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CH Packaging Maintenance Manual

for Kerry Watson 1/17/2002

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Date

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RECORD OF REVISION

Revision	Reason for Revision/Change
0	New CH Packaging Maintenance Manual. This document supercedes DOE/WIPP 93-1001 and must be used in conjunction with DOE/WIPP 02-3183, CH Packaging Program Guidance, and DOE/WIPP 02-3184, CH Packaging Operations Manual.

M&O CONTRACTOR TECHNICAL REVIEW ORGANIZATIONS
WASTE HANDLING OPERATIONS
PACKAGING TRANSPORTATION
QUALITY ASSURANCE
CBFO REVIEW ORGANIZATIONS
NATIONAL TRU PROGRAMS

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1.0 MAINTENANCE LEAKAGE RATE TESTING

1.1 Basic Information

1.1.1 Introduction

This procedure provides instructions for performing inner containment vessel (ICV) and outer containment vessel (OCV) maintenance leakage rate testing on the following packaging seals and corresponding seal surfaces using a nondestructive helium (He) leak test.

- ICV upper main O-ring seal
- ICV outer vent port plug O-ring seal
- OCV upper main O-ring seal
- OCV vent port plug O-ring seal

1.1.2 References

- U.S. Department of Energy, Safety Analysis Report for the TRUPACT-II Shipping Package
- TRUPACT-II Certificate of Compliance No. 9218
- U.S. Department of Energy, Safety Analysis Report for the HalfPACT Shipping Package
- HalfPACT Certificate of Compliance No. 9279
- DOE/WIPP 02-3183, CH Packaging Program Guidance
- DOE/WIPP 02-3184, CH Packaging Operations Manual
- ANSI N 14.5, 1997, Radioactive Materials-Leakage Tests of Packages for Shipment
- ASNT, Recommended Practice No. SNT-TC-1A, June 1980
- U.S. Nuclear Regulatory Commission Information Notice 97-57: Leak Testing of Packaging Used in the Transport of Radioactive Material
- WP 13-RP.01, Test Report for WP 13-QA1082 Procedure Qualification

1.1.3 Equipment

- MEASURING AND TEST EQUIPMENT

  - Varian 938-41 or 959 Helium Leak Detector with 7-14 CFM mechanical vacuum pump

  - Roughing pump

  - He leak standard for calibrating the leak detector

  - Pressure/vacuum gauge, 30-in Hg to 30 psig

  - Temperature measuring device © scale)

  - Ambient atmospheric pressure measuring device

  - Watch or stopwatch, digital or sweep second hand (no calibration required)

  - Torque wrench capable of measuring in the range of 55 to 65 lb-in.

  - Torque wrench capable of measuring in the range of 30 to 50 lb-ft

- SPECIAL TEST EQUIPMENT

  - ICV/OCV vent port plug removal/pressure relief tools
  - ICV/OCV vent port plug/cover removal and installation tools
  - ICV/OCV seal leak check tools
  - ICV/OCV leak detection tools
  - Miscellaneous hardware and test connections

- CONSUMABLE MATERIALS

  - Welding grade helium (He) with certificate of conformance
  - Argon or nitrogen (purge gas)

1.1.4 Precautions and Limitations

- The following leak test procedure may be used, or each user may develop and qualify a procedure in accordance with the guidelines of ANSI N14.5, 1997. Sites that opt to qualify their own leak test procedure(s) must submit it to the WIPP Management and Operating (M&O) Contact-Handled (CH) Packaging Maintenance Engineer for approval.

- Leak testing of CH packaging shall be performed by personnel qualified in accordance with the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A, June 1980 Edition and supplements.

- The procedure is qualified per WP 13-RP.01, Test Report for WP 13-QA1082, Procedure Qualification for the Varian 938-41 and 959 MSLD and test line configuration defined in that report. CH packaging users adopting this leak test must not deviate from the test configuration(s) used to qualify the procedure.

- The He leak detector shall be calibrated to a minimum sensitivity of 1.3×10^{-7} standard cubic centimeters per second (scc/s) He.

- The leakage rate acceptance criterion of 1×10^{-7} scc/s of air equates to a leakage rate of 2.6×10^{-7} scc/s He. The He leakage rate is valid only for a component of $\geq 4.4°$ C. The acceptable He leakage rate increases with temperature, but as a conservative measure, the acceptance criterion of 2.6×10^{-7} scc/s He will be used.

1.1.5 Prerequisite Actions

- Verify air flow through leak check and leak detection tools.

- Verify packaging surface is free of contaminants that might mask a leak. The interior and exterior surfaces shall be dry.

1.2 ICV Upper Main O-Ring Seal

1.2.1 Record the following on Attachment 1:

- ICV body serial number (S/N)
- ICV lid S/N
- Date of leak test
- He leak detector S/N and model
- Pressure/vacuum gauge S/N and calibration due date
- Thermometer S/N and calibration due date
- Torque wrench S/Ns and calibration due dates
- Standard leak S/N and calibration due date
- Barometer S/N and calibration due date

SIGN-OFF

1.2.2 Verify ICV lid installed.

1.2.3 Verify ICV seal test port plug removed.

1.2.4 Verify ICV inner vent port plug installed and torqued to 55 to 65 lb-in.

SIGN-OFF

1.2.5 Measure ICV surface temperature.

1.2.6 If temperature is **<** 4.4° C, stop test until surface temperature ≥ 4.4° C.

1.2.7 Record surface temperature on Attachment 1.

SIGN-OFF

1.2.8 Verify outer vent port plug is retracted into ICV vent port plug removal/pressure relief tool.

1.2.9 Install ICV vent port tool into ICV vent port.

1.2.10 Attach vacuum pump assembly and He gas supply to vent port tool (see Figure 1.1).

1.2.11 Open isolation valve to vacuum pump.

1.2.12 Start vacuum pump.

1.2.13 Record ambient atmospheric pressure (Patm) on Attachment 1.

SIGN-OFF

1.2.14 Evacuate ICV vent port cavity to 90% vacuum (90% of atmospheric pressure) or better,
THEN close isolation valve **AND** stop vacuum pump.

1.2.15 Record vacuum reading (V1) on Attachment 1.

SIGN-OFF

1.2.16 Calculate He concentration correction factor (CCF) as follows:

$$CCF = \frac{Patm}{V1}$$

1.2.17 Record CCF on Attachment 1.

SIGN-OFF

1.2.18 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value) and record results on Attachment 1.

SIGN-OFF

1.2.19 Install ICV seal leak check tool in ICV seal test port.

1.2.20 Connect leak detector to ICV leak check tool (see Figure 1.1).

1.2.21 Evacuate space between O-ring seals through ICV seal test port.

NOTE

To measure a ≤ 2.6×10^{-7} scc/s He leakage rate, the indicated He background must stabilize at ≤ 2.6×10^{-7} scc/s He and remain below the limit for a minimum of 3 minutes.

1.2.22 Record He background (RB) on Attachment 1.

SIGN-OFF

1.2.23 Open He valve and backfill cavity with He to a pressure slightly greater than atmospheric pressure (+1 psi, -0 psi).

1.2.24 Close He valve.

1.2.25 Record backfill pressure reading on Attachment 1.

SIGN-OFF

1.2.26 Begin timing for 3-minute dwell time.

1.2.27 Monitor pressure gauge and add He as required to maintain He atmosphere in cavity.

NOTE

A dwell time of 3 minutes will be used to determine leakage rate of ICV upper main O-ring seal.

1.2.28 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 1.

SIGN-OFF

NOTE

Steps 1.3.1 through 1.3.6 may be performed in parallel with steps 1.2.29 through 1.2.39.

1.2.29 Remove test assembly from leak detector.

1.2.30 Install calibrated leak to leak detector.

1.2.31 Perform post-test calibration of leak detector and record results on Attachment 1.

SIGN-OFF

NOTE

If the background reading (RB) is larger than the leak rate reading (RT), then the background reading will not be subtracted from the leak rate reading and this (RT) becomes the actual leakage rate reading.

NOTE

In steps 1.2.32 through 1.2.34, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 1.

1.2.32 If there is no difference in the post-test calibration from the pretest calibration, use the following equation: subtract the He background at start of test (RB) from the He background at end of test (RT). The leakage rate is (RT – RB) x CCF. This equals the leakage rate for this segment of the test.

1.2.33 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference – RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.2.34 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference - RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.2.35 If the acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criterion is $\leq 2.6 \times 10^{-7}$ scc/s He.

1.2.36 **IF** ICV upper main O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He, **THEN** perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare Nonconformance Report (NCR) and record on Attachment 1.

SIGN-OFF

1.2.37 Remove ICV seal leak check tool and associated leak test equipment from ICV seal test port.

1.2.38 Install ICV seal test port plug.

1.2.39 Torque ICV seal test port plug to 55 to 65 lb-in., and record on Attachment 1.

SIGN-OFF

1.3 ICV Outer Vent Port Plug O-Ring Seal

NOTE

The following test should be performed immediately after Section 1.2 while the He atmosphere is still present in the ICV vent port cavity and to minimize He saturation of O-rings before test completion.

1.3.1 Disconnect vacuum pump assembly and He supply from ICV vent port tool.

1.3.2 Install ICV outer vent port plug.

1.3.3 Remove vent port tool.

1.3.4 Torque ICV outer vent port plug to 55 to 65 lb-in., and record on Attachment 1.

SIGN-OFF

1.3.5 Purge vent port to flush out residual He.

1.3.6 Install clean (He-free) ICV leak detection tool in ICV vent port.

NOTE

If step 1.3.7 begins within 1 hour of completing the ICV upper main O-ring seal test, the pretest calibration is not required. The post-test calibration result can be used for the ICV outer vent port plug O-ring seal pretest calibration.

1.3.7 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

1.3.8 Record pretest calibration results on Attachment 1.

SIGN-OFF

1.3.9 Connect leak detector to ICV leak detection tool (see Figure 1.2).

1.3.10 Verify isolation valve is **OPEN**.

1.3.11 Evacuate ICV leak detection tool.

NOTE

To measure a $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate with He atmosphere already present, indicated He background will be $\leq 2.6 \times 10^{-7}$ scc/s He **BEFORE** the start of the dwell time.

Dwell time for ICV outer vent port plug O-ring seal test is 3 minutes. An initial indication does **NOT** necessarily indicate a leak. Some residual He may still be detected.

1.3.12 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 1.

SIGN-OFF

1.3.13 Remove test assembly from leak detector.

1.3.14 Install calibrated leak to leak detector.

1.3.15 Perform post-test calibration of leak detector and record results on Attachment 1.

SIGN-OFF

NOTE

In steps 1.3.17 through 1.3.19, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 1.

1.3.16 Calculate ICV outer vent port plug O-ring seal leakage rate as follows:

1.3.17 If there is no difference in the post-test calibration from the pretest calibration, the He background at end of test (RT x CCF) equals the leakage rate for this segment of the test.

1.3.18 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.3.19 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference) x CCF. This equals

the leakage rate for this segment of the test under this condition of recalibration.

1.3.20 If the acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criterion is $\leq 2.6 \times 10^{-7}$ scc/s He.

1.3.21 **IF** ICV outer vent port plug O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.01, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 1.

SIGN-OFF

1.3.22 Remove ICV leak detection tool from ICV vent port.

1.3.23 Install ICV vent port cover.

1.3.24 Torque ICV vent port cover to 55 to 65 lb-in., and record on Attachment 1.

SIGN-OFF

1.4 OCV Upper Main O-Ring Seal

1.4.1 Record the following on Attachment 2:

- OCV body S/N
- OCV lid S/N
- Date of leak test
- He leak detector S/N and model
- Pressure/vacuum gauge S/N and calibration due date
- Thermometer S/N and calibration due date
- Torque wrench S/Ns and calibration due dates
- Standard leak S/N and calibration due date
- Barometer S/N and calibration due date

SIGN-OFF

1.4.2 Verify OCV lid installed.

1.4.3 Verify OCV seal test port plug removed.

1.4.4 Verify OCV vent port plug retracted into OCV vent port tool.

1.4.5 Verify OCV vent port tool installed into OCV vent port.

NOTE

Steps 1.4.16 through 1.4.21 may be performed in parallel with steps 1.4.6 through 1.4.15.

1.4.6 Measure OCV surface temperature and record on Attachment 2.

SIGN-OFF

1.4.7 If temperature is **<** 4.4° C, stop test until surface temperature ≥ 4.4° C.

1.4.8 Attach vacuum pump assembly and He gas supply to vent port tool (see Figure 1.3).

1.4.9 Open isolation valve to vacuum pump.

1.4.10 Start vacuum pump

1.4.11 Record ambient atmospheric pressure (Patm) on Attachment 2.

SIGN-OFF

1.4.12 Evacuate OCV cavity to 90% vacuum (90% of atmospheric pressure) or better,
THEN close isolation valve **AND** stop vacuum pump.

1.4.13 Record vacuum reading (V1) on Attachment 2.

SIGN-OFF

1.4.14 Calculate He concentration correction factor as follows:

$$CCF = \frac{Patm}{V1}$$

1.4.15 Record CCF on Attachment 2.

SIGN-OFF

1.4.16 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

1.4.17 Record pretest calibration results on Attachment 2.

SIGN-OFF

1.4.18 Install OCV seal leak check tool in OCV seal test port.

1.4.19 Connect leak detector to OCV leak check tool (see Figure 1.3).

1.4.20 Verify isolation valve open.

1.4.21 Evacuate space between O-ring seals through OCV seal test port.

NOTE

To measure a $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate, the indicated He background must stabilize at $\leq 2.6 \times 10^{-7}$ scc/s He and remain below the limit for a minimum of 3 minutes.

1.4.22 Record He background (RB) on Attachment 2.

SIGN-OFF

1.4.23 Open He valve and backfill OCV cavity with He to a pressure slightly greater than atmospheric pressure (+1 psi, -0 psi).

1.4.24 Close He valve.

1.4.25 Record backfill pressure reading on Attachment 2.

SIGN-OFF

1.4.26 Begin timing for 3-minute dwell time.

1.4.27 Monitor pressure gauge and add He as required to maintain He atmosphere in the cavity.

NOTE

A dwell time of 3 minutes will be used to determine leakage rate of OCV upper main O-ring seal.

1.4.28 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 2.

SIGN-OFF

1.4.29 Remove test assembly from leak detector.

1.4.30 Install calibrated leak to leak detector.

1.4.31 Perform post-test calibration of leak detector and record results on Attachment 2.

SIGN-OFF

NOTE

If the background reading (RB) is larger than the leak rate reading (RT), then the background reading will not be subtracted from the leak rate reading and this (RT) becomes the actual leakage rate reading.

NOTE

In steps 1.4.33 through 1.4.35, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 2.

1.4.32 Calculate OCV upper main O-ring seal leakage rate as follows:

1.4.33 If there is no difference in the post-test calibration from the pretest calibration, use the following equation: subtract the He background at start of test (RB) from the He background at end of test (RT). The leakage rate is (RT – RB) x CCF. This equals the leakage rate for this segment of the test.

1.4.34 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference – RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.4.35 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference - RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.4.36 If acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE
The leakage rate acceptance criterion is ≤ 2.6 x 10^{-7} scc/s He.

1.4.37 **IF** OCV main O-ring seal leakage rate is **>** 2.6 x 10^{-7} scc/s He, **THEN** perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 2.

SIGN-OFF

1.4.38 Remove OCV seal leak check tool and associated leak test equipment from OCV seal test port.

1.4.39 Install OCV seal test port plug.

1.4.40 Torque OCV seal test port plug to 55 to 65 lb-in., and record on Attachment 2.

SIGN-OFF

1.5 OCV Vent Port Plug O-Ring Seal

NOTE
The following test should be performed immediately after Section 1.4, while the He atmosphere is still present in the OCV cavity and to minimize He saturation of the O-rings before test completion.

1.5.1 Disconnect vacuum pump assembly and He supply from OCV vent port tool.

1.5.2 Install OCV vent port plug.

1.5.3 Remove vent port tool.

1.5.4 Torque OCV vent port plug to 55 to 65 lb-in., and record on Attachment 2.

SIGN-OFF

1.5.5 Purge vent port to flush out residual He.

1.5.6 Install clean (He-free) OCV leak detection tool in OCV vent port.

NOTE

If step 1.5.7 begins within 1 hour of completing the OCV upper main O-ring seal leak test, the pretest calibration is not required. The post-test calibration result can be used for the OCV vent port plug O-ring seal pretest calibration.

1.5.7 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

1.5.8 Record pretest calibration results on Attachment 2.

SIGN-OFF

1.5.9 Connect leak detector to OCV leak detection tool (see Figure 1.4).

1.5.10 Verify isolation valve is **OPEN**.

1.5.11 Evacuate OCV leak detection tool.

NOTE

To measure a $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate with He atmosphere already present, the indicated He background will be $\leq 2.6 \times 10^{-7}$ scc/s He before the start of the dwell time.

Dwell time for OCV vent port plug O-ring seal test is 3 minutes. An initial indication does **NOT** necessarily indicate a leak. Some residual He may still be detected.

1.5.12 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 2.

SIGN-OFF

1.5.13 Remove test assembly from leak detector.

1.5.14 Install calibrated leak to leak detector.

1.5.15 Perform post-test calibration of leak detector and record results on Attachment 2.

SIGN-OFF

NOTE
In steps 1.5.17 through 1.5.19, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 2.

1.5.16 Calculate OCV vent port plug O-ring seal leakage rate as follows:

1.5.17 If there is no difference in the post-test calibration from the pretest calibration, the He background at end of test (RT) x CCF equals the leakage rate for this segment of the test.

1.5.18 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.5.19 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

1.5.20 If acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE
The leakage rate acceptance criteria is $\leq 2.6 \times 10^{-7}$ scc/s He.

1.5.21 **IF** OCV vent port plug O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.01, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 2.

SIGN-OFF

1.5.22 Remove OCV leak detection tool from OCV vent port.

1.5.23 Install OCV vent port cover.

1.5.24 Torque OCV vent port cover to 55 to 65 lb-in., and record on Attachment 2.

SIGN- OFF

1.5.25 Install OCV seal test port thermal plug and access plug.

1.5.26 Torque OCV seal test port access plug to 35 to 45 lb-ft and record on Attachment 2.

SIGN-OFF

1.5.27 Install OCV vent port thermal plug and access plug.

1.5.28 Torque OCV vent port access plug to 35 to 45 lb-ft and record on Attachment 2.

SIGN-OFF

Figure 1.1 ICV Upper Main O-Ring Seal Test

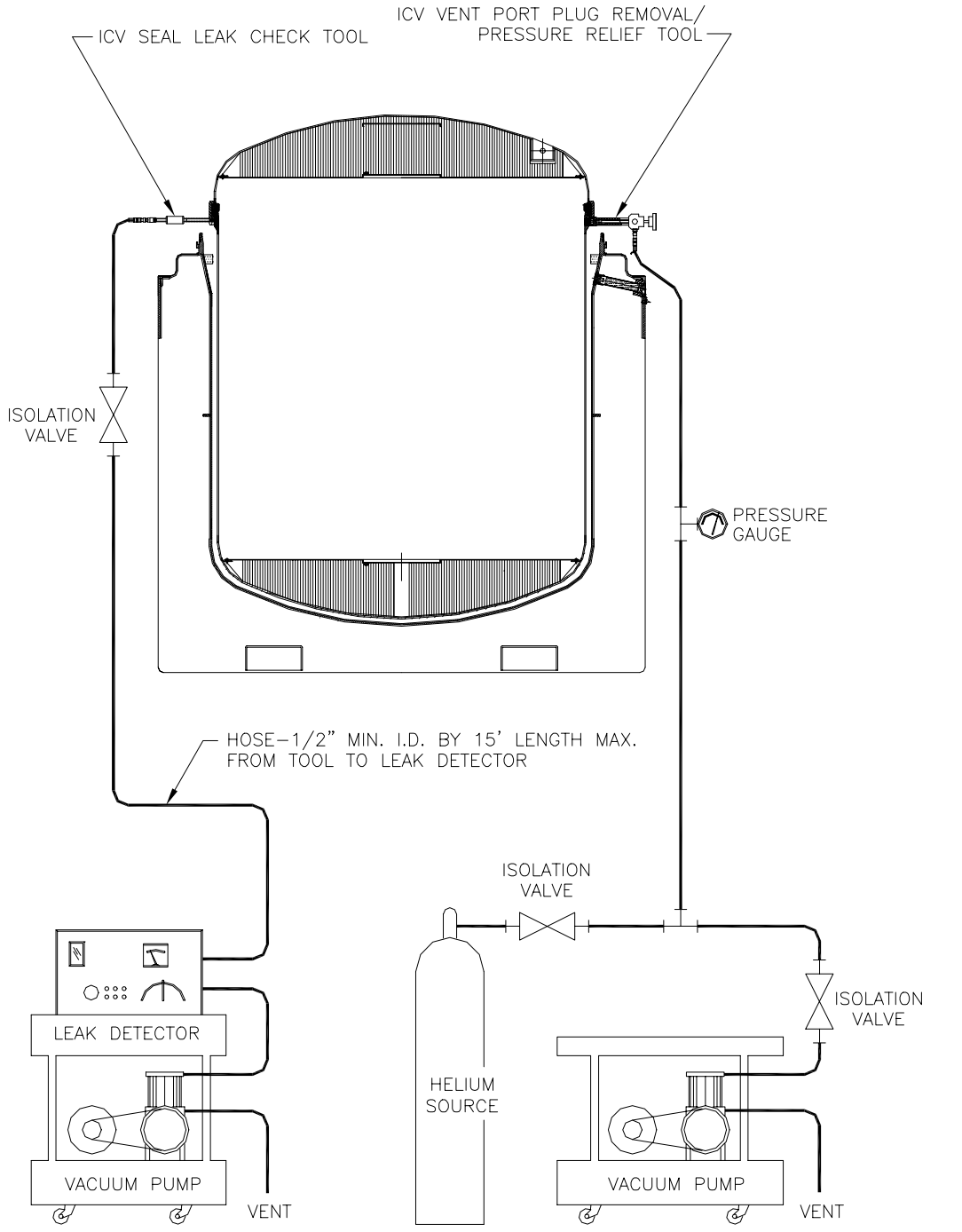


Figure 1.2 ICV Outer Vent Port Plug O-Ring Seal Test

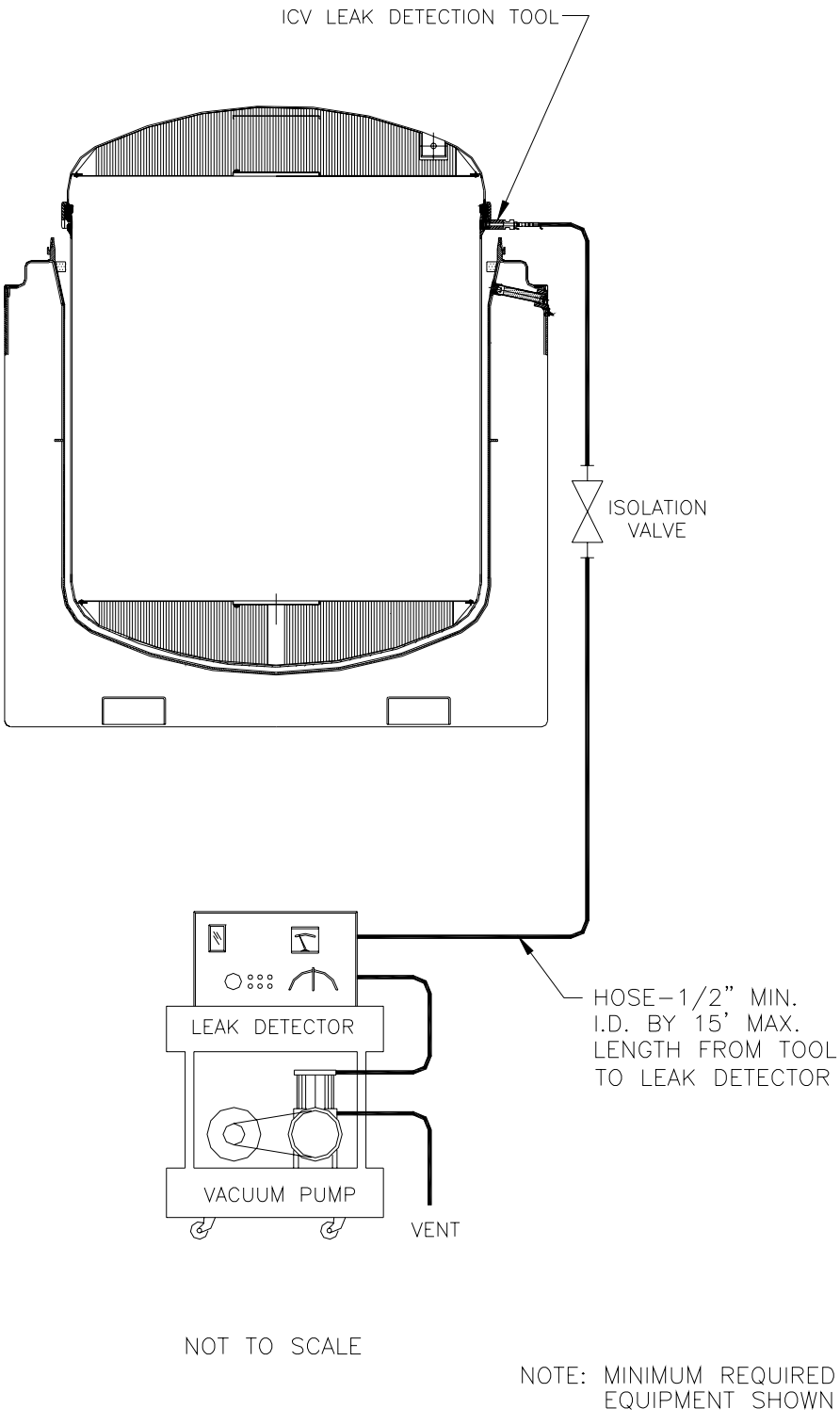


Figure 1.3 OCV Upper Main O-Ring Seal Test

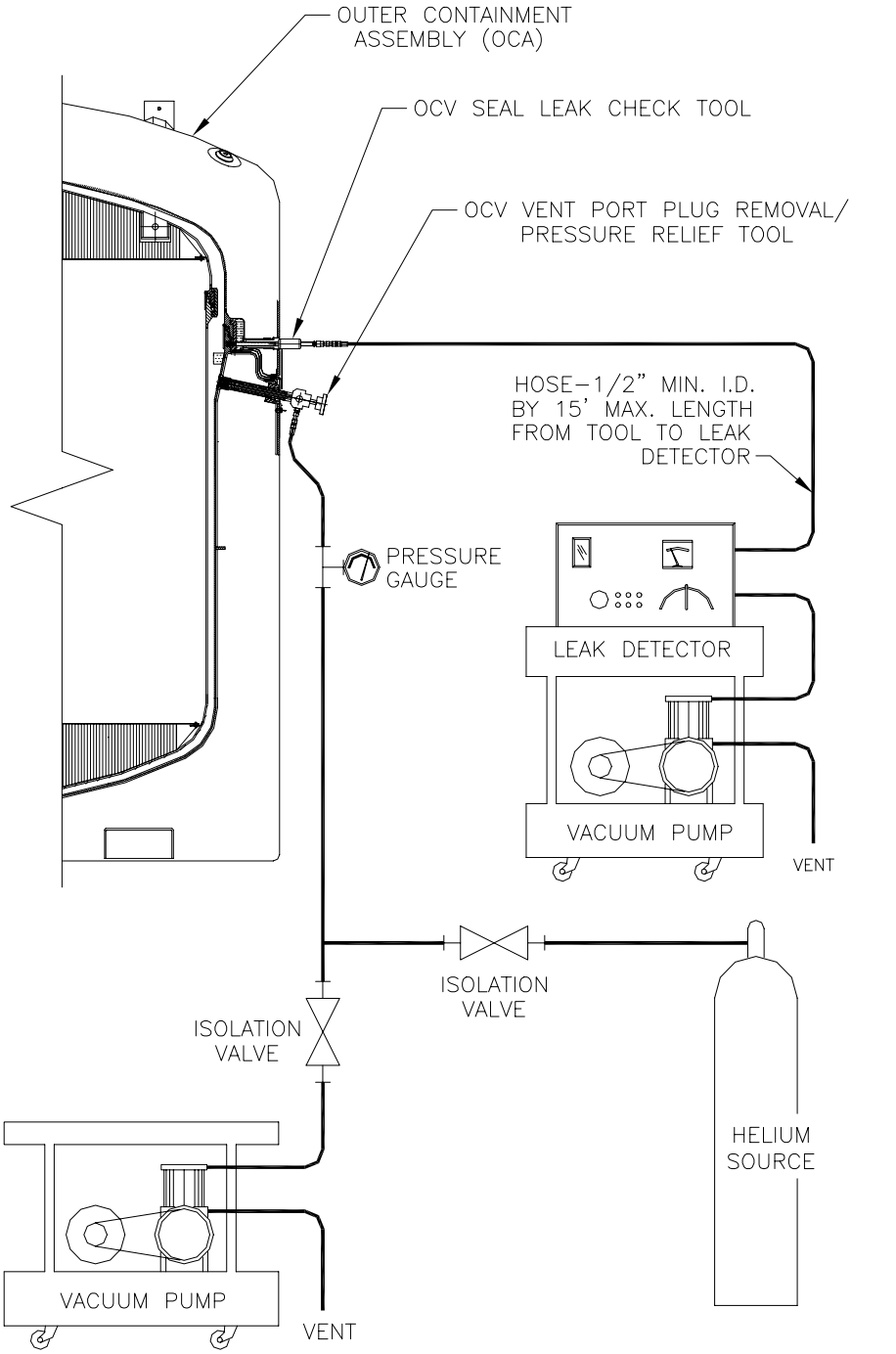
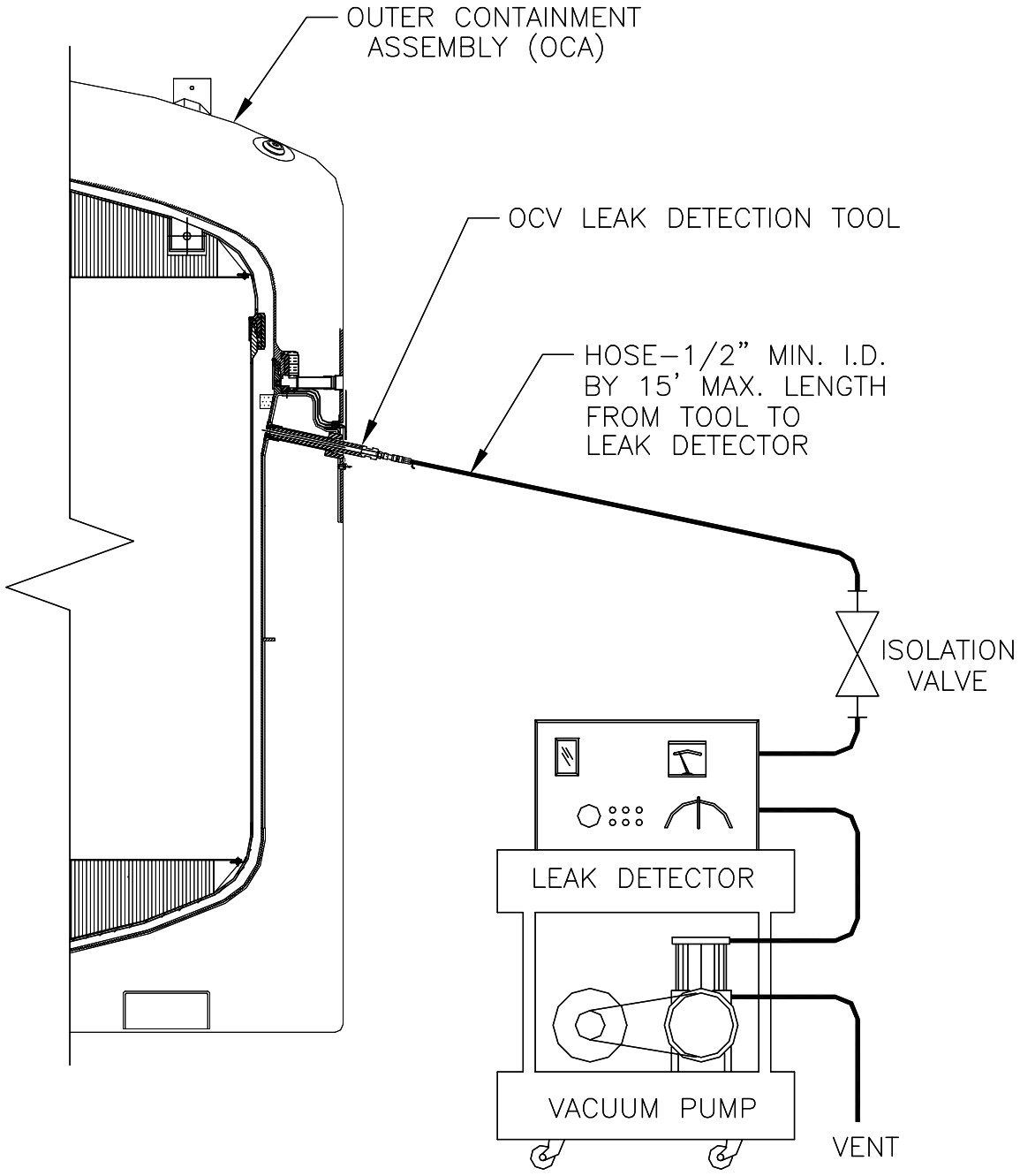


Figure 1.4 OCV Vent Port Plug O-Ring Seal Test



2.0 PERIODIC LEAKAGE RATE TESTING

2.1 Basic Information

2.1.1 Introduction

This procedure provides instructions for performing ICV and OCV periodic leakage rate test using nondestructive He leak test:

2.1.2 References

BASELINE

- U.S. Department of Energy, Safety Analysis Report for the TRUPACT-II Shipping Package
- TRUPACT-II Certificate of Compliance No. 9218
- U.S. Department of Energy, Safety Analysis Report for the HalfPACT Shipping Package
- HalfPACT Certificate of Compliance No. 9279
- DOE/WIPP 02-3183, CH Packaging Program Guidance
- DOE/WIPP 02-3184, CH Packaging Operations Manual
- ANSI N 14.5, 1997, Radioactive Materials-Leakage Tests of Packages for Shipment
- ASNT, Recommended Practice No. SNT-TC-1A, June 1980
- U.S. Nuclear Regulatory Commission Information Notice 97-57: Leak Testing of Packaging Used in the Transport of Radioactive Material
- WP 13-RP.01, Test Report for WP 13-QA1082 Procedure Qualification

2.1.3 Equipment

MEASURING AND TEST EQUIPMENT

- Varian 938-41 or 959 Helium Leak Detector with 7-14 cfm mechanical vacuum pump
- Roughing pump

- He leak standard for calibrating leak detector
- Pressure/vacuum gauge, 30-in. Hg to 30 psig
- Temperature measuring device (C scale)
- Ambient atmospheric pressure measuring device
- Watch or stopwatch, digital or sweep second hand (no calibration required)
- Torque wrench with 55 to 65 lb-in range
- Torque wrench with 30 to 50 lb-ft range

SPECIAL TEST EQUIPMENT

- ICV/OCV vent port plug removal/pressure relief tools
- ICV/OCV vent port plug/cover removal and installation tools
- ICV/OCV seal leak check tools
- ICV/OCV vent port leak detection tools
- Plastic sheeting (for tent fabrication)
- Miscellaneous hardware and test connections

CONSUMABLE MATERIALS

- Welding grade Helium with certificate of conformance
- Argon or nitrogen (purge gas)

2.1.4 Precautions and Limitations

- The following leak test procedure may be used, or each user may develop and qualify a procedure in accordance with the guidelines of ANSI N 14.5, 1997. Sites that opt to qualify their own leak test procedure must submit them to the WIPP M&O CH Packaging Maintenance Engineer for approval.
- Leak testing of CH packaging shall be performed by personnel qualified in accordance with the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A, June 1980 Edition and supplements.
- This procedure is qualified per WP 13-RP.01, Test Report for WP 13-QA1082 Procedure Qualification for the Varian 938-41 and 959 MSLD, and test line configuration defined in that report. CH packaging users and maintenance providers adopting this leak test must not deviate from the test configuration(s) used to qualify the procedure.

- The He leak detector shall be calibrated to a minimum sensitivity of 1.3×10^{-7} standard cubic centimeters per second (scc/s) He.

- The leakage rate acceptance criterion of $\leq 1.0 \times 10^{-7}$ scc/s of air equates to a leakage rate of $\leq 2.6 \times 10^{-7}$ scc/s He. The He leakage rate is only valid for a component of $\geq 4.4°C$. The acceptable He leakage rate increases with temperature, but as a conservative measure, an acceptance criterion of $\leq 2.6 \times 10^{-7}$ scc/s He will be used.

2.1.5 Prerequisite Actions

- Verify air flow through leak check and leak detection tools.

- Verify packaging surface is free of contaminants that might mask a leak. The interior and exterior surfaces shall be dry.

2.2 ICV Upper Main O-Ring Seal

2.2.1 Record the following on Attachment 3:

- ICV body serial number (S/N)
- ICV lid S/N
- Date of leak test
- He leak detector S/N and model
- Pressure/vacuum gauge S/N and calibration due date
- Thermometer S/N and calibration due date
- Torque wrench S/Ns and calibration due dates
- Standard leak S/N and calibration due date
- Barometer S/N and calibration due date

SIGN-OFF

2.2.2 Verify the following:

- ICV lid installed
- ICV vent port cover removed
- ICV inner vent port plug removed
- ICV test port plug removed

2.2.3 Measure ICV surface temperature.

2.2.4 If temperature is **<** 4.4° C, stop test until surface temperature ≥ 4.4° C.

2.2.5 Record surface temperature on Attachment 3.

SIGN-OFF

2.2.6 Verify outer vent port plug is retracted into ICV vent port plug removal/pressure relief tool.

2.2.7 Install ICV vent port tool into ICV vent port.

2.2.8 Attach vacuum pump assembly and He gas supply to vent port tool (see Figure 1.1).

2.2.9 Open isolation valve to vacuum pump.

2.2.10 Start vacuum pump.

2.2.11 Record ambient atmospheric pressure (Patm) on Attachment 3.

SIGN-OFF

2.2.12 Evacuate ICV vent port cavity to 90% vacuum (90% of atmospheric pressure) or better,
THEN close isolation valve **AND** stop vacuum pump.

2.2.13 Record vacuum reading (V1) on Attachment 3.

SIGN-OFF

2.2.14 Calculate He concentration correction factor (CCF) as follows:

$$CCF = \frac{Patm}{V1}$$

2.2.15 Record CCF on Attachment 3.

SIGN-OFF

2.2.16 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value) and record results on Attachment 3.

SIGN-OFF

2.2.17 Install ICV seal leak check tool in ICV seal test port.

2.2.18 Connect leak detector to ICV leak check tool (see Figure 1.1).

2.2.19 Evacuate space between O-ring seals through ICV seal test port.

NOTE

To measure a ≤ 2.6 x 10^{-7} scc/s He leakage rate, the indicated He background must stabilize at ≤ 2.6 x 10^{-7} scc/s He and remain below the limit for a minimum of 3 minutes.

2.2.20 Record He background (RB) on Attachment 3.

SIGN-OFF

2.2.21 Open He valve and backfill cavity with He to pressure slightly greater than atmospheric pressure (+1 psi, -0 psi).

2.2.22 Close He valve.

2.2.23 Record backfill pressure reading on Attachment 3.

SIGN-OFF

2.2.24 Begin timing for 3-minute dwell time.

2.2.25 Monitor pressure gauge and add He to maintain He atmosphere in the cavity.

NOTE

A dwell time of 3 minutes will be used to determine leakage rate of ICV upper main O-ring seal.

2.2.26 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 3.

SIGN-OFF

NOTE

Steps 2.3.1 through 2.3.6 may be performed in parallel with steps 2.2.27 through 2.2.37.

2.2.27 Remove test assembly from leak detector.

2.2.28 Install calibrated leak to leak detector.

2.2.29 Perform post-test calibration of leak detector and record results on Attachment 3.

SIGN-OFF

NOTE

If the background reading (RB) is larger than the leak rate reading (RT), then the background reading will not be subtracted from the leak rate reading and this (RT) becomes the actual leakage rate reading.

NOTE

In steps 2.2.30 through 2.2.32, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 3.

2.2.30 If there is no difference in the post-test calibration from the pretest calibration, use the following equation: subtract the He background at the start of test (RB) from the He background at end of test (RT). The leakage rate is (RT – RB) x CCF. This equals the leakage rate for this segment of the test.

2.2.31 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference – RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.2.32 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference - RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.2.33 If the acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criterion is $\leq 2.6 \times 10^{-7}$ scc/s He.

2.2.34 **IF** ICV upper main O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He, **THEN** perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 3.

SIGN-OFF

2.2.35 Remove ICV seal leak check tool from ICV seal test port.

2.2.36 Install ICV seal test port plug.

2.2.37 Torque ICV seal test port plug to 55 to 65 lb-in., and record on Attachment 3.

SIGN-OFF

2.3 ICV Outer Vent Port Plug O-Ring Seal

NOTE

The following test should be performed immediately after Section 2.2 while the He atmosphere is still present in the ICV cavity and to minimize He saturation of O-rings before test completion.

2.3.1 Disconnect vacuum pump assembly and He supply from ICV vent port tool.

2.3.2 Install ICV outer vent port plug.

2.3.3 Remove vent port tool.

2.3.4 Torque ICV outer vent port plug to 55 to 65 lb-in., and record on Attachment 3.

SIGN-OFF

2.3.5 Purge vent port with either nitrogen or argon to flush out residual He.

2.3.6 Install clean (He-free) ICV leak detection tool in ICV vent port.

NOTE

If step 2.3.7 begins within 1 hour of completing the ICV upper main O-ring seal test, the pretest calibration is not required. The post-test calibration result can be used for the ICV outer vent port plug O-ring seal pretest calibration.

2.3.7 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

2.3.8 Record pretest calibration results on Attachment 3.

SIGN-OFF

2.3.9 Connect leak detector to ICV leak detection tool (see Figure 1.2).

2.3.10 Verify isolation valve is **OPEN**.

2.3.11 Evacuate ICV leak detection tool.

NOTE

To measure a $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate with He atmosphere already present, indicated He background will be $\leq 2.6 \times 10^{-7}$ scc/s He **BEFORE** the start of the dwell time.

Dwell time for ICV outer vent port plug O-ring seal test is 3 minutes. An initial indication does **NOT** necessarily indicate a leak. Some residual He may still be detected.

2.3.12 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 3.

SIGN-OFF

2.3.13 Remove test assembly from leak detector.

2.3.14 Install calibrated leak to leak detector.

2.3.15 Perform post-test calibration of leak detector and record results on Attachment 3.

SIGN-OFF

NOTE

In steps 2.3.17 through 2.3.19, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 3.

2.3.16 Calculate ICV outer vent port plug O-ring seal leakage rate as follows:

2.3.17 If there is no difference in the post-test calibration from the pretest calibration, the He background at end of test (RT x CCF) equals the leakage rate for this segment of the test.

2.3.18 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.3.19 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.3.20 If the acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criterion is $\leq 2.6 \times 10^{-7}$ scc/s He.

2.3.21 **IF** ICV outer vent port plug O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.01, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR, and record on Attachment 3.

SIGN-OFF

2.3.22 Remove ICV leak detection tool from ICV vent port.

2.3.23 Install ICV vent port cover.

2.3.24 Torque ICV vent port cover to 55 to 65 lb-in., and record on Attachment 3.

SIGN-OFF

2.4 ICV Welds

NOTE

The following test should be performed immediately after Section 2.3 to minimize He saturation of the O-rings before test completion.

2.4.1 Place the ICV assembly (if not previously positioned) into OCV.

2.4.2 Install OCV lid.

2.4.3 Measure the OCV surface temperature and record on Attachment 3.

SIGN-OFF

2.4.4 If temperature is **<** 4.4° C, stop test until surface temperature meets this requirement.

2.4.5 Install OCV leak detection tool (if not already installed) into OCV vent port (see Figure 2.1).

2.4.6 Connect vacuum pump/test assembly to OCV leak detection tool.

2.4.7 Evacuate annulus between ICV and OCV to a vacuum sufficient to operate leak detector.

NOTE

If step 2.4.8 begins within 1 hour of completing the ICV outer vent port plug O-ring seal leak test, the pretest calibration is not required. The post-test calibration result can be used for the ICV weld pretest calibration.

2.4.8 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

2.4.9 Record pretest calibration results on Attachment 3.

SIGN-OFF

NOTE

To measure $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate with a He atmosphere already present, indicated He background will be $\leq 2.6 \times 10^{-7}$ scc/s He **BEFORE** the start of the dwell time.

2.4.10 Record measured leakage rate (RT) on Attachment 3 after the required dwell time:

Required Dwell Times:			
959/7 CFM	12 minutes	938-41/7 CFM	17 minutes
959/14 CFM	22 minutes	938-41/14 CFM	18 minutes

SIGN-OFF

2.4.11 Remove vacuum pump/test assembly from leak detector.

2.4.12 Install calibrated leak to leak detector.

2.4.13 Perform post-test calibration of leak detector.

2.4.14 Record post-test calibration results on Attachment 3.

SIGN-OFF

NOTE
In steps 2.4.16 through 2.4.18, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 3.

2.4.15 Calculate ICV fabrication weld leakage rate as follows:

2.4.16 If there is no difference in the post-test calibration from the pretest calibration, the He background at end of test (RT) x CCF x 1.58 equals the leakage rate for this segment of the test.

2.4.17 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference) x CCF x 1.58. This equals the leakage rate for this segment of the test.

2.4.18 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference) x CCF x 1.58. This equals the leakage rate for this segment of the test.

2.4.19 If the acceptance criterion is satisfied (2.6×10^{-7} scc/s He or less), this segment of the test procedure is complete.

SIGN-OFF

2.4.20 **IF** leakage rate, is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] Repeat leak test.

[C] If after repeated testing it is apparent welds cannot pass test, prepare NCR and record on Attachment 3.

SIGN-OFF

2.5 OCV Welds

2.5.1 Record the following on Attachment 4:

- OCV body S/N
- OCV lid S/N
- Date of leak test
- He leak detector S/N and model
- Pressure/vacuum gauge S/N and calibration due date
- Thermometer S/N and calibration due date
- Torque wrench S/Ns and calibration due dates
- Standard leak S/N and calibration due date
- Barometer S/N and calibration due date

SIGN-OFF

2.5.2 If necessary, place ICV assembly into OCV.

2.5.3 Install OCV lid.

2.5.4 Measure OCV surface temperature and record on Attachment 4.

SIGN-OFF

2.5.5 If temperature is **<** 4.4° C, stop test until surface temperature ≥ 4.4° C.

2.5.6 Install OCV seal test port plug.

2.5.7 Torque OCV seal test port plug 55 to 65 lb-in.

SIGN-OFF

2.5.8 Install OCV leak detection tool into OCV vent port (see Figure 2.2).

2.5.9 Place a close fitting plastic tent around the outside of OCA.

2.5.10 Connect vacuum pump/test assembly to OCV leak detection tool.

2.5.11 Evacuate annulus between OCV and ICV to a vacuum sufficient to operate leak detector.

2.5.12 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

2.5.13 Record pretest calibration results on Attachment 4.

SIGN-OFF

NOTE

To measure a 2.6×10^{-7} scc/s He leakage rate, the indicated He background will be allowed to stabilize at 2.6×10^{-7} scc/s He or less and remain below the limit for a minimum of 3 minutes before the start of the dwell time.

2.5.14 Record He background (RB) on Attachment 4.

SIGN-OFF

NOTE

The tent should be vented near the bottom, 180° from He supply line.

2.5.15 Attach He supply line to tent.

2.5.16 Start He flow.

2.5.17 Record time at start of He purge on Attachment 4.

SIGN-OFF

2.5.18 Allow He to purge for three times the length of time required to initially fill the tent.

2.5.19 Reduce He flow.

2.5.20 Seal the vent.

2.5.21 Record time at end of purge on Attachment 4.

SIGN-OFF

2.5.22 Record time at start of dwell time on Attachment 4.

SIGN-OFF

NOTE

As necessary, continue adding He to maintain the He atmosphere inside the tent.

2.5.23 Record measured leakage rate (RT) after the required dwell time on Attachment 4.

Required Dwell Times:			
959/7 CFM	12 minutes	938-41/7 CFM	17 minutes
959/14 CFM	22 minutes	938-41/14 CFM	18 minutes

SIGN-OFF

2.5.24 Record time at end of dwell time on Attachment 4.

SIGN-OFF

2.5.25 Remove vacuum pump/test assembly from leak detector.

2.5.26 Install calibrated leak to leak detector.

2.5.27 Perform post-test calibration of leak detector.

2.5.28 Record post-test calibration results on Attachment 4.

SIGN-OFF

NOTE

If the He concentration in the tent is known, then calculate corresponding correction factor and insert in formulas below. Otherwise, use a correction factor of 2 for a 50% He concentration.

NOTE

In steps 2.5.30 through 2.5.32, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 4.

2.5.29 Calculate OCV fabrication weld leakage rate as follows:

2.5.30 If there is no difference in the post-test calibration from the pretest calibration, subtract the He background at start of test (RB) from He background at end of test (RT). (RT - RB) x CCF x 1.58 equals the leakage rate for this segment of the test.

2.5.31 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference - RB) x CCF x 1.58. This equals the leakage rate for this segment of the test.

2.5.32 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference - RB) x CCF x 1.58. This equals the leakage rate for this segment of the test.

2.5.33 If the acceptance criterion is satisfied (2.6×10^{-7} scc/s He or less), this segment of the test procedure is complete.

SIGN-OFF

2.5.34 **IF** leakage rate, is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] Repeat leak test.

[C] If after repeated testing it is apparent weld cannot pass test, prepare NCR and record on Attachment 4.

SIGN-OFF

2.6 OCV Upper Main O-Ring Seal

2.6.1 Remove tent

NOTE

Steps 2.6.13 through 2.6.18 may be performed in parallel with steps 2.6.2 through 2.6.12.

2.6.2 Remove OCV leak detection tool from vent port.

2.6.3 Verify OCV vent port plug is retracted into vent port tool.

2.6.4 Install OCV vent port tool into OCV vent port.

2.6.5 Attach vacuum pump assembly and He gas supply to vent port tool (see Figure 1.3).

2.6.6 Open isolation valve to vacuum pump.

2.6.7 Start vacuum pump.

2.6.8 Record ambient atmospheric pressure (Patm) on Attachment 4.

SIGN-OFF

2.6.9 Evacuate OCV cavity to 90% vacuum (90% of atmospheric pressure) or better,
THEN close isolation valve **AND** stop vacuum pump.

2.6.10 Record vacuum reading (V1) on Attachment 4.

SIGN-OFF

2.6.11 Calculate He concentration correction factor as follows:

$$CCF = \frac{Patm}{V1}$$

2.6.12 Record CCF on Attachment 4.

SIGN-OFF

NOTE

If step 2.6.13 begins within 1 hour of completing the OCV fabrication weld leak test, the pretest calibration is not required. The post-test calibration result can be used for the OCV upper main O-ring seal pretest calibration.

2.6.13 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

2.6.14 Record pretest calibration results on Attachment 4.

SIGN-OFF

2.6.15 Install OCV seal leak check tool in OCV seal test port.

2.6.16 Connect leak detector to OCV leak check tool (see Figure 1.3).

2.6.17 Verify isolation valve open.

2.6.18 Evacuate space between O-ring seals through OCV seal test port.

NOTE

To measure a 2.6×10^{-7} scc/s He leakage rate, the indicated He background will be allowed to stabilize at $\leq 2.6 \times 10^{-7}$ scc/s He and remain below the limit for a minimum of 3 minutes.

2.6.19 Record He background (RB) on Attachment 4.

SIGN-OFF

2.6.20 Open He valve and backfill OCV cavity with He to a pressure slightly greater than atmospheric pressure (+1 psi, -0 psi).

2.6.21 Close He valve.

2.6.22 Record backfill pressure reading on Attachment 4.

SIGN-OFF

2.6.23 Begin timing for 3-minute dwell time.

2.6.24 Monitor pressure gauge and add He to maintain He atmosphere in cavity.

NOTE

A dwell time of 3 minutes will be used to determine leakage rate of OCV upper main O-ring seal.

2.6.25 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 4.

SIGN-OFF

2.6.26 Remove test assembly from leak detector.

2.6.27 Install calibrated leak to leak detector.

2.6.28 Perform post-test calibration of leak detector and record results on Attachment 4.

SIGN-OFF

NOTE

If the background reading (RB) is larger than the leak rate reading (RT), then the background reading will not be subtracted from the leak rate reading and this (RT) becomes the actual leakage rate reading.

NOTE

In steps 2.6.30 through 2.6.32, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 4.

2.6.29 Calculate OCV main O-ring seal leakage rate as follows:

2.6.30 If there is no difference in the post-test calibration from the pretest calibration, use the following equation: subtract the He background at the start of test (RB) from the He background at end of test (RT). The leakage rate is (RT – RB) x CCF. This equals the leakage rate for this segment of the test.

2.6.31 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference – RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.6.32 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference - RB) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.6.33 If acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criterion is $\leq 2.6 \times 10^{-7}$ scc/s He.

2.6.34 **IF** OCV main O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He, **THEN** perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 4.

SIGN-OFF

2.6.35 Remove OCV seal leak check tool and associated leak test equipment from OCV seal test port.

2.6.36 Install OCV seal test port plug.

2.6.37 Torque OCV seal test port plug to 55 to 65 lb-in., and record on Attachment 4.

SIGN-OFF

2.7 OCV Vent Port Plug O-Ring Seal

NOTE

The following test should be performed immediately after Section 2.6 while the He atmosphere is still present in the OCV cavity and to minimize He saturation of the O-rings before test completion.

2.7.1 Disconnect vacuum pump assembly and He supply from OCV vent port tool.

2.7.2 Install OCV vent port plug.

2.7.3 Remove vent port tool.

2.7.4 Torque OCV vent port plug to 55 to 65 lb-in., and record on Attachment 4.

SIGN-OFF

2.7.5 Purge vent port to flush out residual He.

2.7.6 Install a clean (He-free) OCV leak detection tool in OCV vent port.

NOTE

If step 2.7.7 begins within 1 hour of completing the OCV upper main O-ring seal test, the pretest calibration is not required. The post-test calibration result can be used for the OCV vent port plug O-ring seal pretest calibration.

2.7.7 Perform pretest calibration of leak detector (to the temperature-corrected standard leak value).

2.7.8 Record pretest calibration results on Attachment 4.

SIGN-OFF

2.7.9 Connect leak detector to OCV leak detection tool (see Figure 1.4).

2.7.10 Verify isolation valve is **OPEN**.

2.7.11 Evacuate OCV leak detection tool.

NOTE

To measure a $\leq 2.6 \times 10^{-7}$ scc/s He leakage rate with a He atmosphere already present, the indicated He background will be $\leq 2.6 \times 10^{-7}$ scc/s He before the start of the dwell time.

Dwell time for OCV vent port plug O-ring seal test is 3 minutes. An initial indication does **NOT** necessarily indicate a leak. Some residual He may still be detected.

2.7.12 Record measured leakage rate (RT) after 3-minute dwell time on Attachment 4.

SIGN-OFF

2.7.13 Remove test assembly from leak detector.

2.7.14 Install calibrated leak to leak detector.

2.7.15 Perform post-test calibration of leak detector and record results on Attachment 4.

SIGN-OFF

NOTE

In steps 2.7.17 through 2.7.19, only **ONE** of the listed conditions can be true. The **SIGN-OFF** entries for this condition should be made on Attachment 4.

2.7.16 Calculate OCV vent port plug O-ring seal leakage rate as follows:

2.7.17 If there is no difference in the post-test calibration from the pretest calibration, the He background at end of test (RT) x CCF equals the leakage rate for this segment of the test.

2.7.18 If post-test calibration is less than pretest calibration, use the following calculation: (RT + calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.7.19 If post-test calibration is more than pretest calibration, use the following calculation: (RT - calibration difference) x CCF. This equals the leakage rate for this segment of the test under this condition of recalibration.

2.7.20 If acceptance criterion is satisfied ($\leq 2.6 \times 10^{-7}$ scc/s He), this segment of the test procedure is complete.

SIGN-OFF

NOTE

The leakage rate acceptance criteria is $\leq 2.6 \times 10^{-7}$ scc/s He.

2.7.21 **IF** OCV vent port plug O-ring seal leakage rate is **>** 2.6×10^{-7} scc/s He,
THEN perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.01, replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat leak test.

[C] If after repeated testing it is apparent seal cannot pass test, prepare NCR and record on Attachment 4.

SIGN-OFF

2.7.22 Remove OCV leak detection tool from OCV vent port.

2.7.23 Install OCV vent port cover.

2.7.24 Torque OCV vent port cover to 55 to 65 lb-in., and record on Attachment 4.

SIGN- OFF

2.7.25 Install OCV seal test port thermal plug and access plug.

2.7.26 Torque OCV seal test port access plug to 35 to 45 lb-ft and record on Attachment 4.

SIGN-OFF

2.7.27 Install OCV vent port thermal plug and access plug.

2.7.28 Torque OCV vent port access plug to 35 to 45 lb-ft and record on Attachment 4.

SIGN-OFF

Figure 2.1 ICV Weld Test

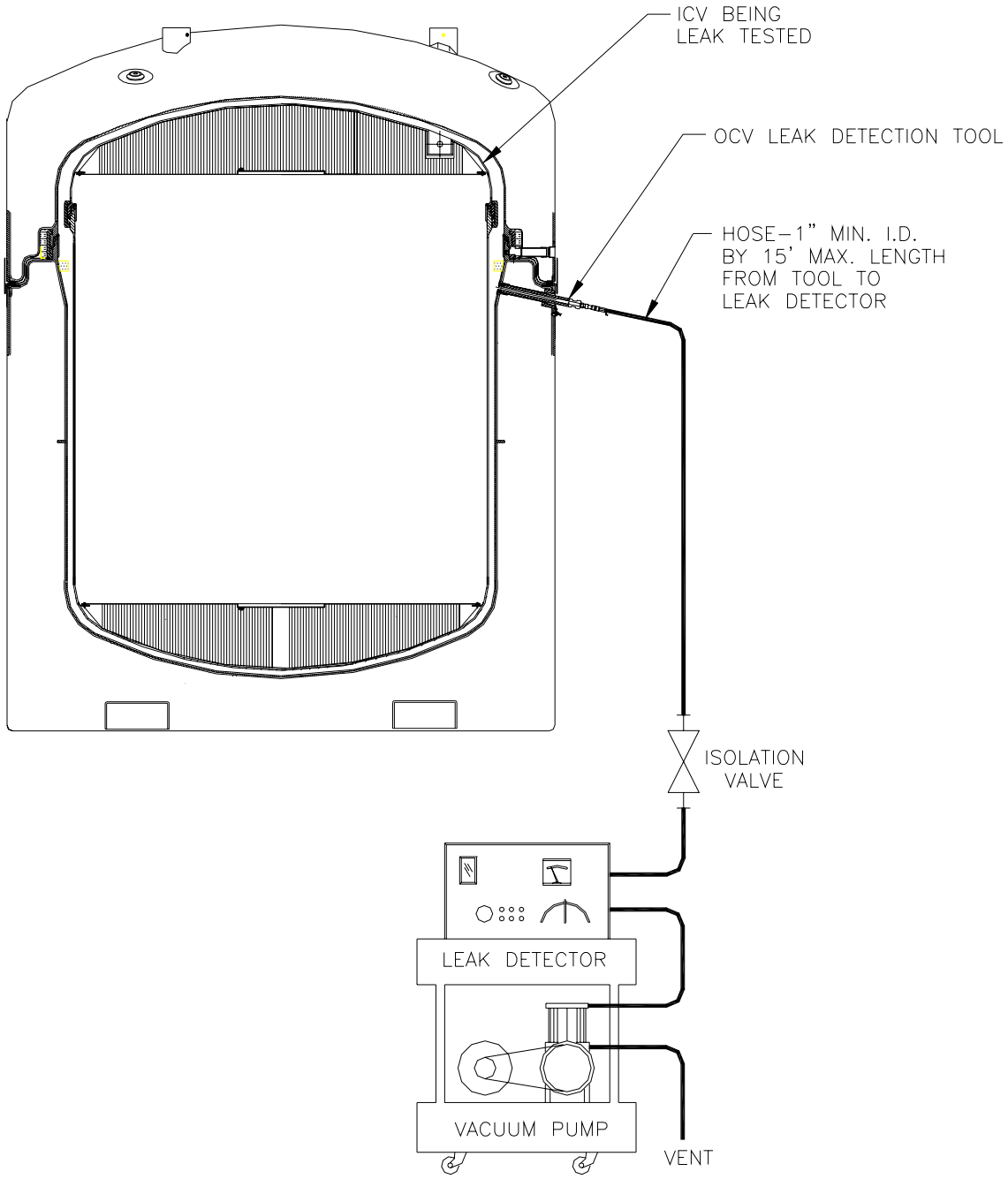
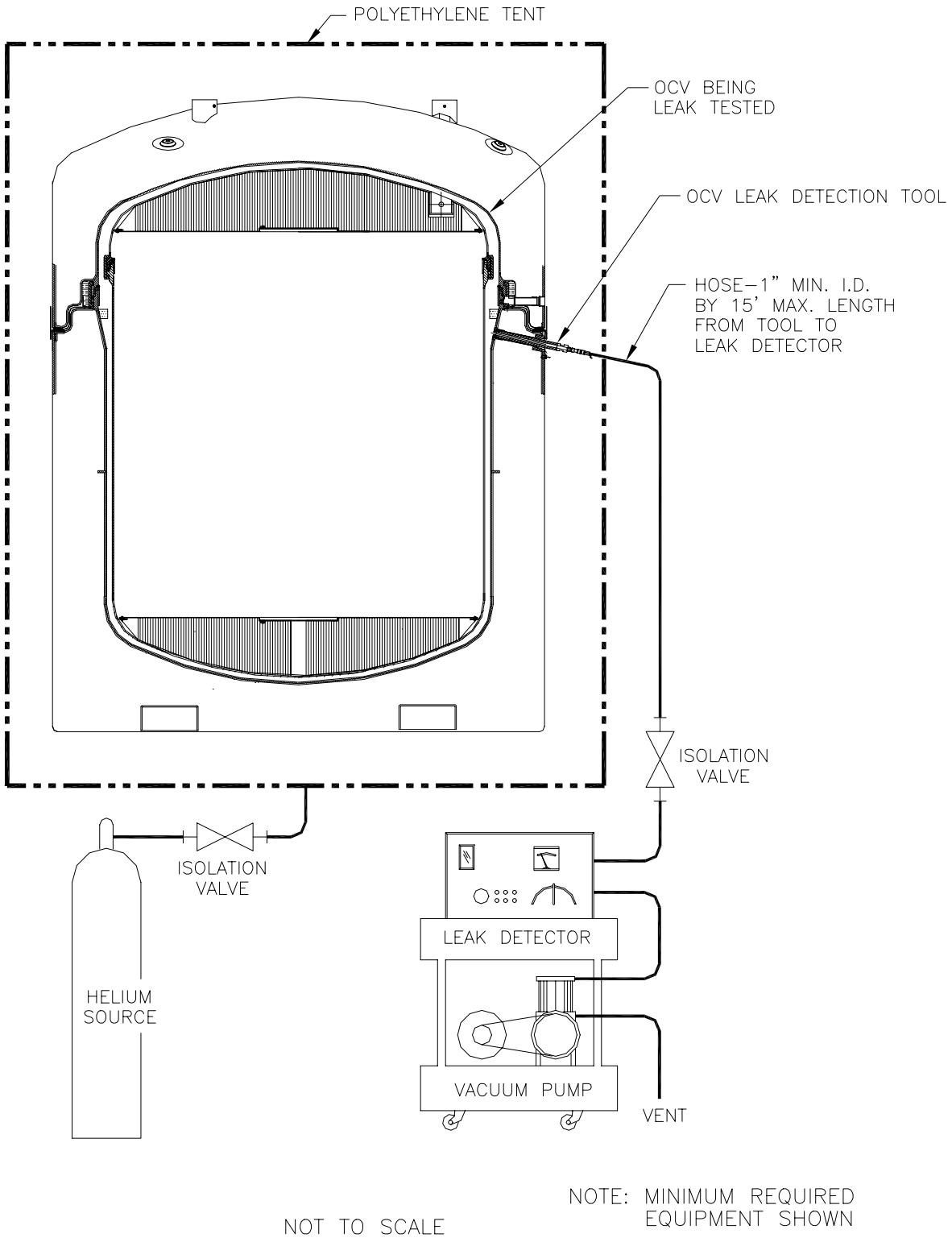


Figure 2.2 OCV Weld Test



3.0 STRUCTURAL PRESSURE TESTING

3.1 Basic Information

3.1.1 Introduction

This procedure provides instructions for performing ICV and OCV structural pressure tests.

3.1.2 References

BASELINE

- 10 CFR 71.85, Preliminary Determinations
- U.S. Department of Energy, Safety Analysis Report for the TRUPACT-II Shipping Package
- TRUPACT-II Certificate of Compliance No. 9218
- U.S. Department of Energy, Safety Analysis Report for the HalfPACT Shipping Package
- HalfPACT Certificate of Compliance No. 9279
- DOE/WIPP 02-3183, CH Packaging Program Guidance
- DOE/WIPP 02-3184, CH Packaging Operations Manual
- ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NB, Article NB 6000

3.1.3 Equipment

MEASURING AND TEST EQUIPMENT

- Pressure gauges (2): Maximum pressure range between 120 psig and 300 psig. The gauges shall have an accuracy, resolution, and repeatability not exceeding 1% of the full scale of the gauge.
- Watch or stopwatch, digital or sweep second hand (no calibration required)

SPECIAL TEST EQUIPMENT

- Safety enclosure
- ICV/OCV leak detection tools
- Miscellaneous hardware and test connections

- Air supply (capable of pressurizing to 80 psig)
- Overpressure protection device

3.1.4 Precautions and Limitations

- The following pressure test procedure may be used, or the maintenance provider may develop a procedure to perform this test by qualified personnel, by following the guidelines of ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NB, Article NB 6000. Maintenance providers that opt to develop their pressure test procedure must submit them to the WIPP M&O Packaging Maintenance Engineer for approval.

- Pressure testing shall be conducted within the confines of a safety enclosure

- The test pressure shall not be applied until the pressurizing fluid (air) and vessel metal temperatures are about the same

3.1.5 Prerequisite Actions

- Verify air flow through leak detection tools.

- Verify packaging surface is free of contaminants that might mask a leak. The interior and exterior surfaces shall be dry.

- Verify vessel is assembled (ICV is without Wiper O-ring and upper and lower spacer assemblies) and the locking ring is in LOCKED position

- Verify overpressure protection device is set at 80 psig

3.2 ICV Pressure Test

3.2.1 Record the following on Attachment 5:

- ICV body serial number (S/N)
- ICV lid S/N
- Date of pressure test
- Pressure gauge S/Ns and calibration due date

SIGN-OFF

3.2.2 Place ICV inside safety enclosure.

3.2.3 Verify ICV seal test port plug installed.

3.2.4 Verify the following items have been removed:

- ICV vent port cover
- Outer vent port plug
- Inner vent port plug

3.2.5 Install ICV leak detection tool (see Figure 3.1) into ICV vent port.

NOTE

The pressure-test manifold shall be equipped with a valve that can isolate the pressure gauge from air supply, but not from ICV cavity. A secondary pressure gauge shall be used for primary pressure gauge verification.

3.2.6 Connect the following to ICV leak detection tool:

- Air supply
- Manifold gauge(s)
- Pressure gauge(s)
- Overpressure protection device

3.2.7 Pressurize ICV cavity **SLOWLY** to 37.5 psig.

3.2.8 Close valve.

3.2.9 Check for leaks.

3.2.10 Increase pressure in steps of about 7.5 psig until test pressure of 75 (+ 5/-0) psig is attained.

3.2.11 Wait 5 minutes for ICV and air temperature to stabilize, increasing pressure if required.

3.2.12 **WHEN** correct air pressure is achieved,
THEN isolate ICV cavity pressure gauges from air supply.

3.2.13 Record primary pressure reading on Attachment 5.

SIGN-OFF

3.2.14 Begin timing for containment structure pressure test.

3.2.15 Record secondary pressure reading on Attachment 5.

SIGN-OFF

3.2.16 Monitor pressure for a minimum of 10 minutes and note pressure changes.

3.2.17 If pressure decreases from initial value, perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02 to replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat the pressure test.

[C] If system cannot pass pressure test, prepare NCR and record on Attachment 5.

SIGN-OFF

3.2.18 When 10-minute dwell time is complete, record final pressure readings on Attachment 5.

SIGN-OFF

3.2.19 Depressurize ICV cavity.

3.2.20 Remove all pressure test equipment from ICV.

3.2.21 Remove ICV from safety enclosure.

3.2.22 Remove ICV lid in accordance with DOE/WIPP 02-3184.

3.2.23 Perform ICV Interior Surfaces Inspection in accordance with DOE/WIPP 02-3183, Subsection 5.3.

3.3 OCV Pressure Test

3.3.1 Record the following on Attachment 5:

- OCA body serial number (S/N)
- OCA lid S/N
- Date of pressure test
- Pressure gauge S/Ns and calibration due date

SIGN-OFF

3.3.2 Place OCA inside safety enclosure.

3.3.3 Verify OCV seal test port plug installed.

3.3.4 Verify OCV vent port cover and vent port plug have been removed.

3.3.5 Install OCV leak detection tool (see Figure 3.2) into OCV vent port.

NOTE

The pressure test manifold shall be equipped with a valve that can isolate the pressure gauge from the air supply, but not from OCV cavity. A secondary pressure gauge shall be used for primary pressure gauge verification.

3.3.6 Connect the following items to OCV leak detection tool:

- Air supply
- Manifold gauge(s)
- Pressure gauge(s)
- Overpressure protection device

3.3.7 Pressurize OCV cavity **SLOWLY** to 37.5 psig.

3.3.8 Close valve.

3.3.9 Check for leaks.

3.3.10 Increase pressure in steps of about 7.5 psig until test pressure of 75 (+ 5/-0) psig is attained.

3.3.11 Wait 5 minutes for OCV and air temperature to stabilize, increasing pressure if required.

3.3.12 **WHEN** correct pressure is achieved,
THEN isolate OCV cavity pressure gauges from air supply.

3.3.13 Record primary pressure reading on Attachment 6.

SIGN-OFF

3.3.14 Begin timing for the containment structure pressure test.

3.3.15 Record secondary pressure reading on Attachment 6.

SIGN-OFF

3.3.16 Monitor pressure for a minimum of 10 minutes and note any pressure changes.

3.3.17 If pressure decreases from initial value, perform the following:

[A] Isolate leak path.

[B] **GO TO** WI-CH.02 to replace O-ring seal(s) and/or WI-CH.12 to repair seal surface(s), and repeat pressure test.

[C] If system cannot pass pressure test, prepare NCR and record on Attachment 6.

SIGN-OFF

3.3.18 When 10-minute dwell time is complete, record final pressure readings on Attachment 6.

SIGN-OFF

3.3.19 Depressurize OCV cavity.

3.3.20 Remove all pressure test equipment from OCV.

3.3.21 Remove OCA from safety enclosure.

3.3.22 Remove OCA lid in accordance with DOE/WIPP 02-3184.

3.3.23 Perform inspection of OCV in accordance with DOE/WIPP 02-3183, Subsection 5.3.

3.3.24 Reassemble TRUPACT-II.

3.3.25 Perform ICV/OCV periodic leakage rate test per Section 2.0.

Figure 3.1 ICV Structural Pressure Test

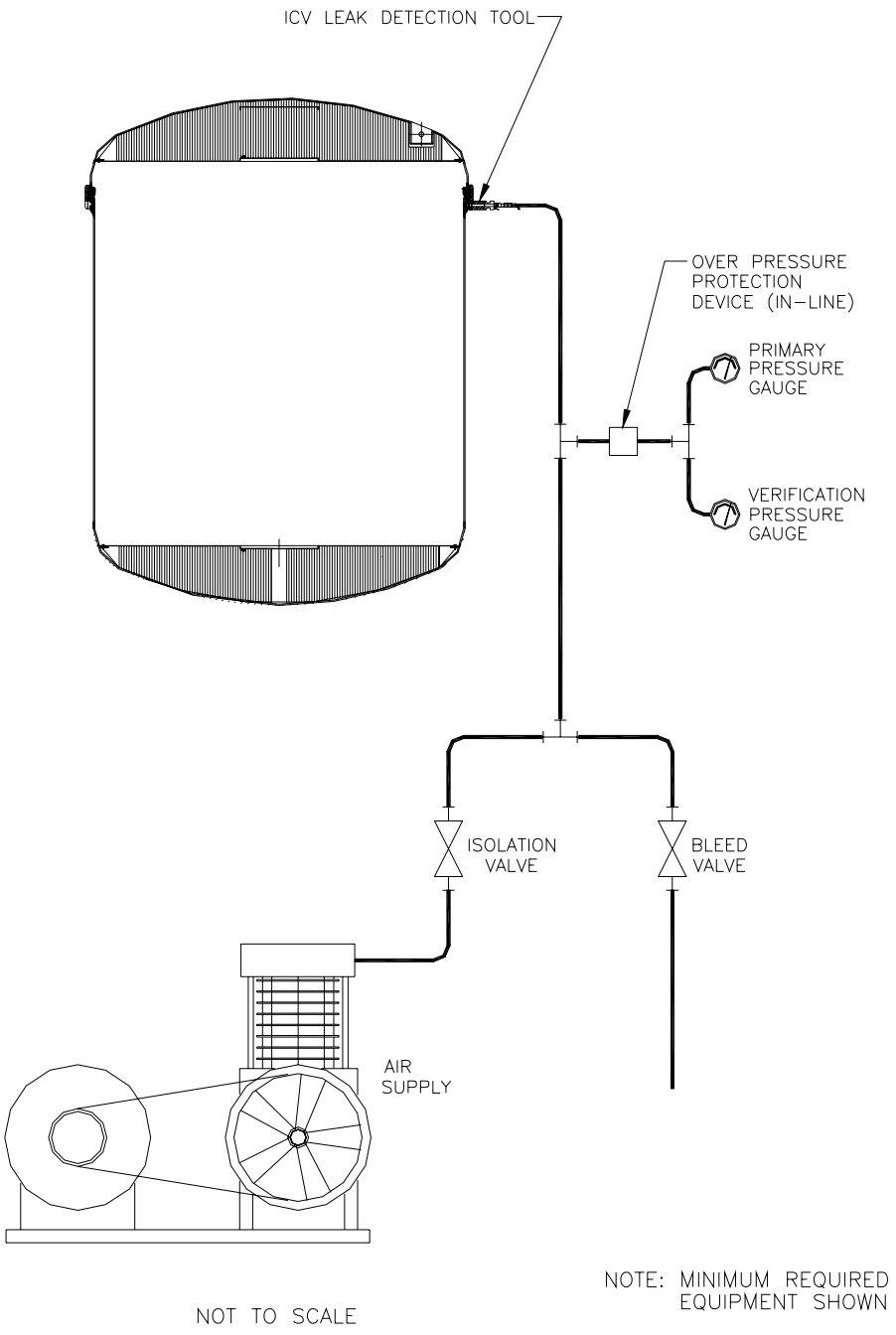
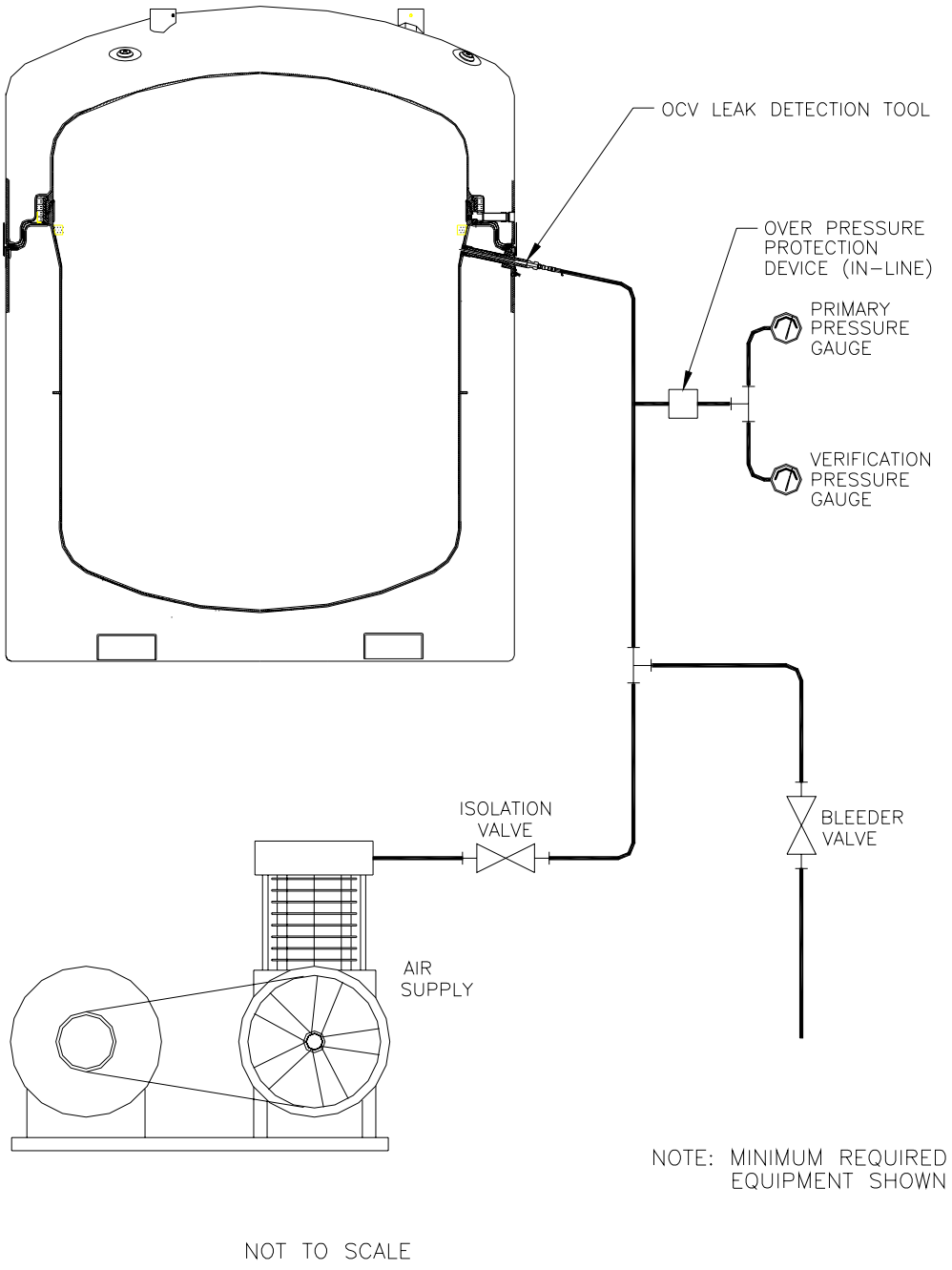


Figure 3.2 OCV Structural Pressure Test



Attachment 1 - ICV Maintenance Leakage Rate Test Data Sheet

	Basic Data:			
1.2.1	ICV body S/N: _____	ICV lid S/N: _____	Date: _____	
	MSLD model: _____		S/N: _____	
	Vacuum/pressure gauge S/N: _____		Due: _____	
	Thermometer S/N: _____		Due: _____	
	Torque wrench S/N: _____		Due: _____	
	Torque wrench S/N: _____		Due: _____	
	Standard leak S/N: _____		Due: _____	
	Barometer S/N: _____		Due: _____	
1.2.4	ICV inner vent port plug installed at 55 to 65 lb-in.		Initials _____	
1.2.7	ICV surface temperature: _____	°C		
	Concentration Correction Factor Data:			
1.2.13	Ambient atmospheric pressure _____	in. Hg (Patm)		
1.2.15	Vacuum reading _____	in. Hg (V1)		
1.2.17	Concentration Correction Factor (CCF) = Patm/V1 _____			
	Pretest Calibration for ICV Upper Main O-Ring Seal Test:			
1.2.18	Leak rate of standard leak _____	scc/s		
	Temperature at time of calibration _____	°C		
	Temperature adjusted leak rate used to calibrate leak detector _____	scc/s		
	Zero reading at time of calibration _____	scc/s		
	Time of calibration _____			
	Test Data for ICV Upper Main O-Ring Seal Test:			
1.2.22	He background before He backfill (RB) _____	scc/s		
1.2.25	Pressure reading at end of He backfill _____	psi		
1.2.28	He reading after 3 minute dwell (RT) = _____	scc/s		
	Post-test Calibration for ICV Upper Main O-Ring Seal Test:			
1.2.31	Temperature at time of recalibration _____	°C		
	He reading with standard leak Installed _____	scc/s		
	Zero reading at time of calibration _____	scc/s		
	Time of calibration _____			

Attachment 1 - ICV Maintenance Leakage Rate Test Data Sheet

	Leak Rate Calculation for ICV Upper Main O-Ring Seal Test:	
1.2.32	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = (RT - RB) X CCF LR = (_____ - _____) X _____ = _____ scc/s	
1.2.33	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference - RB) X CCF LR = (_____ + _____ - _____) X _____ = _____ scc/s	
1.2.34	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference - RB) X CCF LR = (_____ - _____ - _____) X _____ = _____ scc/s	
1.2.36[C]	NCR number recorded _____	Initials _____
1.2.39	ICV seal test port plug at 55 to 65 lb-in.	Initials _____
	Pretest Calibration for ICV Outer Vent Port Plug O-Ring Seal Test:	
1.3.4	ICV outer vent port plug at 55 to 65 lb-in.	Initials _____
1.3.8	Leak rate of standard leak _____ scc/s Temperature at time of calibration _____ °C Temperature adjusted leak rate used to calibrate leak detector _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____	
	Test Data for ICV Outer Vent Port Plug O-Ring Seal:	
1.3.12	He reading after 3 minute dwell (RT) = _____ scc/s	
	Post-test Calibration for ICV Outer Vent Port Plug O-Ring Seal Test:	
1.3.15	Temperature at time of recalibration _____ °C He reading with standard leak installed _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____	
	Leak Rate Calculation for ICV Outer Vent Port Plug O-Ring Seal Test:	
1.3.17	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = RT X CCF LR = _____ X _____ = _____ scc/s	
1.3.18	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference) X CCF LR = (_____ + _____) X _____ = _____ scc/s	

Attachment 1 - ICV Maintenance Leakage Rate Test Data Sheet

1.3.19	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference) X CCF LR = (_____ - _____) X _____ = _____ scc/s	
1.3.21[C]	NCR number recorded _____	Initials _____
1.3.24	ICV vent port cover at 55 to 65 lb-in.	Initials _____
	Accountability Section	
	_____ Tests performed by/Level	_____ Date
	_____ Tests reviewed by/Level	_____ Date

Attachment 2 - OCV Maintenance Leakage Rate Test Data Sheet

	Basic Data:			
1.4.1	OCV body S/N: _____	OCV lid S/N: _____	Date: _____	
	MSLD model: _____	S/N: _____		
	Pressure/vacuum gauge _____	Due: _____		
	Thermometer S/N: _____	Due: _____		
	Torque wrench S/N: _____	Due: _____		
	Torque wrench S/N: _____	Due: _____		
	Standard leak S/N: _____	Due: _____		
	Barometer S/N: _____	Due: _____		
1.4.6	OCV surface temperature: _____ °C			
	Concentration Correction Factor Data:			
1.4.11	Ambient atmospheric pressure _____ in. Hg (Patm)			
1.4.13	Vacuum reading _____ in. Hg (V1)			
1.4.15	Concentration Correction Factor (CCF) = Patm/V1 _____			
	Pretest Calibration for OCV Upper Main O-Ring Seal Test:			
1.4.17	Leak rate of standard leak _____ scc/s			
	Temperature at time of calibration _____ °C			
	Temperature adjusted leak rate used to calibrate leak detector _____ scc/s			
	Zero reading at time of calibration _____ scc/s			
	Time of calibration _____			
	Test Data for OCV Upper Main O-Ring Seal:			
1.4.22	He background (RB) _____ scc/s			
1.4.25	Backfill pressure reading at end of He backfill _____ psi			
1.4.28	He reading after 3 minute dwell (RT) = _____ scc/s			
	Post-test Calibration for OCV Upper Main O-Ring Seal Test:			
1.4.31	Temperature at time of recalibration _____ °C			
	He reading with standard leak installed _____ scc/s			
	Zero reading at time of calibration _____ scc/s			
	Time of calibration _____			
	Leak Rate Calculation for OCV Upper Main O-Ring Seal Test:			
1.4.33	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation:			
	Leak Rate = (RT - RB) X CCF			
	LR = (_____ - _____) X _____ = _____ scc/s			

Attachment 2 - OCV Maintenance Leakage Rate Test Data Sheet

1.4.34	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference - RB) X CCF LR = (_____ + _____ - _____) X _____ = _____ scc/s
1.4.35	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference - RB) X CCF LR = (_____ - _____ - _____) X _____ = _____ scc/s
1.4.37[C]	NCR number recorded _____ Initials _____
	OCV Vent Port Plug O-Ring Seal Test:
1.4.40	OCV seal test port plug at 55 to 65 lb-in. Initials _____
1.5.4	OCV vent port plug at 55 to 65 lb-in. Initials _____
	Pretest Calibration for OCV Vent Port Plug O-Ring Seal Test:
1.5.8	Leak rate of standard leak _____ scc/s Temperature at time of calibration _____ °C Temperature adjusted leak rate used to calibrate leak detector _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____
	Test Data for OCV Vent Port Plug O-Ring Seal Test:
1.5.12	He reading after 3 minute dwell (RT) = _____ scc/s
	Post-test Calibration for OCV Vent Port Plug O-Ring Seal Test:
1.5.15	Temperature at time of calibration _____ °C He reading with standard leak installed _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____
	Leak Rate Calculation for OCV Vent Port Plug O-Ring Seal Test:
1.5.17	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = RT X CCF LR = (_____ X _____) = _____ scc/s
1.5.18	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference) X CCF LR = (_____ + _____) X _____ = _____ scc/s
1.5.19	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference) X CCF LR = (_____ - _____) X _____ = _____ scc/s

Attachment 2 - OCV Maintenance Leakage Rate Test Data Sheet

1.5.21[C]	NCR number recorded _____	Initials	_____
1.5.24	OCV vent port cover at 55 to 65 lb-in.	Initials	_____
1.5.26	OCV seal test port access plug at 35 to 45 lb-ft	Initials	_____
1.5.28	OCV vent port access plug at 35 to 45 lb-ft	Initials	_____
	Accountability Section		
	_____ Tests performed by/Level		_____ Date
	_____ Tests reviewed by/Level		Date

Attachment 3 - ICV Periodic Leakage Rate Test Data Sheet

	Basic Data:				
2.2.1	ICV body S/N:	_____	ICV lid S/N:	_____	Date: _____
	MSLD model:	_____	S/N:	_____	
	Vacuum/pressure gauge S/N:	_____	Due:	_____	
	Thermometer S/N:	_____	Due:	_____	
	Torque wrench S/N:	_____	Due:	_____	
	Torque wrench S/N:	_____	Due:	_____	
	Standard leak S/N:	_____	Due:	_____	
	Barometer S/N:	_____	Due:	_____	
2.2.5	ICV surface temperature:	_____ °C			
	Concentration Correction Factor Data:				
2.2.11	Ambient atmospheric pressure	_____ in. Hg (Patm)			
2.2.13	Vacuum reading	_____ in. Hg (V1)			
2.2.15	Concentration Correction Factor (CCF) = Patm/V1	_____			
	Pretest Calibration for ICV Upper Main O-Ring Seal Test:				
2.2.16	Leak rate of standard leak	_____ scc/s			
	Temperature at time of calibration	_____ °C			
	Temperature adjusted leak rate used to calibrate leak detector	_____ scc/s			
	Zero reading at time of calibration	_____ scc/s			
	Time of calibration	_____			
	Test Data for ICV Upper Main O-Ring Seal:				
2.2.20	He background before He backfill (RB)	_____ scc/s			
2.2.23	Pressure reading at end of He backfill	_____ psi			
2.2.26	He reading after 3 minute dwell (RT) =	_____ scc/s			
	Post-test Calibration for ICV Upper Main O-Ring Seal Test:				
2.2.29	Temperature at time of recalibration	_____ °C			
	He reading with standard leak Installed	_____ scc/s			
	Zero reading at time of calibration	_____ scc/s			
	Time of calibration	_____			
	Leak Rate Calculation for ICV Upper Main O-Ring Seal Test:				
2.2.30	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation:				
	Leak Rate = (RT - RB) X CCF				
	LR = (_____ - _____) X _____ = _____ scc/s				

Attachment 3 - ICV Periodic Leakage Rate Test Data Sheet

2.2.31	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference - RB) X CCF LR = (_____ + _____ - _____) X _____ = _____ scc/s	
2.2.32	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference - RB) X CCF LR = (_____ - _____ - _____) X _____ = _____ scc/s	
2.2.34[C]	NCR number recorded _____	Initials _____
2.2.37	ICV seal test port plug at 55 to 65 lb-in.	Initials _____
	Pretest Calibration for ICV Outer Vent Port Plug O-Ring Seal Test:	
2.3.4	ICV outer vent port plug at 55 to 65 lb-in.	Initials _____
2.3.8	Leak rate of standard leak _____ scc/s Temperature at time of calibration _____ °C Temperature adjusted leak rate used to calibrate leak detector _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____	
	Test Data for ICV Outer Vent Port Plug O-Ring Seal:	
2.3.12	He reading after 3 minute dwell (RT) = _____ scc/s	
	Post-test Calibration for ICV Outer Vent Port Plug O-Ring Seal Test:	
2.3.15	Temperature at time of recalibration _____ °C He reading with standard leak installed _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____	
	Leak Rate Calculation for ICV Outer Vent Port Plug O-Ring Seal Test:	
2.3.17	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = RT X CCF LR = _____ X _____ = _____ scc/s	
2.3.18	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference) X CCF LR = (_____ + _____) X _____ = _____ scc/s	
2.3.19	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference) X CCF LR = (_____ - _____) X _____ = _____ scc/s	
2.3.21[C]	NCR number recorded _____	Initials _____
2.3.24	ICV vent port cover at 55 to 65 lb-in.	Initials _____

Attachment 3 - ICV Periodic Leakage Rate Test Data Sheet

	Pretest Calibration for ICV Weld Test:		
2.4.3	OCV surface temperature	_____	°C
2.4.9	Leak rate of standard leak	_____	scc/s
	Temperature at time of calibration	_____	°C
	Temperature adjusted leak rate used to calibrate leak detector	_____	scc/s
	Zero reading at time of calibration	_____	scc/s
	Time of calibration	_____	
	Test Data for ICV Weld Test:		
2.4.10	He reading after _____ minute dwell (RT) = _____		scc/s
	Post-test Calibration for ICV Weld Test:		
2.4.14	Temperature at time of recalibration	_____	°C
	He reading with standard leak installed	_____	scc/s
	Zero reading at time of calibration	_____	scc/s
	Time of calibration	_____	
	Leak Rate Calculation for ICV Weld Test:		
NOTE:	Correction factors are for He concentration (CCF) and 1.58 due to test configuration.		
2.4.16	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = RT X CCF X 1.58 LR = _____ X _____ X 1.58 = _____ scc/s		
2.4.17	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference) X CCF X 1.58 LR = (_____ + _____) X _____ X 1.58 = _____ scc/s		
2.4.18	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference) X CCF X 1.58 LR = (_____ - _____) X _____ X 1.58 = _____ scc/s		
2.4.20[C]	NCR number recorded _____	Initials	_____
	Accountability Section		
	_____ Tests performed by/Level		_____ Date
	_____ Tests reviewed by/Level		_____ Date

Attachment 4 - OCV Periodic Leakage Rate Test Data Sheet

	Basic Data:		
2.5.1	OCV body S/N: _____	OCV lid S/N: _____	Date: _____
	He leak detector model: _____	S/N: _____	
	Pressure/vacuum gauge S/N: _____	Due: _____	
	Thermometer S/N: _____	Due: _____	
	Torque wrench S/N: _____	Due: _____	
	Torque wrench S/N: _____	Due: _____	
	Standard leak S/N: _____	Due: _____	
	Barometer S/N: _____	Due: _____	
2.5.4	OCV surface temperature: _____ °C		
	Pretest Calibration for OCV Weld Test:		
2.5.7	OCV seal test port plug at 55 to 65 lb-in.		_____
2.5.13	Leak rate of standard leak	_____ scc/s	
	Temperature at time of calibration	_____ °C	
	Temperature adjusted leak rate used to calibrate leak detector	_____ scc/s	
	Zero reading at time of calibration	_____ scc/s	
	Time of calibration	_____	
	Test Data for OCV Weld Test:		
2.5.14	He background at start of purge (RB)	_____ scc/s	
2.5.17	Time at start of He purge	_____	
2.5.21	Time at end of He purge	_____	
2.5.22	Time at start of dwell time	_____	
2.5.23	He reading after _____ minute dwell (RT) =	_____ scc/s	
2.5.24	Time at end of dwell time	_____	
	Post-test Calibration for OCV Weld Test:		
2.5.28	Temperature at time of recalibration	_____ °C	
	He reading with standard leak installed	_____ scc/s	
	Zero reading at time of calibration	_____ scc/s	
	Time of calibration	_____	

Attachment 4 - OCV Periodic Leakage Rate Test Data Sheet

	Leak Rate Calculation For OCV Weld Test:
NOTE:	If He concentration in tent is known, calculate corresponding correction factor and insert in formulas below. Otherwise, use a correction factor of 2 for 50% He concentration. Correction factors are (2 or ___) for He concentration in hood and 1.58 due to test configuration. Multiply leakage reading by correction (_____ and 1.58).
2.5.30	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leak Rate = (RT - RB) X CCF X 1.58 LR = (_____ - _____) X _____ X 1.58 = _____ scc/s
2.5.31	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference - RB) X CCF X 1.58 LR = (_____ + _____ - _____) X _____ X 1.58 = _____ scc/s
2.5.32	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference - RB) X CCF X 1.58 LR = (_____ - _____ - _____) X _____ X 1.58 = _____ scc/s
2.5.34[C]	NCR number recorded _____ Initials _____
	Concentration Correction Factor Data:
2.6.8	Ambient atmospheric pressure _____ in. Hg (Patm)
2.6.10	Vacuum reading _____ in. Hg (V1)
2.6.12	Concentration Correction Factor (CCF) = Patm/V1 _____
	Pretest Calibration for OCV Upper Main O-Ring Seal Test:
2.6.14	Leak rate of standard leak _____ scc/s Temperature at time of calibration _____ °C Temperature adjusted leak rate used to calibrate leak detector _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____
	Test Data for OCV Upper Main O-Ring Seal:
2.6.19	He background (RB) _____ scc/s
2.6.22	Backfill pressure reading at end of He backfill _____ psi
2.6.25	He reading after 3 minute dwell (RT) = _____ scc/s
	Post-test Calibration for OCV Upper Main O-Ring Seal Test:
2.6.28	Temperature at time of recalibration _____ °C He reading with standard leak installed _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____

Attachment 4 - OCV Periodic Leakage Rate Test Data Sheet

	Leak Rate Calculation for OCV Upper Main O-Ring Seal Test:
2.6.30	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leakage Rate = (RT - RB) X CCF LR = (_____ - _____) X _____ = _____ scc/s
2.6.31	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leak Rate = (RT + Calibration Difference - RB) X CCF LR = (_____ + _____ - _____) X _____ = _____ scc/s
2.6.32	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leak Rate = (RT - Calibration Difference - RB) X CCF LR = (_____ - _____ - _____) X _____ = _____ scc/s
2.6.34[C]	NCR number recorded _____ Initials _____
2.6.37	OCV seal test port plug at 55 to 65 lb-in. Initials _____
2.7.4	OCV vent port plug at 55 to 65 lb-in. Initials _____
	Pretest Calibration for OCV Vent Port Plug O-Ring Seal Test:
2.7.8	Leak rate of standard leak _____ scc/s Temperature at time of calibration _____ °C Temperature adjusted leak rate used to calibrate leak detector _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____
	Test Data for OCV Vent Port Plug O-Ring Seal Test:
2.7.12	He leakage rate after 3 minute dwell (RT) = _____ scc/s
	Post-test Calibration for OCV Vent Port Plug O-Ring Seal Test:
2.7.15	Temperature at time of recalibration _____ °C He reading with standard leak installed _____ scc/s Zero reading at time of calibration _____ scc/s Time of calibration _____
	Leak Rate Calculation for OCV Vent Port Plug O-Ring Seal Test:
2.7.17	If there is **NO** difference in the post-test calibration from the pretest calibration, use the following equation: Leakage Rate = RT X CCF LR = _____ X _____ = _____ scc/s
2.7.18	If the post-test calibration is **LESS** than pretest calibration, add the calibration difference: Leakage Rate = (RT + Calibration Difference) X CCF LR = (_____ + _____) X _____ = _____ scc/s

Attachment 4 - OCV Periodic Leakage Rate Test Data Sheet

2.7.19	If the post-test calibration is **MORE** than pretest calibration, subtract the calibration difference: Leakage Rate = (RT - Calibration Difference) X CCF LR = (_____ - _____) X _____ = _____ scc/s	
2.7.21[C]	NCR number recorded _____	Initials _____
2.7.24	OCV vent port cover at 55 to 65 lb-in.	Initials _____
2.7.26	OCV seal test port access plug at 35 to 45 lb-ft	Initials _____
2.7.28	OCV vent port access plug at 35 to 45 lb-ft	Initials _____
	Accountability Section	
	_____ Tests performed by/Level	_____ Date
	_____ Tests reviewed by/Level	_____ Date

Attachment 5 - ICV Structure Pressure Test Data Sheet

Facility: _____ **Date:** _____		
STEP	**DESCRIPTION**	
3.2.1	ICV body serial number (S/N): _____	
	ICV lid S/N: _____	
	Date of pressure test: _____	
	1st pressure gauge S/N: _____	Due: _____
	2nd pressure gauge S/N: _____	Due: _____
3.2.13	Initial primary pressure gauge reading: _____ psig	_____ time
3.2.15	Initial secondary pressure gauge reading: _____ psig	_____ time
3.2.17[C]	NCR number recorded _____ Initials	_____
3.2.18	Final primary pressure gauge reading: _____ psig	_____ time
	Final secondary pressure gauge reading: _____ psig	_____ time
	Accountability Section	
	_____	_____
	Test performed by	Date

Attachment 6 - OCV Structure Pressure Test Data Sheet

Facility: _____ **Date:** _____			
STEP	**DESCRIPTION**		
3.3.1	OCA body serial number (S/N): _____		
	OCA lid S/N: _____		
	Date of pressure test: _____		
	1st pressure gauge S/N: _____	Due:	_____
	2nd pressure gauge S/N: _____	Due:	_____
3.3.13	Initial primary pressure gauge reading: _____ psig	_____	time
3.3.15	Initial secondary pressure gauge reading: _____ psig	_____	time
3.3.17[C]	NCR number recorded _____	Initials	_____
3.3.18	Final primary pressure gauge reading: _____ psig	_____	time
	Final secondary pressure gauge reading: _____ psig	_____	time
	Accountability Section		
	_____	_____	
	Test performed by	Date	