove the edge on the vibro-etched markings.

NOTE 3: Do not attempt to completely remove the markings, as this would remove too much metal. The purpose of this attachment is to remove any sharp edges on the contact surfaces that could result in galling between the surfaces.

- 3.0 **WIPE DOWN** the cone seal contact surfaces with alcohol and a lint-free cloth to remove debris.
- 4.0 **INSPECT** the repaired surfaces to ensure there are no raised edges around the Vibro-etched markings.

Sign

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE**

ATTACHMENT 5**REASSEMBLY OF CONE SEALS AFTER LEAK TESTING**

Page 1 of 1

NOTE 1: This attachment may be performed at any time after the containment vessel has been leak tested.**NOTE 2:** The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

- 1.0 **OPEN** the containment vessel **AND REMOVE** the slug.
 - 2.0 **VERIFY** the new O-rings are the appropriate age (SARP F85 8.2.4.2, SARP F96 8.2.4.3):
 - If the cure date is listed as a certain quarter of the year, assume that the cure date is the first day of that quarter.
 - The age must be less than 20 years old. *Sign*
 - 3.1 **IF** an O-ring is **NOT** over 20 years old **THEN** proceed to Step 3.0. **IF** an O-Ring is older than 20 years, **THEN PERFORM** the following:
 - A. **CUT** the O-ring **AND DISCARD** it.
 - B. **REPEAT** Steps 3.0 with a new O-Ring.
 - 3.0 **VISUALLY INSPECT** the new O-Rings. (SARP 8.2.4.1):
 - The O-ring surface should be smooth, uniform and free of visible defects such as gouges, nicks, cuts, cracks, or scratches that could affect containment performance. *Sign*
 - 4.0 **IF** no defects are observed that could effect containment performance **THEN PROCEED** to Step 6.0. **IF** defects are observed, **THEN PERFORM** the following:
 - 5.1 **CUT** the O-ring **AND DISCARD** it.
 - 5.2 **RETURN TO** Step 3.0 with a new O-Ring.
 - NOTE:** The Manufacturer's part number may have a (0) between the V and the 8 depending on the age of the part. (SARP 8.2.4.2)
 - 5.0 **RECORD** the O-ring data on Form L9.4-10500-3: (SARP 8.2.4.3) *Sign*
 - 6.0 **PUT** a very thin coating of silicone vacuum grease on the new O-ring, **AND INSTALL** the O-Ring in the inner O-ring groove in the cone seal. (SARP 8.2.4.1 and (SARP 8.2.4.3) *Sign*
-

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 6****SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS**

(Page 1 of 6)

NOTE 1: This Attachment is to be used to prepare an empty 9975 for storage and transport at the conclusion of the annual maintenance and leak testing. Ensure that both O-rings have been installed per Attachment 5.

NOTE 2: The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

1.0 **VERIFY** that the serial numbers on the drum and both containment vessels match.

1.1 **IF** a discrepancy exists, **CONTACT** the containment vessel 9975 Design Authority Engineer for a path forward determination.

2.0 **IF** TID seal is needed, **THEN ENSURE** TID seal installer is present to verify PCV is empty and to install seal at the appropriate time (Ref. 7.14 for work in KAC).

3.0 **VERIFY** that the PCV is empty. (SARP 7.5.4)

Sign

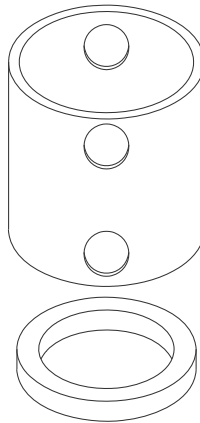
4.0 **REINSTALL** the bottom spacer into the PCV, if not already in place. (SARP 7.5.5)

Sign

5.0 **IF** the PCV sleeve or 3013 spacer was removed in Attachment 1 **AND** the customer did **NOT** request the spacer to be removed, **THEN PLACE** the spacer back into the PCV. (SARP 7.5.5)

Sign

5.1 **IF** the package serial number is in the range of 1301 through 2750, **AND** it does not have a two-piece split-ring 3013 spacer configuration shown below, **THEN CONTACT** the 9975 Design Authority. (SARP 7.2.1.26 and 7.2.2.3)



SHORTENED TOP SPACER
AND
BOTTOM RING SPACER

CAUTION

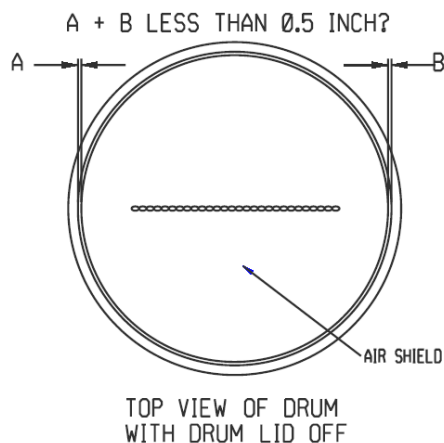
Damage to the SCV threads will result in the SCV not sealing and failing the leak test. Extra care shall be taken to protect the SCV threads when loading. A protective sleeve, if available, may be used to shield the threads during loading of the SCV.

6.0 **CAREFULLY PLACE** the cone seal on the PCV using care to ensure the male and female threads are not cross-threaded and hand tighten.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 6****SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS**

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- 7.0 **TORQUE** the PCV cone seal nut to 30 (+4/-4) ft.lbs. SARP F86 7.5.6, SARP F96 7.5.7) | *Sign*
- 8.0 **REINSTALL** the SCV bottom honeycomb impact absorber, if not already in place. (SARP 7.5.7) *Sign*
- 9.0 **PLACE** the PCV into the SCV using the lifting tool. (SARP 7.5.7) *Sign*
- 10.0 **INSERT** the SCV top honeycomb impact absorber into the SCV. (SARP 7.5.7) *Sign*
- 11.0 **CAREFULLY PLACE** the cone seal on the SCV using care to ensure the male and female threads are not cross-threaded and hand tighten.
- 12.0 **TORQUE** the cone seal nut to 30 (+4/-4) ft. lbs. (SARP F85 7.5.6, SARP F96 7.5.7) *Sign*
- 13.0 **IF** dust or debris is present in the bottom of the shielding assembly, **THEN VACUUM** the bottom of the assembly to remove the dust/debris
- 14.0 **CAREFULLY INSERT** the SCV into the drum using the lifting tool. (SARP 7.5.8) *Sign*
- 15.0 **INSTALL** the aluminum cover plate. (SARP 7.5.9) *Sign*
- 16.0 **INSTALL** each of the four bolts to finger-tight. (SARP 7.5.9) *Sign*
- 17.0 **VERIFY** that the Caplugs are properly installed in the drum vent holes. (Replace any damaged or missing Caplugs.) (SARP 7.5.3) *Sign*
- 18.0 **VERIFY** the Celotex top subassembly and the Air Shield are intact. (SARP 8.2.3) *Sign*
- 19.0 **REINSTALL** the Celotex top subassembly into the shipping container. (SARP 7.5.10) *Sign*
- 20.0 **VERIFY** the gap between the Air Shield and the inside wall of the drum is acceptable by performing the following steps: *Sign*



**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 6****SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS**

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21.0 **REINSTALL** the thermal blanket in the shipping container, roughly centered. (SARP 7.5.11)

Sign

NOTE: Leather or Hyflex gloves shall be worn when installing and sealing lid on drum.

22.0 **PLACE** the lid on the drum. (SARP 7.5.12)

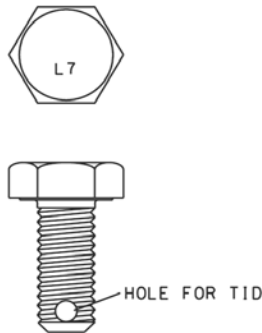
The drum lid should install without difficulty. If excessive body force is required to compress the lid, **STOP**
AND CONTACT the 9975 Design Authority Engineer for a path forward.

Sign

23.0 **VERIFY** that the drum bolts that were removed in Attachment 1 are:

Sign

- drilled to accept Tamper-Indicating Devices
- marked with L7 on the top of the bolt head.



24.0 **BRUSH** heavy rust off of the bolts, if needed. The bolts may be lubricated with Dry Moly Lube if needed.

NOTE: If the drum has an RFID that is to be installed, then 22 regular drum bolts will be installed in the next step, and the two extra-length bolts that come with the RFID will be installed next to each other.

25.0 **REINSTALL** the bolts/washers through the lid holes and hand tighten the bolts. (SARP 7.5.12)

Sign

26.0 **ENSURE** the EMPTY Label is applied to the package. (SARP 7.5.13)

Sign

27.0 **COVER** the package identification plate with durable, opaque tape. (SARP 7.5.13)

Sign

28.0 **REMOVE** any existing shipping labels.

29.0 **IF** a TID seal is needed, **THEN REQUEST** that a TID seal be installed on the empty drum.

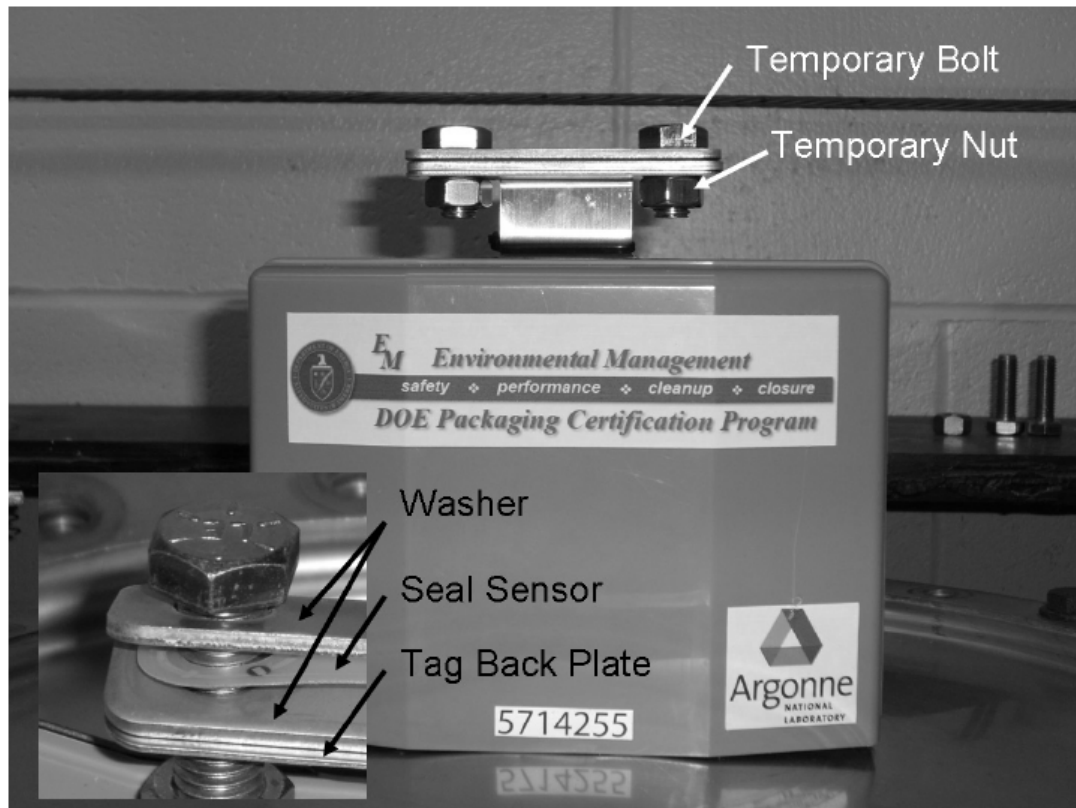
30.0 **IF** an RFID is needed and has been provided, **THEN INSTALL** the RFID on the drum using the following steps:

30.1 **IF** the 9975 had an RFID when it arrived for testing, **THEN ENSURE** the same RFID will be reinstalled on the drum.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 6****SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS**

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- 30.2 **ENSURE** the vent hole and markings on the drum will not be blocked by the tag to be installed.
- 30.3 With the tag laying flat on a tabletop, **REMOVE** the two bolts and the two nuts from the tag.



- 30.4 **PLACE** the two 0.5-13UNC-2A × 1.50-in. bolts (provided along with the tag) with lid washers into the two empty bolt holes on the package lid.
- 30.5 **TORQUE** the two bolts to 30 ± 5 ft-lb. SARP 7.5.12

Sign

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE****ATTACHMENT 6****SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS**

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- 30.6 **FIT** the seal sensor washers, seal sensor, and tag onto the two bolts from the bottom



- 30.7 **ENSURE** that the ribbon of the seal sensor is not damaged by the bolt threads when mounting the tag.

NOTE: The RFID Tag will indicate an alarm if the hex nuts that hold it in place are tightened and then loosened. **IF** this happens, **NOTE** it in the Comments section of Form L9.4-10500-3, along with the date and time of the occurrence.

- 30.8 **USE** two hex nuts (0.5-13UNC-2B, ASME SA-194, Grade 8, provided along with the tag) to hold the tag in place.

- 30.8.1 **TIGHTEN** the two nuts to 4.5 +/- 1.0 ft-lb torque. SARP 7.2.3.14.d

Sign

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE**

ATTACHMENT 6

SHIPPING CONTAINER VESSEL INSTALLATION INSTRUCTIONS

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- 30.9 **COMPLETE AND AFFIX** an RFID Periodic Maintenance Label (shown below) near the Annual Helium Leak Test Label. SARP 7.2.3.14.d *Sign*

NOTE 1: The serial number of the RFID tag is found on the label (e.g., seven-digit number 5714255 in the picture). The serial number of the package is found on the outside of the package.

NOTE 2: The Maintenance Expiration Date shall be one year from the date of the Annual Maintenance Leak Test Date..

Periodic Maintenance

RFID tag/Package Serial Number

/

Date RFID Tag Attached

Max. Allowable Ambient Temperature (°F)

N/A

Maintenance Expiration Date

N/A

- 30.10 **RECORD** the RFID serial number on Form L9.4-10500-3.

**ANNUAL MAINTENANCE AND LEAK TESTING FOR
THE 9975 SHIPPING PACKAGE**

ATTACHMENT 7

9975 SHIPPING PACKAGE ANNUAL LEAK TEST LABELING

NOTE: The *Sign* symbol indicates that there is a place on Form L9.4-10500-3 for initialing this step.

- 1.0 **REMOVE** any previously installed leak test label from the outer 9975 drum.
- 2.0 **IF** the PCV and SCV met the leak test acceptance criteria, **THEN OBTAIN** a new Annual Helium Leak Test Label (see data label example below).

Annual Helium Leak Test

| <u>Serial No.</u> | <u>Test Date</u> | <u>Record No.</u> |
|-------------------|------------------|-------------------|
| PCV: _____ | _____ | _____ |
| SCV: _____ | _____ | _____ |
| PACKAGE SN: _____ | | |

Data Label Example

- 3.0 **RECORD** the PCV, SCV, and Package serial numbers in spaces provided on the Annual Helium Leak Test Label. (SARP 8.1.3 and 8.2.2.2) *Sign*
- 4.0 **RECORD** the test date in the Test Date Column.
- 5.0 **RECORD** the record number from the High Pressure Lab Database program.
- 6.0 **AFFIX** the data label to the outer 9975 drum adjacent to the drum barcode label. (SARP 8.1.3 and 8.2.2.2) *Sign*