Century Industries **Box 17084, Bristol, Virginia 24209**
Phone: 423-646-1864
E-mail:CenturyIndWMA@aol.com

Test Report
Performance Evaluation Test Series Of
Century Industries' Model VP-55 & VP-110
Versa-Pac Shipping Container

US NRC Docket Number 71-9342

Test Conducted in Accordance with Test Plan TP-001 Revision 0
And
Test Specification TS-001 Revision 0
Prepared & Conducted By:
Century Industries
William M. Arnold

Prepared By: _____ Date: _____

Table of Contents

1.0 INTRODUCTION

This Report describes the methods and guidelines Century Industries followed for the preparation and testing of the Versa-Pac Shipping Container in accordance with the requirements specified in Century Industries Test Plan TP-001 Revision 0 and Century Industries Test Specification TS-001 Revision 0 (Attachment A and B). The test program was conducted by Century Industries located in Bristol, Virginia between February 25 and March 5, 2009. This report includes the program objective, test procedure, item description, test results, test records (Attachment C) and other applicable documents including photographs of the testing.

2.0 OBJECTIVE

The objective of this test program was to conduct the physical performance evaluation tests for Century Industries VP-55 and VP-110 Versa-Pac Shipping Container designer and manufacturer of the package, in accordance with the normal conditions and hypothetical accident conditions specified in Title 10 Part 71.73 [1], Test Plan TP-001 Revision 0 and Test Specification TS-001 Revision 0.

The test items were identified as Versa-Pac shipping container prototypes and subjected to the following performance tests:

1. Initial visual inspection of the outer and inner container surfaces.

2. Low Temperature Conditioning

3. Drop testing in accordance with 10 CFR 71.71(c)(7), 71.73 (c)(1),(2) & (3), along with NUREG6818, Shallow Angle Drop in a variety of orientations described in Regulatory Guide 7.9

4. Post Test Visual Inspection of the outer and interior container surfaces.

Following each test the physical condition of the shipping container was inspected and the results recorded.

3.0 RESPONSIBILITIES

Century Industries personnel conducted the test program and were responsible for the base analysis of the test articles, the test plan and oversight of the test series. All test personnel completed the Pre-test Readiness Review and associated procedures.

The test series was performed in accordance with the applicable requirements and guidance of Century Industries QA Program QA-1 Revision 1, 10 CFR 71 and this test plan.

The program manager was William M. Arnold, President of Century Industries.
Quality Assurance Coordinator was Heather Little.

4.0 TEST ITEM IDENTIFICATION

Century Industries was responsible for the design, fabrication, inspection, recording the preliminary measurements and the loading of payload and payload containers with multiple size gravels and loose sand.

5.0 TEST ITEM DESCRIPTION

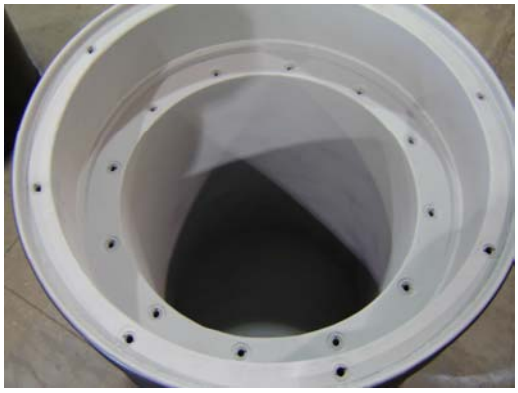
The Versa-Pac Shipping Container is designed for the shipment of Type A radioactive and fissile materials in the form U-metal, oxides, fluorides and nitrate for both product and scrap materials. The fissile payload was design for 350 grams at 100% enrichment and a criticality safety index of 1.5.

The Versa-Pac Shipping Container was designed in two basic versions, a UN1A2 -55 gallon and 110 gallon outer drum with a 16 gauge body, bottom and cover, in addition to the standard 12 gauge closure ring with a 5/8" ASTM A307 bolt, the cover is reinforced and secured using the addition of bolts attached to the internal structure of the package as detailed in the design drawings. The internal structure consists of vertical and horizontal stiffeners at specific points around the package. Outer and inner 16 gauge liners, with an insulating ceramic fiber blanket between the liners complete the primary inner structural components. A secondary barrier of insulation consisting of ceramic fiber blanket; surround the inner containment body. The payload gasket is a woven fiberglass yarn in a flexible substrate, coated with high grade silicone rubber. The gasketed payload containment cavity is made of 10 gauge body and bottom with a ¼" thick top flange to which in the initial series of testing, a 3/16" thick top flange was secure using 12 -1/2" bolts. In the second round of testing the 3/16" thick flange was replaced by a ½ " thick flange and secured by the same number of bolts. The payload cavity is attached to the internal structural components by use of a bolted connection through a fiberglass thermal break between the payload cavity and the structure. Closed cell polyurethane foam is utilized to provide insulation and added impact protection, to both the top and bottom of the Versa-Pac. The top insulation plug is encapsulated in sheet metal welded to the outer drum closure lid. Plastic plugs enclosed within the body of the structure provide a path for venting to the external acetate plug on the exterior of the drum. The cavity is designed to be loaded directly or with the use of an insert to reduce the diameter or with up to a 30 gallon standard drum.

The Versa-Pac was designed in accordance with the requirements of 10 CRF 71 [1] and Century Industries – QA-8, Plan for Manufacture of Versa-Pac Shipping Containers [2].

Pre-Test Photographs 110 and 55 Gallon Versions

110 Gallon - Side View



110 Gallon - Inside View

55 Gallon - Outer Side Top View

55 Gallon - Internal Loaded View

55 Gallon – Blind Flange Bolted

55 Gallon - Top Closure Side View

55 Gallon Version - Side View

6.0 TEST FACILITES & EQUIPMENT

6.1 Environmental Conditioning

Low temperature conditioning of the test articles was conducted before the drop testing was performed in a pre-existing refrigeration chamber. The chamber was cooled by multiple refrigeration units and forced air in the top of the chamber with capability to cool below the required temperatures. Twin door allowed for the packages to be placed into the conditioning chamber by forklift. Temperatures were monitored by the use of calibrated surface thermometers. The packages were transported directly to the drop site in a manner to minimize the time between removal of the shipping container and the drop site.

6.2 Drop Test Pad Facilities

The drop test pad consists of a 70 ton concrete pad made in accordance with IAEA Safety Series No. 37. The pad is 10 feet wide by 10 feet long by 10 feet deep, reinforced with a grid of ¾ inch re-bar spaced on 12 inch centers and capped with a 1 inch thick by 8 feet wide by 10 feet long carbon steel plate, which is embedded into the surface of the concrete and secured by fourteen 1-1/2 inch diameter bolts by 16 inches long.

6.3 Release Device

The release device utilized was capable of releasing the package in a manner that provided a smooth clean drop without imparting any twisting or turning of the package. The device has a safe working load limit of 18,000 pounds. The test articles were lifted into place by use of a crane.

6.4 Orientation and Angles

The orientation if each drop was controlled by the use of nylon fixed straps and adjustable straps used to set the angles required. The orientation of the container was verified using a magnetic protractor attached to the test article surface.

6.5 Measurements and Weights

Drop heights were determined by use of a pre-measured plumb line set by a 100 foot steel tape measure Serial Number 08461846, calibrated by Starett Company and traceable to NIST. The test items tare weights and payload weights were made using a set of floor scales calibrated by Carlton Scales, Kingsport, Tennessee and traceable to NIST.

6.6 Temperature and Wind Speed

Surface and air temperatures were obtained using calibrated surface gauge Serial Number 05548 with a range of -100°F to +160°F and Dickson Temperature Recorder Model SM320 and traceable to NIST. Wind speed was obtained thru the local metro airport service**.**

6.7 Puncture Device

The puncture device consist of a 6 inch diameter by 22 inches long carbon steel round bar welded to a ¾ inch thick plate, which was then secured to the drop test pad by means of tack welding to the center of the pad.

6.8 Photographic Equipment

Color photographs were taken with a Sony 4.1 Mega pixel digital camera by Century Industries. Video was taken using Sony Digital Handy Cam Mini0DVD DCR-TR-17 and Sony Handy Cam Mini DV DCR-HC20 equipment.

6.9 Crush Plate

The crush test plate is made of A36 carbon steel with measurements of 2-5/8 inches thick by 40-1/4 inches wide by 40-1/4 inches long. The weight of the crush test plate is 1205 pounds. The plate is lifted by up to four ½ thick flat bars welded to each corner of the plate.

7.0 EQUIPMENT AND INSTRUMENT CALIBRATION

All applicable test and measurement equipment were calibrated in accordance with Century Industries Quality Assurance Program. Test and measurement calibration certificates are found in Attachment E. The instrumentation used during testing is listed in Table 1 below.

ITEM	MODEL	S/N	CALIBRATION DUE DATE	COMENTS
Starett 100' Tape Measure	N/A	08461846	November 17, 2009	Used to measure length of plumb bob drop heights
Dickson Temperature Recorder	SM320	09057179	February 01, 2009	Used to calibrate surface thermometer and record air temperature
PTC Instruments Surface Thermometer	330F	05548	April 09, 2009	Used to measure the temperature of the test articles during the conditioning
Floor Scale	0-300 Pound	98530806V1812	February 15, 2009	Used to measure the weight of the payload
Elizabethton Airport	N/A	N/A	N/A	Used to check wind speed
Protractor	N/A	N/A	N/A	Used to measure angles, Calibration not required
4 ' Level	N/A	N/A	N/A	Used as straight edge for measurements
Plumb Bob 30', 4' & 1 Meter Drop height	N/A	N/A	N/A	Used during drop series length determined by calibrated tape

Table 1 – Test Instruments

8.0 ACCEPTANCE CRITERIA

The acceptance criteria for this series of testing was retention of the outer closure, no openings, tears or failure that would lead to loss of materials, no open pathway to the insulation materials and no loss of the inner containment payload.

9.0 TEST PREPARATION AND RESULTS

9.1 Initial Inspection

On February 25, 2009, the visual inspection of the test item was conducted prior to performing any of the physical evaluation tests. During the inspection no damage was found to the exterior or interior surface of the shipping containers. Measurements were taken and recorded on all test articles.

Test Article Serial Number 10550

Location	Pre-Test Measurement	Description
A-C	20-15/16" ID	Inner Container
A-C	31" Ø	Outer Container
A	41-7/8"	Drum Height
A	5-1/16"	Wall – In/Our
A	29-11/16"	Inside Height
A	7-5/16"	Top Rim – Inside Flange
B	41-15/16"	Drum Height
B	7-1/4"	Top Rim – Inside Flange
B	5-1/8"	Wall – In/Out
B-D	20-13/16" ID	Inner Container
B-D	31"Ø	Outer Container
C	29-11/16"	Inside Height
C	5-1/16"	Wall – In/Out
C	42"	Drum Height
C	7-1/4"	Top Rim – Inside Flange
D	29-11/16"	Inside Height
D	42"	Outer Container
D	7-5/16"	Top Rim – Inside Flange
D	5-1/8"	Wall – In/Out

Test Article Serial Number 10551

Location	Pre-Test Measurement	Description
A-C	20-7/8" ID	Inner Container
A-C	31-1/16" Ø	Outer Container
A	41-7/8"	Drum Height
A	5-1/8"	Wall – In/Our
A	29-3/4"	Inside Height
A	7-1/4"	Top Rim – Inside Flange
B	41-7/8"	Drum Height
B	7-3/16"	Top Rim – Inside Flange
B	5-1/8"	Wall – In/Out
B-D	20-7/8" ID	Inner Container
B-D	31"Ø	Outer Container
C	29-3/4"	Inside Height
C	5-1/8"	Wall – In/Out
C	41-7/8"	Drum Height
C	7-3/16"	Top Rim – Inside Flange
D	29-3/4"	Inside Height
D	42"	Outer Container
D	7-3/16"	Top Rim – Inside Flange
D	5-3/16"	Wall – In/Out

Test Article Serial Number 10552

Location	Pre-Test Measurement	Description
A-C	20-7/8" ID	Inner Container
A-C	31-1/16" Ø	Outer Container
A	41-7/8"	Drum Height
A	5-1/8"	Wall – In/Our
A	29-5/8"	Inside Height
A	7-3/16"	Top Rim – Inside Flange
B	41-7/8"	Drum Height
B	7-1/8"	Top Rim – Inside Flange
B	5-3/16"	Wall – In/Out
B-D	20-15/16" ID	Inner Container
B-D	31"Ø	Outer Container
C	29-11/16"	Inside Height
C	5-1/8"	Wall – In/Out
C	41-13/16"	Drum Height
C	7-1/8"	Top Rim – Inside Flange
D	29-5/8"	Inside Height
D	41-15/16"	Outer Container
D	7-3/16"	Top Rim – Inside Flange
D	5"	Wall – In/Out

9.2 Weights and Payload

The package tare weights were recorded on the individual test records. In order to provide the test articles with the most aggressive challenge to the inner payload containment of the Versa-Pac it was decided to use 30 gallon drums to contain the payload contents of multiple size gravel and sand. The materials once place into the drum partially filled the drum container. The payload would provide a secondary piston action within the drum, with an additional piston action occurring from the drum to containment flange impact. 1-1/2 pounds of loose sand was place upon the top of each 30 gallon drum within the containment area in order to provide content material capable of breaching the containment flange seal.

Item/Serial Number	10550	10551	10552
Package Tare Weight	660	662	661
Payload Drum/Gravel and Sand	259.5	260	260.5
Loose Sand Weight	1.5	1.5	1.5
Total	921 lbs.	923.5 lbs.	923 lbs.

9.3 Loading of the Test Item

The 30 gallon drums were closed and the bolt closure ring of each container was torqued to 60 ft/lbs. and lowered into the containment cavity and the loose sand placed onto the top of the drum within the containment cavity. The 1/8" thick silicone coated fiberglass gasket and 3/16" thick containment flange were placed into position and the bolts inserted and hand tightened. The flange bolts were then tightened using an alternating method and torqued to 40 ft/lbs. The top gasket and outer closure, which includes the attached encased polyurethane foam insulation top plug, was installed on each of the test articles and the top outer bolts installed and torqued using the same alternating method to a tension of 40 ft/lbs. The outer drum closure rings were then installed and tightened to a torque of 60 ft/lbs.

30 Gallon Drum Loaded With 260 Pounds of Loose Gravel

1-1/2 Pounds of Sand on Top of Containment Payload

Bolted Inner Blind Flange and Top Gasket

Side View – 110 Gallon Acetate Plug

9.4 Test Article Conditioning

The test articles were placed into the conditioning chamber to achieve the targeted test temperature of -40°F, on the exterior skin of the shipping container test articles. To measure the temperature a calibrated surface thermometer was placed on the surface of the test articles and the side walls of the conditioning chamber and temperatures recorded upon removal of the packages from the chamber for transport to the drop test site. Conditioning was conducted for a period of 16 hours, starting on February 24 at 4:00 PM. At time of transport to the test site test article temperatures were -28°F.

Test Articles in Cooling Chamber

110 Gallon upon Removal from Cooling Chamber

10.0 DROP TEST SEQUENCES

The drop test sequences were chosen based upon engineering calculations, historical drop testing and prototype testing conducted on both the 55 gallon and 110 gallon versions. The original prototype testing results are included in Attachment D. All three test articles were produced in accordance with the fabrication drawings and QA-8, plan for the Manufacture of Versa-Pac Shipping Containers. The test articles were tested in accordance with Century Industries Test Plan TP-001 Revision 0. The original series of drops describe below were conducted on February 25, 2009 and recorded on Century Industries NCT and HAC Test Records for each package.

11.0 TEST PACAKGE SERIAL NUMBER 10552 – TEST RECORD TS-001-1

11.1 Test Number 1A – NCT - 4' Top End Drop

The drop test performance evaluation describe in the Test Plan TP-0001 Revision 0 was performed with the undamaged Versa-Pac Shipping Container. Test Configuration 1A was a 4' free drop vertically onto the top end of the test article at an angle of 0 degrees. The air temperature at the start of this series was 45°F and wind speed was 4 mph. The test article was suspended from a crane by use of a sling connected to the clip that was welded to the center of the bottom of the package and attached to a release mechanism. It was lifted above the test pad in a vertical orientation so that the lowest point of the package was at 4 feet above the top surface of the test pad. The test article was released so that it did not impart rotational motion into the package free fall to the test pad. The container impact on to the test pad surface and produced no noticeable damage to the top of the test article. Both height and diameter were unaffected by the drop. Measurements and photographs were taken showing the extent of the damage.

Top End Drop – 4' Height

Damage from NCT 4' Drop

There were no tears or openings to the drum surface. All bolts remained in tact.

11.2 Test Number 1B – HAC 30' Top End Drop

Configuration 1B was a free drop onto the top end of the previously used test article from test number 1A from a height of 30 feet-1 inch. It was positioned vertically onto the top end of the test article at an angle of 0 degrees. The air temperature at the start of this series was 45°F and wind speed was 4 mph. The test article was suspended from a crane by use of a sling connected to the clip that was welded to the center of the bottom of the package and attached to a release mechanism. It was lifted above the test pad in a vertical orientation so that the lowest point of the package was at 30 feet-2 inch above the top surface of the test pad. The test article was released so that it did not impart rotational motion into the package free fall to the test pad. Measurements and photographs were taken showing the extent of damage.

Top End 30' HAC Drop in Position

Free Fall of HAC 30' Top End Drop

Upon impact to the top end of the package the overall height was reduced by 1/4" inch and the diameter was increased by 1/16 inch. The closure ring and all bolts remained in tact and secure.

Side View – Top End Drop Damage

Close-up – Damage to Closure End

11.3 Test Number 1C – HAC 1 Meter Puncture Drop – Horizontal

Configuration 1C was a puncture drop from a height of 41 inches form the lowest point of the package side to the top of the puncture ram, on the side of the test article at a location directly between two of the vertical stiffeners. The package was positioned level and horizontal (1 degree). This location was chosen to validate that upon impact with the puncture ram that the side wall material of the outer surfaces would not tear and create an opening to the internal components of the package.

Horizontal Side – Puncture Drop

Positioned over the Puncture Ram

Horizontal Puncture Impact onto Ram

Upon impact a deformation in the side of the test article was measured at a depth of 3/8 inch. There were no tears as a result of the puncture drop. The results were recorded and photographed.

Close-up Damage from Puncture Between the Vertical Stiffeners

Side View – Horizontal Puncture Damage

11.4 Results and Conclusions

As a result of this test series the outer closure bolts recorded a post test torque of 30 ft/lbs. The outer lid was removed exposing a bulge in the inner containment flange. The bulge allowed sand which was placed on the top of the inner containment payload 30 gallon drum to be forced under the containment gasket. The bulge was caused by the impact of the inner payload and the secondary piston impact of the internal payload within the drum itself. Containment flange bolts were torqued prior to removal and recorded at 20 ft/lbs. The gaskets and the internal cavity of the containment were found to be in good condition with no damage. The conclusion of this test series is that corrections were needed to the blind flange seal and closure and that additional testing would be required.

Internal Blind Flange Bulge

Post Test View - Payload

12.0 TEST PACKAGE SERIAL NUMBER 10551 – TEST RECORD TS-001-2

12.1 Test Number 2A – NCT Horizontal Side Drop

After cooling, test configuration 2A was positioned in a level and horizontal orientation of 0 degrees over the test pad at a height of 48 inches from the lowest point of the test article to the surface of the pad. The package was positioned with the use of nylon straps and attached to the release mechanism. The air temperature was 47.5°F with a wind speed of 4 mph. All measurements were previously recorded. The package was released so as not to impart any rotational motion to the test article free fall to the test pad.

Pre-Test Side View 110 Gallon Version

NCT- Horizontal Side Drop – 4' Height

The resultant impact to the exterior surface allowed the bolted closure ring to push into the side wall approximately 5/8 inch deep. There was no reduction in the diameter or height of the package. No bolts were broken and there were no tears or broken welds. Damage was documented and photographed.

Post-Test – End View of Damage

12.2 Test Number 2B – HAC 30' Horizontal Side Drop

The same package was positioned for test configuration 2B for the HAC 30 foot horizontal side drop onto the same surface as the normal conditions drop. This was done in an effort to accumulated damage in this drop orientation. The air temperature was 48°F with a wind speed of 4 mph. The package was lifted to a height of 30 feet–1 inch with the angle of orientation at 0 degrees. The package was release so as not to impart any rotation motion to the test article freefall to the test pad.

The damage from this drop produced a buckle around the closure bolt area and on the lid, along with a decrease in the diameter of 1 inch in the direction of impact through the bolt. There was no loss of bolts or closure and all welds remained in tact. The damage was recorded and photographed.

Post-Test HAC 30' Drop
End View of Damage

Close-Up HAC 30' Horizontal Side Drop
Damage

Side View – Top End Closure Ring Bolt
30' HAC Horizontal Drop Damage

12.3 Test Number 2C – HAC 30’ Crush Plate Side Drop

Test configuration 2C was conducted using the same test article used in test number 2B above. The air temperature was recorded at 49°F and the wind speed was 4 mph. The test package was placed in the horizontal position on the test pad with the crush test plate suspended at an angle of 0 degrees from horizontal directly over the package so as to impact the test article directly on both the closure and top flange areas and also the bottom edge of the package. The package was lifted to a height of 30 feet-1 inch from the lowest point of the crush plate to the top of the horizontally placed test package. It was suspended and attached to the release mechanism by nylon straps. The crush plate was released so as not to impart any rotational motion to the crush plate free fall to the impact point with the test article.

HAC 30’ Crush Plate Positioning

Crush Plate at 30’ Height

Crush Plate Impact

Upon impact the overall diameter of the package in the direction of the impact was reduced by a total of 2-1/2" from the original diameter at its maximum point. A gap of ¼ inch by 1-1/4 inch long was documented at the drum to lid interface. However due to the design of the Versa-Pac closure lid the metal to metal interface between the top flange and the encased insulation was visible with no direct opening to the internal structure or seals of the package. The results were recorded and photographed.

Post Test – Top Closure Lid Intact

End View – Sheared Drum Ring Top Closure In Place and Secure

Bottom End Impact Damage

Bottom End View – 30' Crush Plate Damage

End View Bottom End Damage

Close-up Top End Damage ¼" x 1-1/14" Gap – Metal to Metal Seal No Opening

Top End Damage - Post Test View

Post Test – Side View Damage

12.4 Results and Conclusions

As result of this series of testing the outer closure bolts were torqued prior to removal and found to be at a reading of 25 ft/lbs. Upon removal of the outer closure lid a slight deformation of the inner wall was noted. There was no loss of containment contents found within the inner well area. The inner containment blind flange remained in good condition and sealed. The interior bolts were torqued with readings at 25 ft/lbs. The gaskets were intact with minimal damage. The payload drum did exhibit some crumpling at the lid but all of the payload materials remained within the drum and payload cavity as required. The inner cavity upon inspection showed no visible damage. The results of this series proved to be acceptable.

Post Test – No Loss of Payload Contents

Top Closure Lid – Post Test

Side Wall Deformation View

Post Test View of Containment Cavity

13.0 TEST PACKAGE SERIAL NUMBER 10550 – TEST RECORD TS-001-3

13.1 Test Number 3A – NCT Center of Gravity Drop

In test configuration 3A the test article was cooled and positioned with the center of gravity impact to be through the package bolted closure ring over the test pad at angle of 57 degrees from horizontal. The height of the drop was 4 feet from the lowest point of the package to the test pad surface. The air temperature at the time of the drop was 53°F and the wind speed was 5 mph. The package was attached to the release device and lifted by use of nylon straps to the proper orientation. The package was release so as not to impart any rotational motion to the free fall to the test pad.

Center of gravity 57° - NCT 4' Drop

Pre-Drop NCT 4' Height

The impact resulted in a deformation on the drum side at the closure bolt measuring 1-1/16 inch deep by 2 inches long. The diameter of the test article was decreased by 1/8 inch. All welds, bolts and closures remained in tact with no tearing of the outer structural components.

Post Drop Damage to Top Closure

Side View Center of Gravity NCT Damage

13.2 Test Number 3B – HAC 30' Center of Gravity Top Closure Drop

The test article used in test configuration 3B was previously used in 3A above and was positioned with the center of gravity through the bolted connection at an angle of 56 degrees from horizontal. The package was raised to the drop height of 30 feet-1 inch above the test pad surface from the lowest point of the package. The air temperature was 54.5°F with a wind speed of 5 mph.

HAC 30' Center of Gravity 57° Position

HAC 30' Impact

The impact resulted in a depression 11/16 inch deep into the lid and caused additional side deformation totaling 2-1/2 inches deep by 20 inches long. All welds, bolts and closures remained intact.

Accumulated Damage – Top Closure

Close-up Post Test Photograph

Close-up Damage from Center of Gravity Drop onto Top Closure Ring

Side View – Top End

13.3 Test Number 3C – HAC Shallow Angle Accelerated Drop (Slap Test)

Using the same test article that was utilized in 3B an oblique (Shallow Angle) drop from a height of 30 feet-1 inch and an angle of 17 degrees from horizontal was positioned over the test pad using nylon strap attached to the release mechanism. The height was measured from the lowest point of the package to the test pad surface.

Shallow Angle Accelerated Drop Set-up

17° Angle of HAC Shallow Angle Drop

Shallow Angle Drop Impact

The damage to the exterior package surface produced a tear at the exterior drum side to bottom rim connection point measuring 3/16 inch at its widest point by 7 inches in length. Although this slit to the outer drum sheet meet metal occurred, no internal breach of the inner liner occurred and the package remained completely sealed from the exterior atmosphere due to the design of the Vera-Pac with its inner liner directly in contact with the outer drum surface. Additional deformation at the bolted closure ring affected an area measuring 2-15/16 inches deep with a 1 inch crumple in the lid closure. The diameter of the package was reduced in the direction of the impact through the bolt by approximately 3 inches. The test article bolts and seals remained in place. Measurements of the damage were recorded and photographed.

Top End Damage from Shallow Angle Drop

Close-up View Impact Damage

Impact Side – Initial Impact Point View

Long Side View of Damage

Bolted top Closure & Ring Post Test Damage View

Bottom Slit at Drum Rim Showing Inner Metal Re-enforcing Sheet In Place with No Openings

13.4 Test Number 3D – HAC 1 Meter Puncture Drop – Center of Gravity Over Bolted Closure

The test article chosen for test configuration 3D was previously used in the test series above due to the accumulated damage to the exterior surface of the package. Based upon this damage the most detrimental orientation was chosen to be through the center of gravity at the bolted closure ring connection. The package was suspended by use of nylon straps which were attached to the release mechanism at a height of 41 inches measured from the lowest point of the package to the top of the puncture ram. The angle of orientation was 56 degrees from the horizontal position. The air temperature was 56°F and the wind speed was 5 mph. The test package was released so as not to impart rotation motion to the test article free fall to the impact point of the puncture ram.

56° Angle for Center of Gravity HAC Puncture Drop

HAC 1 Meter Center of Gravity Puncture Drop Height Position

Free Fall of Center of Gravity Puncture Drop

The impact upon the puncture ram produced additional damage to the side of the drum at the closure bolt with a small opening of ¼ inch by 3 inches long at the drum closure lid and drum rim interface. The opening was again sealed by a metal to metal contact between the flange and the drum lid insulation sheet metal cover and the top flange gasket which remained in tact. All welds, bolts and closures remained in place.

Impact Damage from Puncture Drop

Close-up View of ¼" Wide x 3" Long Gap – Sealed by Metal to Metal Contact and Top Flange Gasket

13.5 Results and Conclusions

As a result of this series of testing the outer closure bolts recorded a torque at less than 20 ft/lbs. Upon removal of the outer closure lid a bulge in the containment blind flange was discovered with some sand from within the containment cavity found. A deformation at the impact point to the inner wall was also recorded. The bolts of the inner containment flange were torqued with a reading of less than 20 ft/lbs recorded. Once the flange and payload had been removed inspection of the inner containment cavity found no visible damage. The inner gaskets were in good condition with only minimal damage to the outer closure gasket.

Damage from Series Testing Drop Total

Bulge in Containment Blind Flange Showing Loose Sand from Containment Cavity

Side Wall Damage and Bulge of Containment Flange

Post Test View of Top Closure Lid

Top View Containment Payload – Post-Test

The conclusion of this test series is that again corrections were needed to the blind flange seal and closure and that additional testing would be required.

14.0 CORRECTIONS AND ADDITIONAL TESTING

Based upon the information obtained from the series of drops conducted it was determined that due to the unsatisfactory results upon post test inspection that corrections to the internal blind flange closure were required prior to an additional testing. It is believed that the piston action from within the inner payload cavity was the primary cause of the damage to the containment closure. The damage to the flange led to the conclusion that the blind flange thickness of 3/16 inch was insufficient for the force that occurred during the test series and that an increase to ½ inch thick and the reinstallation of the inside flange pad would provide an acceptable condition after the follow up testing was complete. In addition it was decided that the bolt torque for all bolts on the Versa-Pac Shipping Container would 60 ft/lbs to provide a better sealing of the silicone coated fiberglass inner gasket and provide a much higher strength to support the impact of the piston action within the payload area.

After evaluation, two of the previously utilized test articles were found to be in good condition and were able to be resealed for use in the follow up test series. The payloads were identical to the original test series with 1-1/2 pounds of loose sand being placed on top of and around the inner payload as before. The test articles were fitted with new ½ inch thick inner blind flanges with 3/8 inch thick neoprene sponge rubber pads affixed to the inside of the inner flange prior to installation. The torque of inner containment blind flange was increased to 60 ft/lbs. The outer closure lid bolts were also torqued at 60 ft/lbs.

On review of the previous testing which produced unsatisfactory results it was determined that the testing should duplicate those tests. The test articles were then placed into the cooling chamber for a period of 18 hours prior to the new drop tests.

These tests were intended to validate that the corrections made to the design of the inner containment flange would prove to correct the loss of materials and damage to the flange previously found during the original drop testing.

15.0 RE-TEST PACKAGE SERIAL NUMBER 10551 – TEST RECORD TS-001-4

Containment Cavity with Payload With Loose Sand on top of Payload

Inner Containment Blind Flange

Pre-Test – Top Closure of Sealed Test Article

15.1 Re-Test Number 1A – NCT - 4' Top End Drop

On March 05, 2009 the package was removed from the cooling chamber and was transported to the test area. It was positioned with the top end of the package over the test target at an angle of 0 degrees so that the impact of the container would be directly onto the top surface of the package. The height of the test article from the lowest point to the surface of the test target was 4 feet. The air temperature was 58.5 degrees and wind speed of 5 mph. The package was release so that no rotational motion was imparted during the free fall to test pad surface. New package tare weight was increased by 43 ponds with the additional thickness of the inner flange.

Pre-Drop Top End Side View

NCT 4' Top End Drop Position

As a result of the impact no visible damage was found on the exterior surface of the package. All welds, closures and bolts remained intact. The results were recorded and photographed.

Post-Test Top End Drop Damage

15.2 Re-Test Number 1B – HAC 30' Top End Drop

After the NCT test above the package was positioned for test configuration 1B the HAC 30' drop onto the same surface and orientation of 0 degrees. The air temperature was 58.5°F and the wind speed was 5 mph.

Pre-Drop HAC 30' Top End Drop **30' Height Position Top End Drop**

Post test inspection of the outer surface found that the overall height had been reduced by 7/16 inch and that three of the top bolts had been impacted, but all bolts remained in place and sealed. There was no damage to any welds and no tears were found during the inspection.

Post Test View of Damage
Total Package Drops – 2 NCT,
3-HAC 30' Drop, 1-wCrush Plate Drop

15.3 Results and Conclusions

Prior to opening of the test package the outer bolts were torqued and readings were found to be between 20 and 80 ft/lbs. with all bolts intact. After opening the test article photographs were taken and the interior well surfaces inspected with no damage found. The new thicker blind flange remained flat, sealed and no loss of the payload contents were found outside the containment cavity. The bolts of the inner blind flange were torqued and found to have readings of between 30 to 50 ft/lbs. The gaskets and payload cavity were in good condition. All post test damage was recorded and photographed.

The conclusion of this series is that the design changes of increasing the flange thickness, increasing the torque requirement and the reinstallation of the flange inside pad were found to be successful.

½" Thick Inner Blind Flange Post Test Flat & No Loss of Payload Contents

Payload and Lose Sand Remained within the Containment Cavity

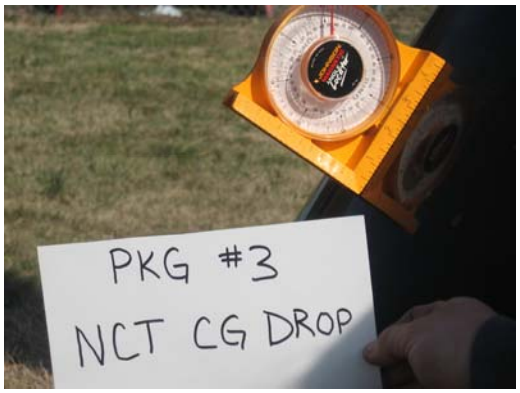
16.0 RE-TEST PACKAGE SERIAL NUMBER 10551 – TEST RECORD TS-001-5

16.1 Re-Test Number 3A – NCT Center of Gravity Drop

Top View of ½" Thick Blind Flange

Pre-Test Top View of Sealed Test Article

After cooling, the test article was positioned with the orientation at 57 degrees from horizontal over the test surface target so that the impact would be through the bolted closure of the package and through the center of gravity. The normal conditions drop was made from a height of 4 feet from the lowest point of the package to the test pad surface. The package was positioned using nylon straps attached to the release mechanism. The package was release so as not to impart any rotational motion during the free fall to the test pad. The temperature was 67.5°F with wind speed of 5 mph.



57° Angle NCT Center of Gravity

Positioned NCT 4' Height Center of Gravity Drop – Pre-Test View

NCT 4' Center of Gravity Impact

The impact resulted in a deformation on the closure bolt area with measurements of 1-3/16 inch deep by 2-1/4 inches long. All welds, bolts and closures remained intact. Damage was recorded and photographed.

NCT Post Test Damage View

16.2 Re-Test Number 3B – HAC 30' Center of Gravity Drop

Test configuration 3B was repositioned in the same attitude of 57 degrees so as to impact the identical area previously tested in test number 3A. The test article was raised to a height of 30 feet from the lowest point of the package to the surface of the test pad using nylon straps attached to the release mechanism.

HAC Center of Gravity Drop Positioned at 57° Angle

30’ Height Drop Position

HAC 30’ Impact Thru the Center of Gravity

As a result of the impact a deformation on the closure bolt area totaling 2-9/16 inches deep by 20-1/2 inches long was recorded. The diameter of the package was reduced by 5/16 inch. All welds, bolts and closures remain in place. There were no tears or openings found on the package.

Side View – Impact Damage from 30' Center of Gravity Drop

Top View of Damage

16.3 Re-Test Number 3C – HAC Shallow Angle Accelerated Drop (Slap Test)

Using the same test package, an oblique (Shallow angle) drop was positioned over the test pad at an angle of 17 degrees from horizontal with the height of the lowest point of the package 30 feet from the top surface of the test pad target. It was positioned using nylon straps attached to the release device. The package was released so as not to impart any rotational motion during the free fall to the test pad target.

HAC 30' Shallow Angle 17° Drop Position

30' Shallow Angle Drop Position

The damage to the exterior surface produced deformation on the initial top closure, measuring 2-5/16 inches deep with a 1 inch crumple of the outer closure lid. The secondary impact produced damage measuring – on the bottom rim of the test article. The diameter of the package in the direction of the impact was reduced by approximately 1 inch. There was no damage to any bolts, welds or closures and there were no tears found on inspection of the package.

End View of Top Damage from Initial Impact of Shallow Angle Drop

Close-Up of Damage to Impact Point

16.4 Results and Conclusions

Before opening the outer closure the torque was measure and found to be less than 20 ft/lbs. Photographs were taken and an inspection of the inner well area found only minor deformation to the sidewalls no other damage was found. The inner flange was flat and sealed with no loss of materials form within the inner containment cavity. Bolt torque of the inner flange recorded arrange of torque from 20 to 40 ft/lbs.

The conclusion of this series is that again, the design changes of increasing the flange thickness, increasing the torque requirement and the reinstallation of the flange inside pad were found to provide acceptable results.

Post Series Side View–Package Drop Total 2- NCT Drops, 3-HAC 30' Drops & 1-Puncture Drop

½" Thick Inner Blind Flange Post Test Flat & No Loss of Payload Contents

Payload and Lose Sand Remained within the Containment Cavity

17.0 POST TEST MEASEUREMENTS

On March 05, 2009, the post test inspection and measurements were taken and recorded on all test articles.

Test Article Serial Number 10550

Location	Post-Test Measurement	Description
A-C	21-1/16” ID	Inner Container
A-C	31-1/6” Ø	Outer Container
A	42”	Drum Height
A	5”	Wall – In/Our
A	29-11/16”	Inside Height
A	7-7/16”	Top Rim – Inside Flange
B	42”	Drum Height
B	7-5/16”	Top Rim – Inside Flange
B	5”	Wall – In/Out
B-D	20-7/8” ID	Inner Container
B-D	30-15/16”Ø	Outer Container
C	29-11/16”	Inside Height
C	5-1/4”	Wall – In/Out
C	42”	Drum Height
C	7-3/16”	Top Rim – Inside Flange
D	29-11/16”	Inside Height
D	42”	Outer Container
D	7-1/4”	Top Rim – Inside Flange
D	5-9/16”	Wall – In/Out

Final Tare Weight – 660 Pounds
Final Gross Weight – 920 Pounds

Test Article Serial Number 10551

Location	Post-Test Measurement	Description
A-C	20-7/8" ID	Inner Container
A-C	31-1/16" Ø	Outer Container
A	41-15/16"	Drum Height
A	5-1/16"	Wall – In/Our
A	29-3/4"	Inside Height
A	7-3/8"	Top Rim – Inside Flange
B	41-7/8"	Drum Height
B	7-3/16"	Top Rim – Inside Flange
B	5-1/8"	Wall – In/Out
B-D	20-7/8" ID	Inner Container
B-D	31-1/8"Ø	Outer Container
C	29-3/4"	Inside Height
C	5-3/16"	Wall – In/Out
C	42-3/16"	Drum Height
C	7-3/16"	Top Rim – Inside Flange
D	29-3/4"	Inside Height
D	42-1/16"	Outer Container
D	7-1/4"	Top Rim – Inside Flange
D	5-1/16"	Wall – In/Out

Final Tare Weight – 704 Pounds Final Gross Weight 964 Pounds

Test Article Serial Number 10552

Location	Post-Test Measurement	Description
A-C	20-15/16" ID	Inner Container
A-C	29-7/8" Ø	Outer Container
A	41-11/16"	Drum Height
A	5-1/4"	Wall – In/Our
A	29-5/8"	Inside Height
A	6-13/16"	Top Rim – Inside Flange
B	41-5/8"	Drum Height
B	6-7/8"	Top Rim – Inside Flange
B	5-5/16"	Wall – In/Out
B-D	20-15/16" ID	Inner Container
B-D	30-11/16"Ø	Outer Container
C	29-11/16"	Inside Height
C	5-1/16"	Wall – In/Out
C	41-11/16"	Drum Height
C	6-7/8"	Top Rim – Inside Flange
D	29-5/8"	Inside Height
D	41-7/8"	Outer Container
D	6-3/4"	Top Rim – Inside Flange
D	5"	Wall – In/Out

Final Tare Weight - 705 Pounds Final Gross Weight – 965 Pounds

18.0 FINAL CONCLUSION OF ALL TEST RESULTS

The objective of this test program was to conduct the physical evaluation test of Century Industries Versa-Pac Shipping Container design in accordance with the Normal Conditions of Transport (NCT) and the Hypothetical Accident Conditions (HAC) specified in 10 CFR 71 and Century Industries Test Plan TP-001 Revision 0 to verify the performance capabilities under specified conditions. The Versa-Pac was subjected to performance test simulating hypothetical accident condition for free drop, crush, shallow angle and puncture described in 10 CFR 71.71 and 73. Following each test, the physical condition of the test package was inspected and the results were recorded and photographed.

The acceptance criteria for the all test series was retention of the outer closure, no openings, tears or failure that would lead to loss of material, no open pathways to the insulation materials and no loss of the inner containment payload.

The test series results provided information that the internal blind flange of the containment cavity allowed payload contents to escape into the outer well of the package during two of the initial three test series.

To correct this condition it was determined that a increase in the thickness of the blind flange, addition of a neoprene sponge rubber pad affixed to the inside of the flange and an increase in the torque requirement would be needed. With completion of these changes two previously utilized test articles were refitted with the changes and subjected to the identical test series which caused the unacceptable results.

Following the re-test of these packages, when subjected to the original test series requirements, the post test inspection found that the acceptance criteria had been successfully met.

There was no shift in the payload cavity, no contents outside the containment cavity and no unacceptable damage to the inner or outer surfaces of the Versa-Pac Shipping Container. Additionally, the results of these physical performance evaluation tests demonstrate that the package system is capable of meeting the requirements of 10 CFR 71 and Century Industries Test Plan TP-0001 Revision 0.

19.0 TEST DROP TOTALS

Three Versa-Pac Shipping Containers were subjected to a total of 5 test series during the test program described above, along with the preliminary testing as follows in the table below:

Item	55 Gallon – Preliminary Prototype	110 Gallon Preliminary Prototype	110 Gallon Test Article
4’ NCT Drops	1	1	5
30’ HAC Drops	1	1	5
30’ Shallow Angle	N/A	N/A	2
30’ Crush Plate	1	1	1
1 Meter Puncture	3	4	2

20.0 ATTACHMENTS, REFENECES & CALIBRATION RECORDS

Attachment A – Test Plan TP-001 Revision 0
Attachment B – Test Specification TS-001-1 Revision 0
Attachment C – Century Industries NCT and HAC Test Record
Attachment D – Preliminary Drop Test Results & Conclusions
Attachment E – Training & Calibration Records
Reference 1 – 10 CFR Part 71
Reference 2 – NUREG 6818

Attachment A

Test Plan TP-001 Revision 0

(Consisting of 28 pages)

Century Industries
Bristol, Virginia 24209

Versa-Pac Shipping Container
Test Plan
TP-001 Revision 0

US NRC Docket No. 71-9342

Prepared By:
Century Industries
William M. Arnold

Prepared By: _William M. Arnold – Signature of File_ Date: January 20, 2009

Reviewed By: _Heather Little – Signature on File Date: _January 20, 2009

Proprietary Information Notice

Record of Revision

Revision No.	Description of Revision	Date
0	Original Issue	01-20-09

Table of Contents

1.0 INTRODUCTION

Century Industries Versa-Pac Shipping Container is designed for the shipment of Type A radioactive and fissile materials in the form of U-metal oxides, fluorides and nitrates for both product and scrap materials. The fissile payload was design for 350 grams at 100% enrichment and a criticality safety index of 1.5.

The Versa-Pac Shipping Container was designed in two basic versions, a UN1A2 - 55 gallon and 110 gallon outer drum with a 16 gauge body, bottom and cover, in addition to the standard 12 gauge closure ring with a 5/8" ASTM A307 bolt, the cover is reinforced and secured using the addition of bolts attached to the internal structure of the package as detailed in the design drawings. The internal structure consists of vertical and horizontal stiffeners at specified points around the package. Outer and inner 16 gauge liners, with an inner insulating ceramic fiber blanket between the liners complete the primary inner structural components. A secondary barrier of insulation consisting of ceramic fiber blankets; surround the inner containment body. The payload gasket is a woven fiberglass yarn in a flexible substrate, coated with a high grade silicone rubber. The gasketed payload containment cavity is made of 10 gauge body and bottom with a ¼" thick top flange to which a 3/16" top cover is secured using 12 – ½" bolts. The payload cavity is attached to the internal structural components by use of a bolted connection through a fiberglass thermal break between the payload cavity and the structure. Closed Cell Polyurethane foam is utilized to provide insulation and added impact protection, to both the top and bottom of the Vera-Pac. Plastic plugs enclosed within the body of the structure provide a path for venting to external acetate vent plug on the exterior of the drum. The cavity is designed to be loaded directly or with the use of an insert to reduce the inside diameter or with up to a 30 gallon drum.

It was designed in accordance the requirements of 10 CFR Part 71 [1]] and Century Industries – QA-8 Plan for Manufacture of Versa-Pac Shipping Containers [2].

Preliminary testing conducted on both 55 and 110 gallon version prototype containers provided essential information about the reactions of both versions when subjected to initial HAC drop test requirements. Drop tests on both versions included 30' drops on the top corner thru the center of gravity, a 30' drop onto the bottom corner thru the center of gravity producing no unexpected damage results in both versions. Also conducted were 30' crush plate drop onto the sides of both packages at the bolted top connections, the 55 gallon version produced the egg-shape impact results expected with no opening at the impact area, while the 110 gallon proved to need additional stiffeners and bolt connections at spacing similar to the 55 gallon version to avoid a gap located at the lid closure interface. This correction has been incorporated into the 110 gallon version by reducing the spacing of the top lid bolt closures to be more in line with the 55 gallon version. A series of puncture test drops were made on both the 55 and 110 gallon version. Both were subjected to puncture drops in the center of the top and bottom with only minor indentations of ¼" to 3/8" deep on the bottom and ¾" deep in the center top of the containers. The containers were also dropped on the side near one of the vertical stiffeners producing indentations of 5/16" on the 110 gallon and ¾" in the 55 gallon version. An additional puncture test was conducted thru the center of gravity onto the bolt

closure ring in the same area that a 30' drop was previously conducted with no additional damage noted. Both inner containers remained sealed with no loss of contents. These packages were loaded at weights of 231 lbs. loaded directly into the 55 gallon and 266.5 lbs loaded in an inner 30 gallon drum, placed into the containment area of the 110 gallon package respectfully.

2.0 SCOPE AND OBJECTIVE

2.1 Scope

This test plan describes the methods, guidelines and requirements that are to be utilized during the performance of the task described in this procedure.

2.2 Objective

The objective of this test plan is to provide the requirements for a series if physical test to demonstrate the performance capabilities of the Versa-Pac Shipping Container in satisfying the requirements of 10 CFR 71 [1], Century Industries – Test Specification TS-0001 [3] and this test plan for both normal and hypothetical accident conditions of transport.

The primary objectives of this test plan are as follows:

1. Define the responsibilities of the personnel performing the drop test series.
2. Define the general requirements
3. Define the test sequences that will be performed.
4. Define the required configurations for each test.
5. Define the required pre-test and post test measurements.
6. Define the data acquisition requirements for each test.
7. Define the documentation requirements.

3.0 RESPONSIBILITIES

Century Industries has the overall responsibility for the test program and is responsible for the design and analysis of the test articles, development of the test specification, the test plan and oversight of the Versa-Pac test series. Century Industries is also responsible for the procurement, fabrication and inspection of the test articles. The test series will be performed in accordance with the applicable requirements of Century Industries QA Program QA-1 [4], Test Specification TS-001 [3] and this test plan.

Individual responsibilities include the following:

1. Test Program Manager: This individual is responsible for the overall management and implementation of the test program. The Test Manager has the authority to resolve any question that may arise between members of the team.

2. Test Engineer: This individual is responsible for preparation of the equipment and facilities required to conduct the testing. They are also responsible for the both the pre-test and post test measurements and documentation.

3. Quality Assurance: This individual; is responsible for the QA oversight and witness of the test series

4.0 TEST SEQUENCES

Based upon preliminary prototype testing of both the 55 and 110 gallon versions, testing indicated that the 110 gallon version will bound the 55 gallon Versa-Pac version. Three prototypes are planned for fabrication for the test series. All test articles will be tested using a 30 gallon drum containing 250 pounds of the test media, placed within the inner package cavity, a residual amount of sand will be placed into the inner cavity so that some material will face the possibility of release from within the inner cavity to the external surface of the package between the inner and outer closures. The inner drum is being utilized to simulate a piston action within the inner containment cavity of the test articles.

Three separate test series are planned, as shown in Table 1 below to verify satisfactory compliance with 10 CFR 71 [1] and this plan:

4.1 Test Series No. 1 – Flat Top Drop Orientation

This series will include an NCT free drop, one HAC free drop and one puncture drop. During this test surfaces are to be examined and measured and the damage recorded between drops.

4.2 Test Series No. 2 – Flat Side Drop Orientation

This series will include an NCT free drop, one HAC free drop and one HAC crush plate drop. During this test surfaces are to be examined and measured and the damage recorded between drops.

4.3 Test Series No. 3 – Center of Gravity Over Top Corner

This series will include an NCT free drop, one HAC free drop and one HAC shallow angle drop. During this test surfaces are to be examined and measured and the damage recorded between drops.

Note: A Puncture Test will be conducted on one of the test packages based upon initial drop damage.

Table 1 –Planned Test Sequences

Package Number	Test Number	Test Description	Test Objective
1	1A	NCT 4' Top End Drop	Test Top Closure
	1B	HAC 30' Top End Drop	Test Top Closure
	1C	HAC 1Meter Flat Side Puncture Drop	Test Side Wall Between Vertical Stiffeners
2	2A	NCT 4' Horizontal Side Drop	Evaluate Side Deformation
	2B	HAC 30' Horizontal Side Drop	Evaluate the Side Deformation and Closure From Impact
	2C	HAC 30' Crush Plate Drop	Evaluate the Side Deformation From Crush
3	3A	NCT 4' Center of Gravity Drop	Test the Top Closure
	3B	HAC 30' Center of Gravity Drop	Evaluate the Damage From a C.G. Closure Drop
	3C	HAC 30' Shallow Angle Accelerated Drop	Evaluate the Damage From an Accelerated Shallow Angle Drop
To Be Determined	4A	HAC 1 Meter Puncture Drop	Evaluate & Attack a Vulnerable Area

Notes:

1. All NCT Drops are from a height of 4' feet, HAC drops are from a height of 30 feet and all puncture drops are from a height of 40 inches. Distance measured from the lowest point of the package to the test pad surface.
2. All tests are conducted from a test article starting cooling chamber temperature of -40°F.

5.0 TEST SERIES REQUIREMENTS

5.1 General Requirements

5.1.1 Quality Assurance

All testing shall be witnessed using the Quality Assurance oversight as required in the test specification.

5.1.2 Rigging

Rigging methods shall be chosen such that the test article is lifted in the correct inclination and orientation as necessary. Rigging locations shall be positioned so as not to interfere or affect the performance or response of the Versa-Pac during the test series.

5.1.3 Measuring and Equipment

The guidelines for measurement and test equipment are described in the Test Specification TS-001 []. All items that require calibration shall be conducted against a certified known that are referenced to the National Institute of Standards and Technology (NIST), for scales the applicable state standards and bureaus are acceptable. Where such standards do not exist, the basis for the calibration shall be documented.

Height measurements may be established using either; a pre-measured line and plumb bob attached to the lowest point of the test article, a properly calibrated laser or other means that are verifiable.

5.1.4 Test Media

The test media may consist of the proper combination of either lead, gravel, sand, steel shot and/or clean soil needed to obtain the appropriate payload test weight. The test weight of each test article must be within +5/-0 pounds of the required test weight of 250 pounds.

5.1.5 Environmental

The requirements for environmental controls are described in the Test Specification TS-001 [3] and shall be recorded as required by each individual test sequence.

5.1.6 Electronic Recording Documentation

All aspects of the test series shall be recorded as required in the test plan using equipment as specified within the Test Specification TS-001 [3].

6.0 TEST PACAKAGE NO. 1

6.1 Test Number 1A – NCT Top End Drop

6.1.1 Test Configuration

Test 1A is a free drop onto the top end of an undamaged test article from a height of 1.2 meters (4 Feet) as shown in Figure 1. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a vertical orientation so that the lowest point of the package is at 1.2 meters (4 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

6.1.2 Pre-test Requirements & Measurements

Prior to performing Test Number 1A, the following pre-test activities are to be complete:

- Measure and record the test article temperature upon removal from the conditioning room.
- Record the test article serial number.
- Measure the centerline and the near side distance to the edge of the cavity, prior to closure of the inner containment cavity. All measurement locations should be marked on the package.
- Take photographs of the interior and exterior of the package to provide visual evidence of the pre-test condition.
- Weigh and record the empty test article.
- Load the pre-loaded 30 gallon inner drum into the test article inner containment cavity.
- Spread one (1) pound of residual sand/dirt into the inner containment cavity.
- Verify that components used for the inner containment cavity are in good condition and are the proper components per the drawings.
- Install the containment cavity gasket and blind flange. Snug all lid bolts prior to applying the required torque of 40 ft. lbs. in an alternating torque rotation.
- Install the outer gasket and reinforced drum lid using the appropriate bolts as required by the drawing, applying torque of 40 ft. lbs to the closure bolts in the proper alternating manner.
- Install outer drum ring and torque to 60 ft. lbs. and install security seal.
- Weigh and record the loaded test article.
- Upon closure, measure the height, from the bottom rim to the top of the closure ring and diameter of the outer package at the center rolling hoop of the drum. All measurement locations should be marked on the package.
- Verify that the external acetate vent plug is in place.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.

- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

6.1.3 Post-Test Requirements

Following the NCT top end drop (Test Number 1A), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any apparent damage.
- Document any apparent damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

6.2 Test Number 1B – HAC - 30' Top End Drop

6.2.1 Test Configuration

Test 1B is a free drop onto the top end of the damaged test article used in Test Number 1A from a height of 9 meters (30 feet) as shown in Figure 1. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a vertical orientation so that the lowest point of the package is at 9 meters (30 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

6.2.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.

- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

6.2.3 Post-Test Requirements

Following the HAC top end drop (Test Number 1B), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

6.3 Test Sequence Number 1C – HAC 1 Meter Puncture Drop

6.3.1 Test Configuration

Test 1C is a free drop onto the side of the damaged test article used in Test Number 1B from a height of 1 meter (40 inches) as shown in Figure 1. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a horizontal orientation so that the lowest point of the package is at 1 meter (40 inches) above the top surface of the test pad. The test article is to be positioned so that the impact is located between the vertical stiffeners within the package. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

6.3.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.

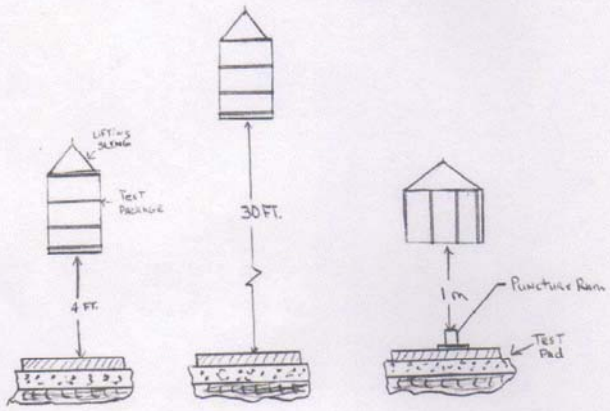
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

6.3.3 Post-Test Requirements

Following the HAC side puncture drop (Test Number 1C), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Record the information on the applicable test forms and proceed to next test sequence.
- Measure and record the torque of outer closure bolts.
- Open outer package and remove the outer lid.
- Photograph the interior surface of the test article and examine for any apparent indications of containment boundary loss, e.g. payload materials.
- Measure and record the torque of interior bolts and remove the inner containment cavity blind flange.
- Examine the condition of the gasket and payload contents and record the information on the test record.
- Measure and record the centerline and near side distance to the edge of the cavity.
- Remove the inner payload (if possible) and record any apparent damage or movement to the inner containment cavity.
- Photograph the inner cavity to provide visual evidence of any apparent damage.
- Complete the test sequence record.

14



Test No. 1A
NCT Top End Drop

Test No. 1B
HAC Top End Drop

Test No. 1C
HAC Side Puncture Drop

Figure 1 – Test Package No.1 - Drop Test Configurations

Century Industries
Bristol, Virginia

Versa-Pac Test Plan

TP-001 Revision 0
January 20, 2009

7.0 TEST PACAKGE NO. 2

7.1 Test Number 2A – NCT Horizontal Side Drop

7.1.1 Test Configuration

Test 2A is a free drop onto the horizontal side of an undamaged test article from a height of 1.2 meters (4 Feet) as shown in Figure 2. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a horizontal side orientation so that the lowest point of the package is at 1.2 meters (4 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

7.1.2 Pre-test Requirements & Measurements

Prior to performing Test Number 2A, the following pre-test activities are to be complete:

- Measure and record the test article temperature upon removal from the conditioning room.
- Record the test article serial number.
- Measure the centerline and the near side distance to the edge of the cavity, prior to closure of the inner containment cavity. All measurement locations should be marked on the package.
- Take photographs of the interior and exterior of the package to provide visual evidence of the pre-test condition.
- Weigh and record the empty test article.
- Load the pre-loaded 30 gallon inner drum into the test article inner containment cavity.
- Spread one (1) pound of residual sand/dirt into the inner containment cavity.
- Verify that components used for the inner containment cavity are in good condition and are the proper components per the drawings.
- Install the containment cavity gasket and blind flange. Snug all lid bolts prior to applying the required torque of 40 ft. lbs. in an alternating torque rotation.
- Install the outer gasket and reinforced drum lid using the appropriate bolts as required by the drawing, applying torque of 40 ft. lbs to the closure bolts in the proper alternating manner.
- Install outer drum ring and torque to 60 ft. lbs. and install security seal.

- Weigh and record the loaded test article.
- Upon closure, measure the height, from the bottom rim to the top of the closure ring and diameter of the outer package at the center rolling hoop of the drum. All measurement locations should be marked on the package.
- Verify that the external acetate vent plug is in place.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

7.1.3 Post-Test Requirements

Following the NCT top end drop (Test Number 2A), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any apparent damage.
- Document any apparent damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

7.2 Test Number 2B – HAC - 30' Horizontal Side Drop

7.2.1 Test Configuration

Test 2B is a free drop onto the horizontal side of the damaged test article used in Test Number 2A from a height of 9 meters (30 feet) as shown in Figure 2. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a horizontal side orientation so that the lowest point of the package is at 9 meters (30 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

7.2.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

7.2.3 Post-Test Requirements

Following the HAC top end drop (Test Number 2B), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

7.3 Test Sequence Number 2C – HAC 30' Crush Plate Side Drop

7.3.1 Test Configuration

Test 2C is a crush plate drop onto the horizontal side of the damaged test article covering the top closure and the top internal containment cavity closure used in Test Number 2B from a height of 9 meters (30 feet) as shown in Figure 2. The crush plate is suspended from a crane by slings and attached to a release mechanism is to be lifted above the top of the test article located on the test pad in a horizontal orientation so that the lowest point of the crush plate is at 9 meters (30 feet) above the top surface of the test article located on the test pad. The crush plate should be released so that it does not impart rotational motion into the crush plate free fall to the impact point.

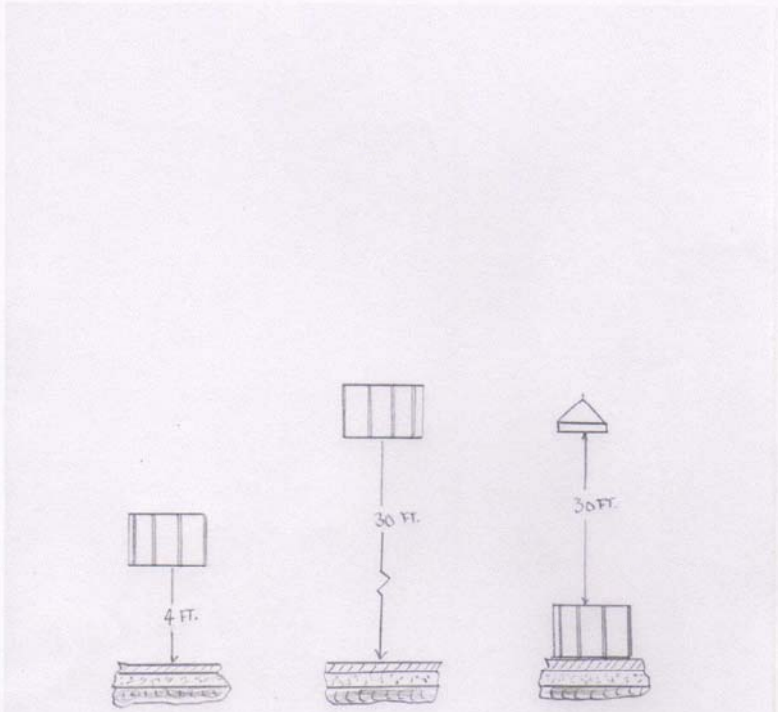
7.3.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

7.3.3 Post-Test Requirements

Following the HAC crush plate drop (Test Number 2C), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Record the information on the applicable test forms and proceed to next test sequence.



Test No. 2A
NCT Top End Drop

Test No. 2B
HAC Top End Drop

Test No. 2C
HAC Crush Plate
Side Drop

Figure 2 – Test Package No. 2 – Test Configurations

8.0 TEST PACAKGE NO. 3

8.1 Test Number 3A – NCT Center of Gravity Drop

8.1.1 Test Configuration

Test 3A is a free drop thru the center of gravity onto the top closure of an undamaged test article from a height of 1.2 meters (4 Feet) as shown in Figure 3. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a center of gravity thru the top closure orientation so that the lowest point of the package is at 1.2 meters (4 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

8.1.2 Pre-test Requirements & Measurements

Prior to performing Test Number 3A, the following pre-test activities are to be complete:

- Measure and record the test article temperature upon removal from the conditioning room.
- Record the test article serial number.
- Measure the centerline and the near side distance to the edge of the cavity, prior to closure of the inner containment cavity. All measurement locations should be marked on the package.
- Take photographs of the interior and exterior of the package to provide visual evidence of the pre-test condition.
- Weigh and record the empty test article.
- Load the pre-loaded 30 gallon inner drum into the test article inner containment cavity.
- Spread one (1) pound of residual sand/dirt into the inner containment cavity.
- Verify that components used for the inner containment cavity are in good condition and are the proper components per the drawings.
- Install the containment cavity gasket and blind flange. Snug all lid bolts prior to applying the required torque of 40 ft. lbs. in an alternating torque rotation.
- Install the outer gasket and reinforced drum lid using the appropriate bolts as required by the drawing, applying torque of 40 ft. lbs to the closure bolts in the proper alternating manner.

- Install outer drum ring and torque to 60 ft. lbs. and install security seal.
- Weigh and record the loaded test article.
- Upon closure, measure the height, from the bottom rim to the top of the closure ring and diameter of the outer package at the center rolling hoop of the drum. All measurement locations should be marked on the package.
- Verify that the external acetate vent plug is in place.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

8.1.3 Post-Test Requirements

Following the NCT top end drop (Test Number 3A), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any apparent damage.
- Document any apparent damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

8.2 Test Number 3B – HAC - 30' Center of Gravity Top Closure Drop

8.2.1 Test Configuration

Test 3B is a free drop thru the center of gravity onto the top closure of the damaged test article used in Test Number 3A from a height of 9 meters (30 feet) as shown in Figure 3. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad in a center of gravity thru the top closure orientation so that the lowest point of the package is at 9 meters (30 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

8.2.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

8.2.3 Post-Test Requirements

Following the HAC top end drop (Test Number 3B), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Measure the height and diameter of the test article and record the information.
- Record the information on the applicable test forms and proceed to next test sequence.

8.3 Test Sequence Number 3C – HAC 30' Shallow Angle Accelerated Drop

8.3.1 Test Configuration

Test 3C is a shallow angle accelerated drop at an angle of 17 degrees from the horizontal side of the damaged test article from a height of 9 meters (30 feet) as shown in Figure 3. The test article should be oriented so that the top closure makes the initial impact with test pad surface. The test article suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad so that the lowest point of the package is at 9 meters (30 feet) above the top surface of the test pad. The test article should be released so that it does not impart rotational motion into the package free fall to the test pad.

8.3.2 Pre-test Requirements & Measurements

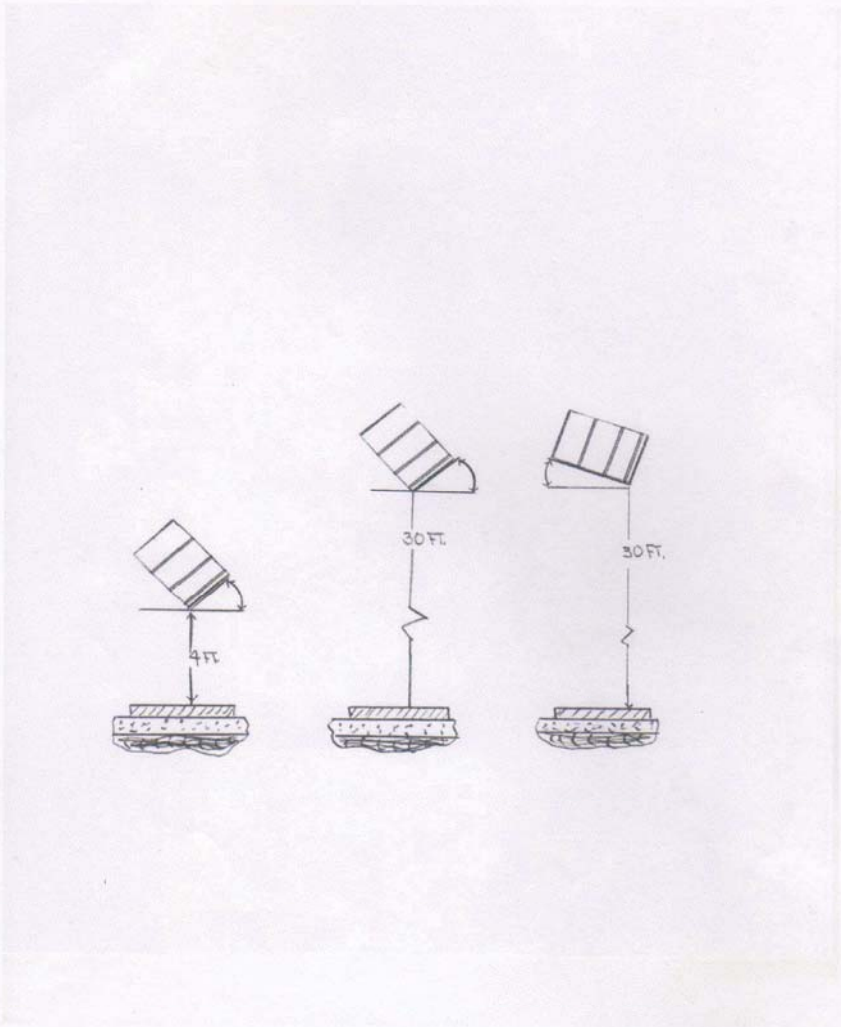
- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

8.3.3 Post-Test Requirements

Following the HAC shallow angle accelerated drop (Test Number 3C), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Record the information on the applicable test forms and proceed to next test sequence.

- Measure and record the torque of outer closure bolts.
- Open outer package and remove the outer lid.
- Photograph the interior surface of the test article and examine for any apparent indications of containment boundary loss, e.g. payload materials.
- Measure and record the torque of interior bolts and remove the inner containment cavity blind flange.
- Examine the condition of the gasket and payload contents and record the information on the test record.
- Measure and record the centerline and near side distance to the edge of the cavity.
- Remove the inner payload (if possible) and record any apparent damage or movement to the inner containment cavity.
- Photograph the inner cavity to provide visual evidence of any apparent damage.
- Complete the test sequence record.



Test No. 3A
NCT C.G. Top Drop

Test No. 3B
HAC C.G. Top Drop

Test No. 3C
HAC Shallow Angle
Accelerated Drop

Figure 3 – Test Package No. 3 – Test Configurations

9.1 Test Sequence Number 4 – HAC 1 Meter Puncture Drop

9.1.1 Test Configuration

Test number 4 is a free drop onto the damaged test article used in a previous, to be determined based upon particular damage assessed after the initial package series testing, from a height of 1 meter (40 inches) as shown in Figure 4. The test article will be suspended from a crane by slings and attached to a release mechanism is to be lifted above the test pad at an angle orientated to impact the damaged area so that the lowest point of the package is at 1 meter (40 inches) above the top surface of the puncture pin. The test article should be released so that it does not impart rotational motion into the package free fall to the impact point on the puncture pin.

9.1.2 Pre-test Requirements & Measurements

- Record measurements taken from previous test of the test article on the test record.
- Take photographs of the exterior of the test article to provide visual evidence of the test article pre-test condition.
- Measure and record the air temperature at the drop pad.
- Measure and record the temperature on the surface of the package.
- Once suspended measure and record the angle at which the test article is oriented to the nearest 1° increment. The measurement is to be within ± 1.0° of the specified drop orientation.
- Lift the test article to the required drop height. Measure and record the height from the surface of the test pad to the lowest point of the test article. The measured height must be at least the specified height required for the drop, but no more than plus 2 inches.

9.1.3 Post-Test Requirements

Following the HAC puncture drop (Test Number 4), the following activities are required:

- Photograph the exterior surfaces of the test article to provide visual evidence of any additional apparent damage.
- Document any additional damage to the package, e.g. deformation or bolt failure.
- Record the information on the applicable test forms and proceed to next test sequence.

- Measure and record the torque of outer closure bolts.
- Open outer package and remove the outer lid.
- Photograph the interior surface of the test article and examine for any apparent indications of containment boundary loss, e.g. payload materials.
- Measure and record the torque of interior bolts and remove the inner containment cavity blind flange.
- Examine the condition of the gasket and payload contents and record the information on the test record.
- Measure and record the centerline and near side distance to the edge of the cavity.
- Remove the inner payload (if possible) and record any apparent damage or movement to the inner containment cavity.
- Photograph the inner cavity to provide visual evidence of any apparent damage.
- Complete the test sequence record.

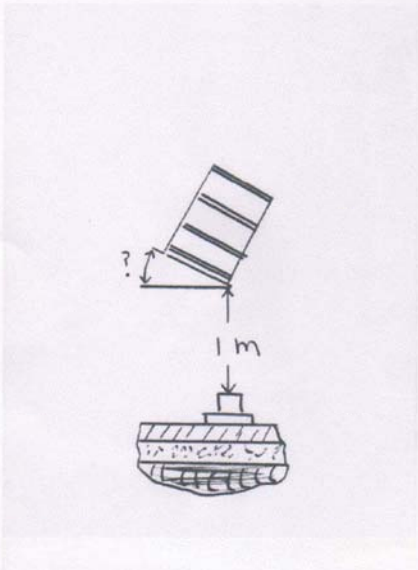


Figure 4 - 1- Meter Puncture Drop – Example Configuration

10.0 References

1. Title 10, Code of Federal Regulations, Pert 71, Packaging and Transportation of Radioactive Materials
2. Century Industries – QA-8 Plan for Manufacture of Versa-Pac Shipping
3. Title 10, Code of Federal Regulations, Part 21, Reporting of Defects and Noncompliance
4. Century Industries, Versa-Pac Shipping Container Test Specification TS-001
5. Century Industries, Quality Assurance Manual, QA-1

Attachment B

Test Specification TS-001 Revision 0

(Consisting of 12 Pages)

Century Industries
Bristol, Virginia 24209

Versa-Pac Shipping Container
Test Specification
TS-001 Revision 0

US NRC Docket No. 71-9342

Prepared By:
Century Industries
William M. Arnold

Prepared By: William M. Arnold –Signature on File Date: November 01, 2009

Reviewed By: Heather Little – Signature on File Date: November 01, 2009

Record of Revision

Revision No.	Description of Revision	Date
0	Original Issue	11-01-08

Table of Contents

1.0 INTRODUCTION

Century Industries is designing and licensing a new transportation package, called the Vera-Pac Shipping Container, in accordance with the requirements of 10 CFR Part 71 [Ref. 1]. The results of this series of test may also be used as part of the analytic information evaluating other areas of the package performance for the Normal Conditions of Transport (NCT) and Hypothetical Accident Conditions (HAC) tests of 10 CFR Part 71.

This document specifies the requirements for the confirmatory test program. A separate Test Plan will be prepared describing the specific test conditions, configurations and the sequence in which they will be carried out. Included in this document will be the fabrication specification for the test packages used in this series of test for the Versa-Pac Shipping Container.

2.0 TEST REQUIREMENTS

2.1 Pre-Test Readiness Review

Prior to performing any test series a readiness review will be conducted by Century Industries to assure the following:

1. All necessary test plans and/or procedures have been prepared in accordance with Century Industries QA program, reviewed and approved.
2. All required test articles and test facilities have been received and inspected by Century Industries personnel.
3. The documentation packages for the test articles have been reviewed and accepted by Century Industries inspection personnel.
4. Personnel are trained and available to perform the test series.
5. Test and inspection personnel have been trained in accordance with the appropriate test plans and/or procedures as required.
6. All test and Measurement equipment to be used fro the test series are current and will remain current during the testing period for which they are required.
7. Any subcontractors to be used have been trained in accordance with the test plan and/or procedures.

2.2 Pre-Test Measurements

Prior to performing any test, any per-test measurements required by the test plan must be taken and documented.

2.3 Instrumentation and Data Acquisition Systems

Prior to performing any test, the instrumentation and data acquisition system, if any, shall be checked to assure that it is properly functioning. Any instrumentation that is not properly functioning shall be either repaired or replaced. The test procedures shall include QA inspection hold points to verify that the instrumentation and acquisition equipment meets pre-test requirements.

2.3.1 Photographic Equipment

At least two consumer grade color video cameras shall be used to record the package response for each drop test series. One camera should have a field of view sufficient to capture the entire drop sequence, both free fall and impact. The field of view of the second camera should concentrate on the lower half of the impact area to provide more detailed footage of the drop sequence. The video recording of each drop test series shall be maintained for visual evidence.

Color still photographs shall be taken to document the test set-up and test results. Photographs should be taken with a minimum 3.0 Mega pixel digital camera or 35 mm standard camera equipment.

2.4 Environmental Conditions

2.4.1 Drop Test

Prior to performing each drop test series the following environmental conditions must be recorded:

1. Precipitation: Any precipitation (i.e. rain, snow. etc.) directly on the test article or test pad surface during the drop test shall be noted.

2. Wind Speed: The wind speed at the time of the drop series shall be recorded. If wind speed is considered to be strong enough to effect the drop orientation the drop test series should be delayed.

3. Package Temperature: Record the package temperature at removal from the conditioning chamber.

4. Air Temperature: Record the air temperature at the drop site prior to conducting the drop series.

2.5 Test Components

2.5.1 Test Articles

All test articles shall be fabricated in accordance with the requirements Section 3 of this test specification and QA-8 - Plan for Manufacture of the Versa-Pac Shipping Container [7].

2.5.2 Puncture Pin

The puncture pin must meet the requirements of 10 CFR 71(c)(3)[1]. The puncture pin must be a solid, vertical, cylindrical, mild steel bar mounted on an essentially unyielding, horizontal surface. The bar must be 15 cm (6 inches) in diameter, with the top horizontal and its edge rounded to a radius of not more than 6 mm (0.25 inches) and a length as to cause maximum damage to the package, but not less than 20 cm (8 inches) long. The long axis of the bar must be vertical. The puncture pin must be attached so as to prevent it from sliding or overturning during the 1-meter puncture drop test.

2.5.3 Drop Test Facility

The drop test facility must have a suitable drop test pad, lifting equipment and drop release mechanism. The drop test facilities must meet the following specifications:

1. Drop Test Pad

The drop test pad must satisfy the requirements of IAEA [2] recommendations for an unyielding target. An example of an unyielding surface is: The drop test pad should consist of a rigid steel plate mounted on a concrete pad with the combined mass of the steel and concrete at least 10 times that of the test article, with a surface area sufficient in size so as to allow the entire test article to contact the steel surface plate. The steel and concrete interface should be floated on grout and mechanically anchored to the concrete base (e.g. anchor blots). The concrete must reach design strength prior to performing any drop test series. The drop test pad steel plate should be clean, and free from any significant surface imperfections (e.g. large gouges) that could affect the response of the package.

The drop test pad must also include a provision for attaching the puncture pin device used in the 1-meter puncture drop.

2. Lifting Equipment

The drop test facility must be equipped with a lifting device (e.g. crane) and lifting slings that are capable of lifting the lowest point of the test packages to the height prescribe above the top surface of the drop test pad for all drops in the test series. The lifting equipment (e.g. crane, slings) shall have at least the working load capacity to safely handle the test article weight.

3. Drop Release Mechanism

The drop test release mechanism must be capable of releasing the test articles without causing the package to rotate during the free fall to the test pad. Mechanical or administrative means shall be provided to prevent inadvertent release of the test article.

2.6 Test Plan and Procedures

Detailed test plans and procedures shall be developed for each droop test series and approved by Century Industries prior to perform any drop test. The test plan and procedures shall include step-by-step instructions for performing the test series. Each step or sequence shall include a provision for the responsible person to initial and date to indicate completion of the step(s). Each sequence shall allow for QA Hold Points necessary to confirm critical test items.

2.7 Test Sequences

Test sequences shall comply with the requirements of 10 CFR 71 [1]. A separate test article may be used for the NCT test series. When assessing cumulative package damage for the HAC test series; the test must be performed in the order shown within the Versa-Pac Shipping Container Test Plan [9] using the same test article within any given test series.

2.8 Quality Assurance Requirements

2.8.1 Test Inspection Personnel

All personnel performing measurements and inspections required by the test plan shall be qualified and trained in accordance with the requirements of the applicable test plan and procedures.

2.8.2 Quality Assurance Hold Points

The test package manufacturing plan and test plan shall establish appropriate hold points for QA for QA personnel to perform the following activities:

1. Receipt inspection of test articles.
2. Verification that all test personnel have been trained in accordance with the test plan prior to test activities.
3. Verification that all prerequisites have been satisfied.

2.8.3 Material and Test Equipment

When calibrated measurement and test equipment is required by the test plan, the equipment shall meet the applicable requirements of Century Industries QA Program QA-1 [10].

2.9 Documentation and Reporting Requirements

The following documents must be provided after the test series has been completed:

1. Test article documentation package(s).
2. Measurement and test equipment records.
3. Personnel training and qualification records.
4. Test Plan and procedures.
5. Pre-test and post-test inspection data, photographic records, video recordings and other pertinent records.

3.0 Responsibilities

Century Industries is responsible for all activities including the preparation of fabrication control records, shop drawings, material procurement, testing and inspection, material certification records as required, welding procedures and final documentation packages.

3.1 Design Requirements

The Century Industries Versa-Pac is designed in accordance with the requirements of 10 CFR 71 [1] and the structural design in accordance with the American Welding Society D1.1 [4]. Welder and welding procedure are in accordance with the applicable requirements of AWS D1.1 [4].

3.2 Fabrication and Material Requirements

Century Industries Versa-Pac shall be fabricated in accordance with the requirements as outlined in the appropriate manufacturing plan and instructions referenced in the sections below. Century Industries Versa-Pac Shipping Container Test Plan [9]

3.2.1 Manufacturing Plan

Century Industries shall prepare a manufacturing plan for the Versa-Pac Shipping Container which should address the following items as a minimum:

- Receipt of materials
- Cutting and Preparation Instructions (Route Sheets)
- Fabrication Control Records (FCR's)
- Performance of functional tests
- Final inspections
- Package documentation review

3.2.2 Fabrication Procedures and Processes

All operations associated with the fabrication of the Versa-Pac shall include written instructions (e.g. Fabrication Control Records and/or Standard Operating Procedures). Additional instructions may be given in the form of drawings and/or sketches, along with verbal communications.

3.2.3 Base Materials

Base materials shall conform to the requirements given in the purchase orders and/or drawings as applicable.

3.2.4 Welding Materials

All weld filler materials shall conform to the requirements of the appropriate welding procedure and be in compliance with the requirements in AWS D1.1 [4].

General welding material certificates are acceptable.

3.2.5 Polyurethane Foam Insulation Materials

The Versa-Pac Shipping Container utilizes polyurethane closed cell foam to provide thermal insulation and impact protection in both the top and bottom ends of the container, this material shall be manufactured in accordance with the requirements of Century Industries Standard Operation Procedure 6.11 Revision 1 [5]. Sample foam specimens shall be taken and analyzed in accordance with the requirements of the procedure to confirm that the product meets the requirements for density, compressive strength, thermal conductivity, flame retardancy, water absorption, moisture content and chloride content. The foam manufacturer shall provide a Certificate of Compliance and a written report of all testing required by the procedure.

3.2.6 Ceramic Fiber Insulation Materials

The Versa-Pac Shipping Container body is surrounded by two separate insulation chambers which utilize a 6# refractory ceramic fiber blanket (Aluminosilicate Fiber) in accordance with the requirements of Century Industries Standard Operating Procedure 6.12 Revision 1 [6].

3.2.7 Welding

All welding shall be in accordance with applicable requirements of AWS D1.1 [4], qualified welding procedures and written instructions.

All welding personnel shall be qualified in accordance with AWS D1.1 [4].

Precautions should be taken to minimize objectionable weld spatter and arc strikes outside the weld joint.

AWS Pre-qualified Welding Procedures and/or qualified welding procedures shall be used.

3.3 Testing and Inspection Requirements

3.3.1 General

1. All test articles shall be inspected to assure that the dimensions of the test article satisfy the requirements of the drawings.

2. Inspection personnel are qualified in accordance AWS CWI or CAWI and/or ASNT-TC-1A [8], as applicable.

3. Welds requiring NDE examination are performed in accordance with Century Industries Standard Operating Procedures, as applicable.

4. Written reports for any NDE shall be completed as required by the appropriate test procedure.

5. Acceptance criteria shall meet AWS D1.1 [4] and/or the requirements of the manufacturing plan and drawings.

6. Functional tests shall be performed as required by the Fabrication Control Records.

7. All test and measurement equipment shall be properly calibrated.

3.4 Quality Assurance

All work shall be performed in accordance with Century Industries QA Program or specific requirements imposed upon its subcontractors.

The Vera-Pac Shipping Container specifications require the application of 10 CR Part 21 [3]. Century Industries is responsible for providing notification to its suppliers and subcontractors.

3.5 Material Traceability

Material traceability shall be maintained throughout the fabrication process thru the use of Route Sheets and Fabrication Control Records as appropriate and by marking on necessary components that will not result in harmful contamination or damage affecting the performance of that component in the end product.

3.6 Storage, Handling and Shipping Requirements

All test articles that must be shipped to a subcontractor's facility shall be packaged using blocking, straps, hold-down devices and/or other materials required to prevent damage to the test article during transportation. Storage and handling may be conducted using the appropriate equipment needed to safely handle the test articles.

4.0 References

1. Title 10, Code of Federal Regulations, Pert 71, Packaging and Transportation of Radioactive Materials
2. International Atomic Energy Agency (IAEA), Regulations for the Safe Transportation of Radioactive Material, No. TS-R-1
3. Title 10, Code of Federal Regulations, Part 21, Reporting of Defects and Noncompliance
4. American Welding Society, Structural Welding Code D1.1
5. Century Industries, Standard Operating Procedure, Polyurethane Closed Cell Foam Specification for Century Products
6. Century Industries, Standard Operating Procedure, Ceramic Fiber Insulation Specification for Century Products
7. Century Industries, QA-8, Plan for the Manufacture of Versa-Pac Shipping Containers
8. American Society of Nondestructive Testing (ASNT), Recommended Practice No. SNT-TC-1A
9. Century Industries, Versa-Pac Shipping Container Test Plan - TP-001
10. Century Industries, Quality Assurance Manual, QA-1

Attachment C

NCT & HAC Test Series Records

(25 Pages)

Century Industries **NCT and HAC Test Record No.** TS-001-1 **Page 1 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Package Serial No. 10552 (#3) Package Description: Versa-Pac (110-Gallon Version)

Test Program Manager: William M. Ald Date: 2-25-09
Test Engineer: William M. Ald Date: 2-25-09
Quality Assurance Coordinator: Heather Yuill Date: 2/26/09

Photographic Equipment

Sony Cyber-Shot (4.1 Mega Pixel) Digital Camera DSC-P73
Sony Digital Handycam Mini-DV DCR-TRV17
Sony Handycam Mini-DV DCR-HC20

Calibrated Equipment Utilized

Surface Thermometer s/N: 05548
Starrett Steel Tape Measure s/N: 08461846
Cummins Industrial Tools Tape Measure (25'x1") No. 3286

Package Preparation Checklist and Measurements

Procedure Step No.	Description	Date	Initials
6.1.2	Measure and record package temperature upon removal from conditioning room AT TRANSPORT. -28°F Package temperature (°F)	2-26-09	WMA
	Photograph interior and exterior of the package prior to loading	2-25-09	WMA
	Measure centerline and near side distance to edge of cavity and mark on package	2-25-09	WMA
	Weigh empty test package 661 Package tare weight (lbs)	2-25-09	WMA
	Load pre-loaded 30-gal drum into the test package, closed and torque drum to required torque of 60 ft./lbs.	2-25-09	WMA
	Spread one (1) pound of residual sand/dirt into the inner containment cavity	2-25-09	WMA
	Inspect the inner containment components for good condition and in accordance with drawings	2-25-09	WMA
	Install cavity gasket and blind flange, snug all bolts, then torque to 40 ft-lbs	2-25-09	WMA
	Install outer gasket and reinforced drum lid with proper bolts per drawing and torque to 40 ft-lbs.	2-25-09	WMA
↓	Install outer drum ring and torque to 60 ft-lbs	2-25-09	WMA

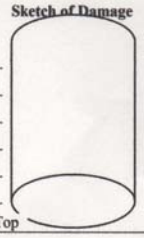
Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-1
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

Page 2 of 5

Procedure Step No.	Description	Date	Initials
6.1.2	Weigh loaded test package 923 Package test weight (lbs)	2-25-09	WMA
↓	Measure height from bottom rim to top of closure ring and diameter of outer package at center rolling hoop of drum and mark measurements on the test package 41 7/8 Package height (in.) 31 3/8 Package diameter (in.)	2/26/09	HL
	Verify the external acetate vent plug is in place	2/26/09	HL
↓	Photograph exterior of test package for evidence of pre-test condition	2/26/09	HL

Test Number (Description): 1A (NCT Top End Drop)

Procedure Step No.	Description	Date	Initials
6.1.2	Measure and record air temperature at drop pad 45 Air Temperature(°F) 4 Wind speed (mph)	2/26/09	HL
↓	Measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	2/26/09	HL
	Lift test article to required drop height	2/26/09	HL
↓	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 48 Drop test height (in.)	2/26/09	HL
6.1.3	Photograph exterior surfaces of test article for visual evidence of damage	2/26/09	HL
↓	Document visual damage to package (e.g. deformation or bolt failure) No visible damage. Sketch of Damage  Top	2/26/09	HL
↓	Measure height and diameter of test package 41 7/8 Package height (in.) 31 3/16 Package diameter (in.)	2/26/09	HL

Century Industries **NCT and HAC Test Record No.** TS-001-1 **Page 3 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Number (Description): 1B (HAC Top End Drop)

Procedure Step No.	Description	Date	Initials
6.2.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HK
	Measure and record the air temperature at the drop pad 45 Air temperature(°F) 4 Wind speed (mph)	2/26/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	2/26/09	HK
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 360 Drop test height (in.)	2/26/09	HK
6.2.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HK
	Document visual damage to package (e.g. deformation or bolt failure) Crumple zone under lid rim is 2 3/8". Reduced height of package by 1/4" and increased diameter by 1/16". Sketch of Damage  Top	2/26/09	HK
	Measure and record height and diameter of test article 41 5/8 Package height (in.) 31 3/8 Package diameter (in.)	2/26/09	HK

Test Number (Description): 1C (HAC 1-M Puncture Drop-Horizontal)

Procedure Step No.	Description	Date	Initials
6.3.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HK
	Measure and record the air temperature at the drop pad HK 2/26/09 45 56 Air temperature (°F) HK 2/26/09 4 5 Wind speed (mph)	2/26/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 1° Angle of orientation	2/26/09	HK

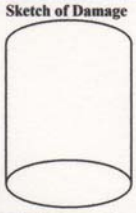
Century Industries **NCT and HAC Test Record No.** TS-001-1 **Page 4 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
6.3.2	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 41 Drop test height (in.)	2/26/09	HR
6.3.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) 3/8" maximum deformation from puncture pin. Sketch of Damage  Top	2/26/09	HR
↓	Measure and record height and diameter of test article 41 11/16 Package height (in.) 31 3/8 Package diameter (in.)	2/26/09	HR

Test Number (Description): N/A

Procedure Step No.	Description	Date	Initials
	Photograph exterior surfaces of test article for visual evidence of pre-test condition		
	Measure and record the air temperature at the drop pad _____ Air temperature(°F) _____ Wind speed (mph)		
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) _____ Angle of orientation		
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) _____ Drop test height (in.)		
	Photograph exterior surfaces of test article for visual evidence of additional damage		

Century Industries **NCT and HAC Test Record No.** TS-001-1 **Page 5 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
	Document visual damage to package (e.g. deformation or bolt failure) _____ _____ _____ _____ _____ Top 		
	Measure and record height and diameter of test article _____ Package height (in.) _____ Package diameter (in.)		

Final Test Record Measurements

Procedure Step No.	Description	Date	Initials
6.3.3	Measure and record torque of outer closure bolts 30 Torque (ft-lbs)	2/26/09	HR
	Open outer package and remove outer lid	2/26/09	HR
	Photograph interior surface of test article and examine for any apparent indications of containment boundary loss, e.g. payload materials Bulge in containment lid with a little sand around outside edge of lid.	2/26/09	HR
	Measure and record torque of interior bolts 20 Torque (ft-lbs)	2/26/09	HR
	Remove inner containment cavity blind flange	2/26/09	HR
	Examine and document condition of the gasket and payload contents Bulge in inner drum lid. No damage to gasket.	2/26/09	HR
	Measure and record the pre-test and post-test centerline and near side distance to edge of cavity for comparison (See attached Measurement Data Sheet)	2/26/09	HR
	Remove (if possible) and document any apparent damage or movement to the inner containment cavity No apparent damage.	2/26/09	HR
↓	Photograph inner cavity to provide visual evidence of any apparent damage	2/26/09	HR

Century Industries **NCT and HAC Test Record No.** TS-001-2 **Page 1 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Package Serial No. 10551 (#2) Package Description: Versa-Pac (110-Gallon Version)

Test Program Manager: William D. Arnold Date: 2-25-09
Test Engineer: William D. Arnold Date: 2-25-09
Quality Assurance Coordinator: Heather Little Date: 2/26/09

Photographic Equipment

Sony Cyber-Shot (4.1 Mega Pixel) Digital Camera DSC-P73
Sony Digital Handy-cam Mini-DV DCR-TRV17
Sony Handycam Mini-DV DCR-HC20

Calibrated Equipment Utilized

Surface Thermometer S/N: 05548
Starrett Steel Tape Measure S/N: 08461846
Cummins Industrial Tools Tape Measure (25'x1") No. 3286

Package Preparation Checklist and Measurements

Procedure Step No.	Description	Date	Initials
7.1.2	Measure and record package temperature upon removal from conditioning room AT TRANSPORT. -28°F Package temperature (°F)	2-26-09	WMA
	Photograph interior and exterior of the package prior to loading	2-25-09	WMA
	Measure centerline and near side distance to edge of cavity and mark on package	2-25-09	WMA
	Weigh empty test package 662 Package tare weight (lbs)	2-25-09	WMA
	Load pre-loaded 30-gal drum into the test package, closed and torque drum to required torque of 60 ft./lbs.	2-25-09	WMA
	Spread one (1) pound of residual sand/dirt into the inner containment cavity	2-25-09	WMA
	Inspect the inner containment components for good condition and in accordance with drawings	2-25-09	WMA
	Install cavity gasket and blind flange, snug all bolts, then torque to 40 ft-lbs	2-25-09	WMA
	Install outer gasket and reinforced drum lid with proper bolts per drawing and torque to 40 ft-lbs.	2-25-09	WMA
✓	Install outer drum ring and torque to 60 ft-lbs	2-25-09	WMA

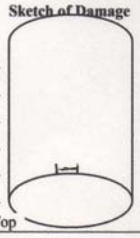
Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-2
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

Page 2 of 5

Procedure Step No.	Description	Date	Initials
7.1.2	Weigh loaded test package 923 1/2 Package test weight (lbs)	2/26/09	HR
↓	Measure height from bottom rim to top of closure ring and diameter of outer package at center rolling hoop of drum and mark measurements on the test package 42 1/4 Package height (in.) 31 1/8 Package diameter (in.)	2/26/09	HR
	Verify the external acetate vent plug is in place	2/26/09	HR
↓	Photograph exterior of test package for evidence of pre-test condition	2/26/09	HR

Test Number (Description): 2A (NCT Horizontal Side Drop)

Procedure Step No.	Description	Date	Initials
7.1.2	Measure and record air temperature at drop pad 47.5 Air Temperature(°F) 4 Wind speed (mph)	2/26/09	HR
↓	Measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	2/26/09	HR
	Lift test article to required drop height	2/26/09	HR
↓	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 48 Drop test height (in.)	2/26/09	HR
7.1.3	Photograph exterior surfaces of test article for visual evidence of damage	2/26/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) Closure bolt pushed into package about 5/8". Sketch of Damage  	2/26/09	HR
↓	Measure height and diameter of test package 42 1/4 Package height (in.) 31 1/8 Package diameter (in.)	2/26/09	HR

Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-2
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

Page 3 of 5

Test Number (Description): 2B (HAC - 30' Horizontal Drop)

Procedure Step No.	Description	Date	Initials
7.2.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HR
	Measure and record the air temperature at the drop pad 48 Air temperature(°F) 4 Wind speed (mph)	2/26/09	HR
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	2/26/09	HR
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 361 Drop test height (in.)	2/26/09	HR
7.2.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HR
	Document visual damage to package (e.g. deformation or bolt failure) Buckling around closure bolt area and on lid. Decreased diameter by 1". Sketch of Damage: 	2/26/09	HR
	Measure and record height and diameter of test article 42 1/4 Package height (in.) 31 3/8 Package diameter (in.) 30" at bolt	2/26/09	HR

Test Number (Description): 2C (HAC - 30' Crush Plate Side Drop)

Procedure Step No.	Description	Date	Initials
7.3.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HR
	Measure and record the air temperature at the drop pad 49 Air temperature (°F) 4 Wind speed (mph)	2/26/09	HR
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	2/26/09	HR

Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-2
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

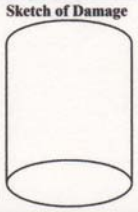
Page 4 of 5

Procedure Step No.	Description	Date	Initials
7.3.2	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 36 1/2 Drop test height (in.)	2/26/09	HR
7.3.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) 1" decrease in diameter. Additional 1/4" deformation from bolt to opposite seam. 1/4" x 1 1/4" gap at bolt btw. drum lid and rim with visible metal-metal contact. Lost drum ring. Sketch of Damage  Top	2/26/09	HR
↓	Measure and record height and diameter of test article 42 1/4 Package height (in.) 31 3/8 Package diameter (in.) 28 3/4" at bolt 29" at crush point	2/26/09	HR

Test Number (Description): N/A

Procedure Step No.	Description	Date	Initials
	Photograph exterior surfaces of test article for visual evidence of pre-test condition		
	Measure and record the air temperature at the drop pad _____ Air temperature(°F) _____ Wind speed (mph)		
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) _____ Angle of orientation		
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) _____ Drop test height (in.)		
	Photograph exterior surfaces of test article for visual evidence of additional damage		

Century Industries **NCT and HAC Test Record No.** TS-001-2 **Page 5 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
	Document visual damage to package (e.g. deformation or bolt failure) _____ _____ _____ _____ _____ Top 		
	Measure and record height and diameter of test article _____ Package height (in.) _____ Package diameter (in.)		

Final Test Record Measurements

Procedure Step No.	Description	Date	Initials
7.3.3	Measure and record torque of outer closure bolts 25 Torque (ft-lbs)	2/26/09	HR
	Open outer package and remove outer lid	2/26/09	HR
	Photograph interior surface of test article and examine for any apparent indications of containment boundary loss, e.g. payload materials Slight inner wall deformation. No apparent loss of contents.	2/26/09	HR
	Measure and record torque of interior bolts 25 Torque (ft-lbs)	2/26/09	HR
	Remove inner containment cavity blind flange	2/26/09	HR
	Examine and document condition of the gasket and payload contents Gasket intact with minimal damage. Payload still inside drum. Some crumpling of drum lid.	2/26/09	HR
	Measure and record the pre-test and post-test centerline and near side distance to edge of cavity for comparison (See attached Measurement Data Sheet)	2/26/09	HR
	Remove (if possible) and document any apparent damage or movement to the inner containment cavity No apparent damage	2/26/09	HR
	Photograph inner cavity to provide visual evidence of any apparent damage	2/26/09	HR

Century Industries **NCT and HAC Test Record No.** TS-001-3 **Page 1 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Package Serial No. 10550(#1) Package Description: Versa-Pac (110-Gallon Version)

Test Program Manager: William D. Arld Date: 2-25-09
Test Engineer: William D. Arld Date: 2-25-09
Quality Assurance Coordinator: Heather Little Date: 2/26/09

Photographic Equipment

Sony Cyber-Shot (4.1 Mega Pixel) Digital Camera DSC-P73
Sony Digital Handycam Mini-DV DCR-TR17
Sony Handycam Mini-DV DCR-HC20

Calibrated Equipment Utilized

Surface Thermometer S/N: 05548
Starrett Steel Tape Measure S/N: 08461846
Cummins Industrial Tools Tape Measure (25'x1") No. 3286

Package Preparation Checklist and Measurements

Procedure Step No.	Description	Date	Initials
8.1.2	Measure and record package temperature upon removal from conditioning room AT TRANSPORT. -28°F Package temperature (°F)	2-26-09	WMA
	Photograph interior and exterior of the package prior to loading	2-25-09	WMA
	Measure centerline and near side distance to edge of cavity and mark on package	2-25-09	WMA
	Weigh empty test package 1660 Package tare weight (lbs)	2-25-09	WMA
	Load pre-loaded 30-gal drum into the test package, closed and torque drum to required torque of 60 ft./lbs.	2-25-09	WMA
	Spread one (1) pound of residual sand/dirt into the inner containment cavity	2-25-09	WMA
	Inspect the inner containment components for good condition and in accordance with drawings	2-25-09	WMA
	Install cavity gasket and blind flange, snug all bolts, then torque to 40 ft-lbs	2-25-09	WMA
	Install outer gasket and reinforced drum lid with proper bolts per drawing and torque to 40 ft-lbs.	2-25-09	WMA
	Install outer drum ring and torque to 60 ft-lbs	2-25-09	WMA

Century Industries **NCT and HAC Test Record No.** TS-001-3 **Page 2 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
8.1.2	Weigh loaded test package 920 Package test weight (lbs)	2-25-09	WMR
	Measure height from bottom rim to top of closure ring and diameter of outer package at center rolling hoop of drum and mark measurements on the test package 41 13/16 Package height (in.) 31 1/8 Package diameter (in.)	2/26/09	HR
	Verify the external acetate vent plug is in place	2/26/09	HR
	Photograph exterior of test package for evidence of pre-test condition	2/26/09	HR

Test Number (Description): 3A (NCT Center of Gravity Drop)

Procedure Step No.	Description	Date	Initials
8.1.2	Measure and record air temperature at drop pad 53 Air Temperature(°F) 5 Wind speed (mph)	2/26/09	HR
	Measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 57° Angle of orientation	2/26/09	HR
	Lift test article to required drop height	2/26/09	HR
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 48 Drop test height (in.)	2/26/09	HR
8.1.3	Photograph exterior surfaces of test article for visual evidence of damage	2/26/09	HR
	Document visual damage to package (e.g. deformation or bolt failure) 1 1/16" x 2" deformation at bolt area. Sketch of Damage Top	2/26/09	HR
	Measure height and diameter of test package 42 3/16" Package height (in.) 31" Package diameter (in.)	2/24/09	HR

Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-3
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

Page 3 of 5

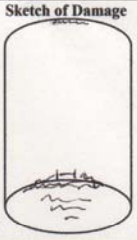
Test Number (Description): 3B (HAC - 30' Center of Gravity Top Closure Drop)

Procedure Step No.	Description	Date	Initials
8.2.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HK
	Measure and record the air temperature at the drop pad 54.5 Air temperature(°F) 5 Wind speed (mph)	2/26/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 56° Angle of orientation	2/26/09	HK
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 361 Drop test height (in.)	2/26/09	HK
8.2.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HK
	Document visual damage to package (e.g. deformation or bolt failure) 11/16" ht. in crumpling on lid. 2 1/2" x 20" deformation at bolt area Sketch of Damage  Top	2/26/09	HK
	Measure and record height and diameter of test article 42 3/16 Package height (in.) → 40 3/4" at bolt 31 1/2 Package diameter (in.) → 30 1/4" at bolt	2/26/09	HK

Test Number (Description): 3C (HAC 30' Shallow Angle Accelerated Drop)

Procedure Step No.	Description	Date	Initials
8.3.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HK
	Measure and record the air temperature at the drop pad 54.5 Air temperature (°F) 5 Wind speed (mph)	2/26/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 17° Angle of orientation	2/26/09	HK

Century Industries **NCT and HAC Test Record No.** TS-001-3 **Page 4 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
8.3.2	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 361 Drop test height (in.)	2/26/09	HR
8.3.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) 3/16" x 7" weld tear on drum bottom with no breach of inner liner. 2 15/16" deformation at bolt. 1" crumpling ht. in lid. Sketch of Damage  Top	2/26/09	HR
↓	Measure and record height and diameter of test article 42 3/16 Package height (in.) → 40 15/16" at bolt 31 5/8 Package diameter (in.) → 28 1/2" at bolt	2/26/09	HR

Test Number (Description): 4 3D (HAC 1-M Puncture Drop - CG over bolt area) HMM 2-26-09

Procedure Step No.	Description	Date	Initials
9.1.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	2/26/09	HR
↓	Measure and record the air temperature at the drop pad 56 Air temperature(°F) 5 Wind speed (mph)	2/26/09	HR
↓	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 56° Angle of orientation	2/26/09	HR
↓	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 41" Drop test height (in.)	2/26/09	HR
9.1.3	Photograph exterior surfaces of test article for visual evidence of additional damage	2/26/09	HR

Century Industries **NCT and HAC Test Record No.** TS-001-3 **Page 5 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
9.1.3	Document visual damage to package (e.g. deformation or bolt failure) 1/4" maximum deformation from puncture pin. 1/4" x 3" gap in already damaged area btw. drum lid + rim. ~~No~~ Visible metal-metal contact and apparent intact gasket seal inside this gap. Sketch of Damage  Top	2/26/09	HH
9.1.3	Measure and record height and diameter of test article 42 3/16 Package height (in.) 31 5/8 Package diameter (in.) → 28 9/16 at bolt	2/26/09	HH

Final Test Record Measurements

Procedure Step No.	Description	Date	Initials
8.3.3	Measure and record torque of outer closure bolts < 20 Torque (ft-lbs)	2/26/09	HH
	Open outer package and remove outer lid	2/26/09	HH
	Photograph interior surface of test article and examine for any apparent indications of containment boundary loss, e.g. payload materials Bulge in containment lid with some sand on top of lid. Deformation of inner wall at impact area.	2/26/09	HH
	Measure and record torque of interior bolts < 20 Torque (ft-lbs)	2/26/09	HH
	Remove inner containment cavity blind flange	2/26/09	HH
	Examine and document condition of the gasket and payload contents Inner and outer gaskets in good condition with minimal damage of outer gasket.	2/26/09	HH
	Measure and record the pre-test and post-test centerline and near side distance to edge of cavity for comparison (See attached Measurement Data Sheet)	2/26/09	HH
	Remove (if possible) and document any apparent damage or movement to the inner containment cavity No apparent damage.	2/26/09	HH
	Photograph inner cavity to provide visual evidence of any apparent damage	2/26/09	HH

Century Industries **NCT and HAC Test Record No.** TS-001-4 **Page 1 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Package Serial No. 10551 (#2) Package Description: Versa-Pac (110-Gallon Version)

Test Program Manager: William M. Ald Date: 3-4-09
Test Engineer: William M. Ald Date: 3-4-09
Quality Assurance Coordinator: Heather Little Date: 3/5/09

Photographic Equipment

Sony Cyber-Shot (4.1 Mega Pixel) Digital Camera DSC-P73
Sony Digital Handycam Mini-DV DCR-TR17
Sony Handycam Mini-DV DCR-HC20

Calibrated Equipment Utilized

Surface Thermometer S/N: 05548
Starrett Steel Tape Measure S/N: 09461846
Cummins Industrial Tools Tape Measure (25'x1") No. 3286

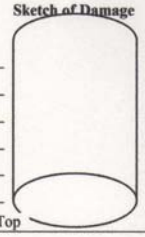
Package Preparation Checklist and Measurements

Procedure Step No.	Description	Date	Initials
6.1.2	Measure and record package temperature upon removal from conditioning room AT TRANSPORT. -29°F Package temperature (°F)	3-5-09	WMA
	Photograph interior and exterior of the package prior to loading	3-4-09	WMA
	Measure centerline and near side distance to edge of cavity and mark on package	3-4-09	WMA
	Weigh empty test package 105 Package tare weight (lbs)	3-4-09	WMA
	Load pre-loaded 30-gal drum into the test package, closed and torque drum to required torque of 60 ft./lbs.	3-4-09 WMA	WMA
	Spread one (1) pound of residual sand/dirt into the inner containment cavity	WMA 3-4-09	WMA
	Inspect the inner containment components for good condition and in accordance with drawings	3-4-09	WMA
	Install cavity gasket and blind flange, snug all bolts, then torque to ~~40~~ ft-lbs WMA 3-4-09 60 FT/Lbs.	3-4-09	WMA
	Install outer gasket and reinforced drum lid with proper bolts per drawing and torque to ~~40 ft-lbs.~~ WMA 3-04-09 60 Ft-Lbs.	3-4-09	WMA
	Install outer drum ring and torque to 60 ft-lbs	3-4-09	WMA

Century Industries **NCT and HAC Test Record No.** TS-001-4 **Page 2 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

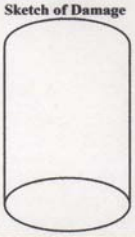
Procedure Step No.	Description	Date	Initials
6.1.2	Weigh loaded test package _____ Package test weight (lbs) 965	3-4-09	WMA
	Measure height from bottom rim to top of closure ring and diameter of outer package at center rolling hoop of drum and mark measurements on the test package 42 1/4 Package height (in.) 31 3/8 Package diameter (in.)	3/5/09	HK
	Verify the external acetate vent plug is in place	3/5/09	HK
	Photograph exterior of test package for evidence of pre-test condition	3/5/09	HK

Test Number (Description): 1A (NCT Top End Drop)

Procedure Step No.	Description	Date	Initials
6.1.2	Measure and record air temperature at drop pad 58.5 Air Temperature(°F) 5 Wind speed (mph)	3/5/09	HK
	Measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	3/5/09	HK
	Lift test article to required drop height	3/5/09	HK
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 48 Drop test height (in.)	3/5/09	HK
6.1.3	Photograph exterior surfaces of test article for visual evidence of damage	3/5/09	HK
	Document visual damage to package (e.g. deformation or bolt failure) No visible additional damage. Sketch of Damage  	3/5/09	HK
	Measure height and diameter of test package 42 1/4 Package height (in.) 31 3/8 Package diameter (in.)	3/5/09	HK

Century Industries **NCT and HAC Test Record No.** TS-001-4 **Page 3 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Number (Description): 1B (HAC Top End Drop)

Procedure Step No.	Description	Date	Initials
6.2.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	3/5/09	HR
	Measure and record the air temperature at the drop pad 58.5 Air temperature(°F) 5 Wind speed (mph)	3/5/09	HR
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 0° Angle of orientation	3/5/09	HR
↓	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 360 Drop test height (in.)	3/5/09	HR
6.2.3	Photograph exterior surfaces of test article for visual evidence of additional damage	3/5/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) 3 bolts flattened and 2 bolts partially flattened. 7/16" decrease in height. Sketch of Damage  Top	3/5/09	HR
↓	Measure and record height and diameter of test article 41 13/16 Package height (in.) 31 3/8 Package diameter (in.)	3/5/09	HR

Test Number (Description): N/A

Procedure Step No.	Description	Date	Initials
	Photograph exterior surfaces of test article for visual evidence of pre-test condition		
	Measure and record the air temperature at the drop pad _____ Air temperature (°F) _____ Wind speed (mph)		
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) _____ Angle of orientation		

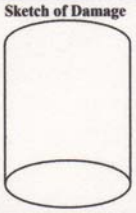
Century Industries **NCT and HAC Test Record No.** TS-001-4 **Page 4 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) _____ Drop test height (in.)		
	Photograph exterior surfaces of test article for visual evidence of additional damage		
	Document visual damage to package (e.g. deformation or bolt failure) _____ _____ _____ _____ _____ _____ Sketch of Damage  Top		
	Measure and record height and diameter of test article _____ Package height (in.) _____ Package diameter (in.)		

Test Number (Description): N/A

Procedure Step No.	Description	Date	Initials
	Photograph exterior surfaces of test article for visual evidence of pre-test condition		
	Measure and record the air temperature at the drop pad _____ Air temperature(°F) _____ Wind speed (mph)		
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) _____ Angle of orientation		
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) _____ Drop test height (in.)		
	Photograph exterior surfaces of test article for visual evidence of additional damage		

Century Industries **NCT and HAC Test Record No.** TS-001-4 **Page 5 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
	Document visual damage to package (e.g. deformation or bolt failure) _____ _____ _____ _____ _____ Top 		
	Measure and record height and diameter of test article _____ Package height (in.) _____ Package diameter (in.)		

Final Test Record Measurements

Procedure Step No.	Description	Date	Initials
6.3.3	Measure and record torque of outer closure bolts 20-80 Torque (ft-lbs)	3/5/09	HK
	Open outer package and remove outer lid	3/5/09	HK
	Photograph interior surface of test article and examine for any apparent indications of containment boundary loss, e.g. payload materials No apparent damage and no loss of contents.	3/5/09	HK
	Measure and record torque of interior bolts 30-50 Torque (ft-lbs)	3/5/09	HK
	Remove inner containment cavity blind flange	3/5/09	HK
	Examine and document condition of the gasket and payload contents Gasket and payload in good condition	3/5/09	HK
	Measure and record the pre-test and post-test centerline and near side distance to edge of cavity for comparison (See attached Measurement Data Sheet) N/A	3-5-09	WMA
	Remove (if possible) and document any apparent damage or movement to the inner containment cavity INNER Blind Flange Remains Sealed & Flat No Loss of MATL OUTSIDE INNER CONTAINMENT.	3-5-09	WMA
↓	Photograph inner cavity to provide visual evidence of any apparent damage	3-5-09	WMA

Century Industries **NCT and HAC Test Record No.** TS-001-5 **Page 1 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Package Serial No. 10552 (#3) Package Description: Versa-Pac (110-Gallon Version)

Test Program Manager: Willm. A U Date: 3-4-09
Test Engineer: Willm. A U Date: 3-4-09
Quality Assurance Coordinator: Heather Little Date: 3/5/09

Photographic Equipment

Sony Cyber-Shot (4.1 MegaPixel) Digital Camera DSC-P73
Sony Digital Handycam Mini-DV DCR-TR17
Sony Handycam Mini-DV DCR-HC20

Calibrated Equipment Utilized

Surface Thermometer S/N: 05548
Starrett Steel Tape Measure S/N: 084618446
Cummins Industrial Tools Tape Measure (25'x1") No. 3286

Package Preparation Checklist and Measurements

Procedure Step No.	Description	Date	Initials
8.1.2	Measure and record package temperature upon removal from conditioning room AT TRANSPORT -29°F Package temperature (°F)	3-5-09	WMA
	Photograph interior and exterior of the package prior to loading	3-4-09	WMA
	Measure centerline and near side distance to edge of cavity and mark on package	3-4-09	WMA
	Weigh empty test package 704 ~~705~~ WMA 3-4-09 Package tare weight (lbs)	3-4-09	WMA
	Load pre-loaded 30-gal drum into the test package, closed and torque drum to required torque of 60 ft./lbs.	3-4-09	WMA
	Spread one (1) pound of residual sand/dirt into the inner containment cavity	3-4-09	WMA
	Inspect the inner containment components for good condition and in accordance with drawings	3-4-09	WMA
	Install cavity gasket and blind flange, snug all bolts, then torque ~~to 40 ft-lbs~~ WMA 3-4-09 60 FT-Lbs.	3-4-09	WMA
	Install outer gasket and reinforced drum lid with proper bolts per drawing and torque ~~to 40 ft-lbs.~~ WMA 3-4-09 60 FT-Lbs.	3-4-09	WMA
	Install outer drum ring and torque to 60 ft-lbs	3-4-09	WMA

Century Industries **NCT and HAC Test Record No.** TS-001-5 **Page 2 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
8.1.2	Weigh loaded test package 965 Package test weight (lbs)	3-4-09	WMA
	Measure height from bottom rim to top of closure ring and diameter of outer package at center rolling hoop of drum and mark measurements on the test package 42 Package height (in.) 31 3/8 Package diameter (in.)	3/5/09	HR
	Verify the external acetate vent plug is in place	3/5/09	HR
↓	Photograph exterior of test package for evidence of pre-test condition	3/5/09	HR

Test Number (Description): 3A (NCT Center of Gravity Drop)

Procedure Step No.	Description	Date	Initials
8.1.2	Measure and record air temperature at drop pad 67.5 Air Temperature(°F) 5 Wind speed (mph)	3/5/09	HR
	Measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 57° Angle of orientation	3/5/09	HR
	Lift test article to required drop height	3/5/09	HR
↓	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 48 Drop test height (in.)	3/5/09	HR
8.1.3	Photograph exterior surfaces of test article for visual evidence of damage	3/5/09	HR
↓	Document visual damage to package (e.g. deformation or bolt failure) ~~2 9/16" crumpling ht. in lid~~ ~~7 1/2" x 20 1/2" deformation at bolt area.~~ HR 3/5/09 1 3/16 x 2 1/4" deformation at bolt area. Sketch of Damage: Top	3/5/09	HR
↓	Measure height and diameter of test package 41 3/4 Package height (in.) 31 3/16 Package diameter (in.)	3/5/09	HR

Century Industries **NCT and HAC Test Record No.** TS-001-5 **Page 3 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Test Number (Description): 3B (HAC - 30' Center of Gravity Drop

Procedure Step No.	Description	Date	Initials
8.2.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	3/5/09	HK
	Measure and record the air temperature at the drop pad 67.5 Air temperature(°F) 5 Wind speed (mph)	3/5/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 57° Angle of orientation	3/5/09	HK
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 360 Drop test height (in.)	3/5/09	HK
8.2.3	Photograph exterior surfaces of test article for visual evidence of additional damage	3/5/09	HK
	Document visual damage to package (e.g. deformation or bolt failure) 2 9/16" crumpling ht. in lid, 7 1/2" x 20 1/2" deformation at bolt area. Sketch of Damage  Top	3/5/09	HK
	Measure and record height and diameter of test article 41 9/16 Package height (in.) 30 7/8 Package diameter (in.)	3/5/09	HK

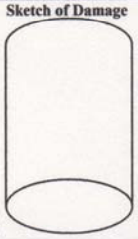
Test Number (Description): 3C (HAC-30' Shallow Angle Accelerated Drop)

Procedure Step No.	Description	Date	Initials
8.3.2	Photograph exterior surfaces of test article for visual evidence of pre-test condition	3/5/09	HK
	Measure and record the air temperature at the drop pad 67.5 Air temperature (°F) 5 Wind speed (mph)	3/5/09	HK
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) 17° Angle of orientation	3/5/09	HK

Century Industries
Bristol, Virginia

NCT and HAC Test Record No. TS-001-5
in accordance with
Versa- Pac Test Specification, TS-001, Rev. 0

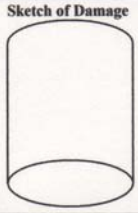
Page 4 of 5

Procedure Step No.	Description	Date	Initials
8.3.2	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) 360 Drop test height (in.)	3/5/09	HL
8.3.3	Photograph exterior surfaces of test article for visual evidence of additional damage	3/5/09	HL
↓	Document visual damage to package (e.g. deformation or bolt failure) 4 3/4" x 14 1/2" deformation on bottom of drum. Sketch of Damage  Top	3/5/09	HL
↓	Measure and record height and diameter of test article 42 3/8 Package height (in.) 29 3/4 Package diameter (in.) at bolt	3/5/09	HL

Test Number (Description): N/A

Procedure Step No.	Description	Date	Initials
	Photograph exterior surfaces of test article for visual evidence of pre-test condition		
	Measure and record the air temperature at the drop pad _____ Air temperature(°F) _____ Wind speed (mph)		
	Once suspended, measure and record the angle at which the test article is oriented to the nearest degree (within ±1 degree of specified drop orientation) _____ Angle of orientation		
	Measure and record height from test pad surface to lowest point on test package (at least the specified drop height and not more than +2 inches) _____ Drop test height (in.)		
	Photograph exterior surfaces of test article for visual evidence of additional damage		

Century Industries **NCT and HAC Test Record No.** TS-001-5 **Page 5 of 5**
Bristol, Virginia **in accordance with**
Versa- Pac Test Specification, TS-001, Rev. 0

Procedure Step No.	Description	Date	Initials
	Document visual damage to package (e.g. deformation or bolt failure) _____ _____ _____ _____ _____ Top 		
	Measure and record height and diameter of test article _____ Package height (in.) _____ Package diameter (in.)		

Final Test Record Measurements

Procedure Step No.	Description	Date	Initials
8.3.3	Measure and record torque of outer closure bolts ≤20 Torque (ft-lbs)	3/5/09	HL
	Open outer package and remove outer lid	3/5/09	HL
	Photograph interior surface of test article and examine for any apparent indications of containment boundary loss, e.g. payload materials No apparent damage to containment lid and no loss of contents. Some inner wall deformation.	3/5/09	HL
	Measure and record torque of interior bolts ≤20 Torque (ft-lbs) 3 bolts with 25, 30+ 40 ft.-lbs.	3/5/09	HL
	Remove inner containment cavity blind flange	3/5/09	HL
	Examine and document condition of the gasket and payload contents Gasket and payload in good condition.	3/5/09	HL
	Measure and record the pre-test and post-test centerline and near side distance to edge of cavity for comparison (See attached Measurement Data Sheet) N/A	3-5-09	WMA
	Remove (if possible) and document any apparent damage or movement to the inner containment cavity Blind Flange on inner containment flat, sealed with no matl. escaping from inner containment area.	3-5-09	WMA
	Photograph inner cavity to provide visual evidence of any apparent damage	3-5-09	WMA

Attachment D

Preliminary Drop Test Results & Conclusions

(9 Pages)

Century Industries Box 17084, Bristol, Virginia 24209
E-mail:CenturyIndWMA@aol.com Phone: 423-646-1864

Test Results
For
Preliminary Performance Evaluation
Of
Century Industries' Model VP-55 & VP-110
Versa-Pac Shipping Container

Prepared & Conducted By:
Century Industries
William M. Arnold

Prepared By: _____ Date: July 16, 2008

Proprietary Information Notice

Table of Contents

1.0 INTRODUCTION

This report describes the results and conclusions drawn from the development, manufacture and preliminary testing of the Versa-Pac Shipping Containers in both the 55 and 110 gallon version. The preliminary testing was conducted by Century Industries located in Bristol, Virginia on July 16, 2008. This report includes the test objective, tested positions, item description, test results and other applicable items including photographs of the testing.

2.0 OBJECTIVE

The objective of this test program was to conduct the preliminary physical performance evaluation tests on Century Industries VP-55 and VP-110 Versa-Pac Shipping Container. Century Industries is the designer and manufacturer of the packages, in accordance with the normal conditions and hypothetical accident conditions specified in Title 10 Part 71.73.

The test items were identified as Versa-Pac shipping container prototypes and subjected to the following performance tests:

1. Initial visual inspection of the outer and inner container surfaces.
2. Drop testing in accordance with 10 CFR 71.73 (c)(1),(2) & (3) in a variety of orientations described below.
3. Post Test Visual Inspection of the outer and interior container surfaces.

Following each test the physical condition of the shipping container was inspected and the results recorded.

3.0 RESPONSIBILITIES

Century Industries personnel conducted the preliminary tests and were responsible for the base analysis of the test articles.

The tests were performed in accordance with the applicable requirements and guidance of Century Industries QA Program QA-1 Revision 1 and 10 CFR 71.

4.0 TEST ITEM DESCRIPTIOPN

The Versa-Pac Shipping Container is designed for the shipment of Type A radioactive and fissile materials in the form U-metal, oxides, fluorides and nitrate for both product and scrap materials. The fissile payload was design for 350 grams at 100% enrichment and a criticality safety index of 1.5.

The Versa-Pac Shipping Container was designed in two basic versions, a UN1A2 -55 gallon and 110 gallon outer drum with a 16 gauge body, bottom and cover, in addition to the standard 12 gauge closure ring with a 5/8" ASTM A307 bolt, the cover is reinforced and secured using the addition of bolts attached to the internal structure of the package as detailed in the design drawings. The internal structure consists of vertical and horizontal stiffeners at specific points around the package. Outer and inner 16 gauge liners, with an insulating ceramic fiber blanket between the liners complete the primary inner structural components. A secondary barrier of insulation consisting of ceramic fiber blanket; surround the inner containment body. The payload gasket is silicone rubber. The gasketed payload containment cavity is made of 10 gauge body and bottom with a ¼" thick top flange to which in the initial series of testing, a 3/16" thick top flange was secure using 12 -1/2" bolts. Closed cell polyurethane foam is utilized to provide insulation and added impact protection, to both the top and bottom of the Versa-Pac. The top insulation plug is encapsulated in sheet metal welded to the outer drum closure lid. Plastic plugs enclosed within the body of the structure provide a path for venting to the external acetate plug on the exterior of the drum. The cavity is designed to be loaded directly or with the use of an insert to reduce the diameter or with up to a 30 gallon standard drum in the 110 gallon version.

The Versa-Pac was designed in accordance with the requirements of 10 CRF 71 and Century Industries – QA-8, Plan for Manufacture of Versa-Pac Shipping Containers.

Century Industries was responsible for the design, fabrication, inspection, measurements and the loading of payload and payload containers with multiple size gravels and loose sand.

5.0 TEST FACILITES & EQUIPMENT

5.1 Drop Test Pad Facilities

The drop test pad consists of a 70 ton concrete pad made in accordance with IAEA Safety Series No. 37. The pad is 10 feet wide by 10 feet long by 10 feet deep, reinforced with a grid of ¾ inch re-bar spaced on 12 inch centers and capped with a 1 inch thick by 8 feet wide by 10 feet long carbon steel plate, which is embedded into the surface of the concrete and secured by fourteen 1-1/2 inch diameter bolts by 16 inches long.

5.2 Release Device

The release device utilized was capable of releasing the package in a manner that provided a smooth clean drop without imparting any twisting or turning of the package. The device has a safe working load limit of 18,000 pounds. The test articles were lifted into place by use of a crane.

5.3 Orientation and Angles

The orientation if each drop was controlled by the use of nylon fixed straps and adjustable straps used to set the angles required. The orientation of the container was verified using a magnetic protractor attached to the test article surface.

5.4 Measurements and Weights

Drop heights were determined by use of a pre-measured plumb line The test items tare weights and payload weights were made using floor scales supplied calibrated by Carlton Scales, Kingsport, Tennessee and traceable to NIST.

5.5 Temperature and Wind Speed

Air temperature and wind speed was obtained thru the local metro airport service.

5.6 Puncture Device

The puncture device consist of a 6 inch diameter by 22 inches long carbon steel round bar welded to a ¾ inch thick plate, which was then secured to the drop test pad by means of tack welding to the center of the pad.

5.7 Photographic Equipment

Color photographs were taken with a Sony 4.1 Mega pixel digital camera by Century Industries. Video was taken using Sony Digital Handy Cam Mini DV equipment.

6.0 ACCEPTANCE CRITERIA

The acceptance criteria for this series of testing was retention of the outer closure, no openings, tears or failure that would lead to loss of materials, no open pathway to the insulation materials and no loss of the inner containment payload.

7.0 TEST PREPARATION AND RESULTS

7.1 Initial Inspection

On July 16, 2008, the visual inspection of the test item was conducted prior to performing the preliminary physical evaluation tests. During the inspection no damage was found to the exterior or interior surface of the shipping containers.

7.2 Weights and Payload

The package tare and gross weights were recorded. In order to provide the test articles with the most aggressive challenge to the inner payload containment of the Versa-Pac it was decided to use a 30 gallon drum in the 110 version partially filled with contents of multiple size gravel and sand. The 55 gallon version was also filled with multiple sized gravel and sand directly into the containment cavity. These payloads would provide a secondary piston action within the containment cavities.

tem/Version	55 Gallon	110 Gallon
Package Tare Weight	375	587
Payload Drum/Gravel and Sand	231	266.5
Total	606 lbs.	853.5 lbs.

7.3 Loading of the Test Item

Once loaded, the appropriate gaskets were placed into position and the bolts inserted and hand tightened. The inner flange bolts were then tightened using an alternating method and torqued to 40 ft/lbs. The top gasket and outer closure, which includes the polyurethane foam insulation top plug, were installed on each of the test articles and the top outer bolts installed and torqued using the same alternating method to a tension of 40 ft/lbs. The outer drum closure rings were then installed and tightened to a torque of 60 ft/lbs.

8.0 DROP TEST SEQUENCES

The drop test sequences were chosen based upon historical drop testing of other package systems. Both test articles were produced in accordance with the fabrication drawings and QA-8, plan for the Manufacture of Versa-Pac Shipping Containers.

9.0 55 GALLON VERSION

9.1 HAC 30' Drop onto the Top Bolt Closure Center of Gravity

The test package was lifted to a height of 30 feet from the lowest point of the package to the surface of the test pad at an angle of 56 degrees from the horizontal, so as to make contact with the top bolt closure ring. The air temperature at the start of testing was 75°F and wind speed was 3 mph. The package was suspended from a crane by use of a sling and attached to a release mechanism. It was released so that it did not impart rotational motion into the package free fall to the test pad. Damage to the package at the impact point was a deformation 16 inches long by 1-1/12 inches deep. The closure ring and all bolts remained in tact and secure with no tears or openings in the package.

9.2 HAC 30' Drop onto the Bottom Edge thru the Center of Gravity

The test package was lifted to a height of 30 feet from the lowest point of the package to the surface of the test pad at an angle of 55 degrees from the horizontal, so as to make contact with the bottom edge of the package. The package was suspended from a crane by use of a sling and attached to a release mechanism. It was released so that it did not impart rotational motion into the package free fall to the test pad. Damage to the package at the impact point was a deformation 8 inches long by 1-1/4 inches deep. The closure ring and all bolts remained in tact and secure with no tears or openings in the package.

9.3 HAC Crush Plate Drop onto the Side of the Package

The 55 gallon test package was place on its side on the test pad surface with the crush plate positioned to impact the side of the package at 0 degrees. The crush plate was suspended from a crane at a height 30 feet from the bottom of the plate to the surface of the test package, by use of slings and attached to the release mechanism. It was released so that it did not impart rotational motion into the crush plate free fall to the side of the test package. The impact of the crush test plate on the side of the package resulted in an oval shape to the diameter of the package with measurements of 25 inches by 21-7/8 inches. The impact side of the package produced a flat spot the entire length of the package 9 inches in width. The test pad side of the package produced the same flattening that measured 8-1.2 inches wide. The closure ring and all bolts remained in tact and secure with no tears or openings in the package.

9.4 Puncture Testing

The package was subjected to three separate puncture tests the first impact was to the side of the package between the vertical stiffeners which produced a ¾ inch depression. The second was to the top end of the container with a depression measuring 1 inch deep and one onto the bottom which resulted in a minor indentation of 1/4 inch deep. All drops were made from a height of 1 meter from the lowest point of the package to the top of the puncture ram. There were no tears, opening or other unacceptable damage from these drops.

9.5 Results and Conclusions

As a result of these tests the outer closure bolts recorded a post test torque of 30 ft/lbs. The containment flange bolts were torqued prior to removal and recorded at 30 ft/lbs. The gaskets and the internal cavity of the containment were found to be in good condition with no damage. The conclusion of this test is that the 55 gallon version successfully accomplished the requirements set forth in the acceptance criteria of this report.

10.0 110 GALLON VERSION

10.1 HAC 30' Drop onto the Top Bolt Closure Center of Gravity

The test package was lifted to a height of 30 feet from the lowest point of the package to the surface of the test pad at an angle of 58 degrees from the horizontal, so as to make contact with the top bolt closure ring. The air temperature at the start of testing was 78°F and wind speed was 2 mph. The package was suspended from a crane by use of a sling and attached to a release mechanism. It was released so that it did not impart rotational motion into the package free fall to the test pad. Damage to the package at the impact point was a deformation 14 inches long by 3 inches deep. The closure ring and all bolts remained in tact and secure with no tears or openings in the package.

10.2 HAC 30' Drop onto the Bottom Edge thru the Center of Gravity

The test package was lifted to a height of 30 feet from the lowest point of the package to the surface of the test pad at an angle of 56 degrees from the horizontal, so as to make contact with the bottom edge of the package. The package was suspended from a crane by use of a sling and attached to a release mechanism. It was released so that it did not impart rotational motion into the package free fall to the test pad. Damage to the package at the impact point was a deformation 18 inches long by 2-1/2 inches deep. The closure ring and all bolts remained in tact and secure with no tears or openings in the package.

10.3 HAC Crush Plate Drop onto the Side of the Package

The 55 gallon test package was place on its side on the test pad surface with the crush plate positioned to impact the side of the package at 0 degrees. The crush plate was suspended from a crane at a height 30 feet from the bottom of the plate to the surface of the test package, by use of slings and attached to the release mechanism. It was released so that it did not impart rotational motion into the crush plate free fall to the side of the test package. The impact of the crush test plate on the side of the package resulted in a slight oval shape to the diameter of the package, with the lid closure bent out 2-1/2 inches at the drum closure to top flange interface. The impact side of the package produced a flat spot the entire length of the package 12 inches in width. The test pad side of the package produced the same flattening that measured 9 inches wide. The closure ring and all bolts remained in place, the opening at the closure lid edge was found to be unacceptable.

10.4 Puncture Testing

The package was subjected to three separate puncture tests the first impact was to the side of the package between the vertical stiffeners which produced a 5/16 inch depression. The second was to the top end of the container thru the center of gravity with a depression measuring a total of 2-3/4 inch deep and one onto the bottom which resulted in a minor indentation of 1/4 inch deep. All drops were made from a height of 1 meter from the lowest point of the package to the top of the puncture ram. There were no tears, opening or other unacceptable damage that resulted from these drops.

10.5 Results and Conclusions

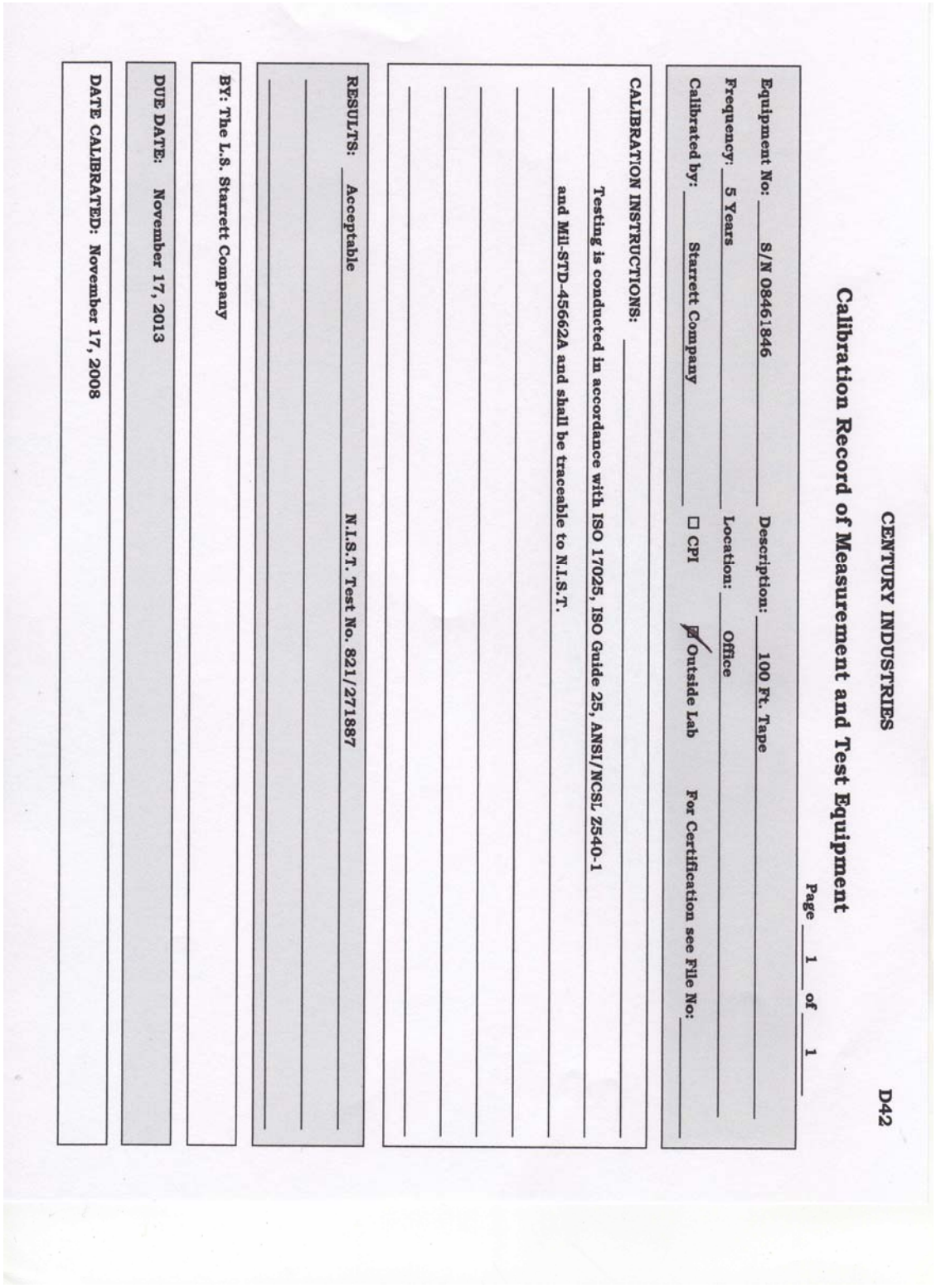
Following these tests the outer lid was removed exposing a small bulge in the inner containment flange, but no loss of materials was found. The containment flange bolts were torqued prior to removal and recorded at 30 ft/lbs. The gaskets and the internal cavity of the containment were found to be in good condition with no damage. The conclusion of this test is that the 110 gallon version was not success in meeting the requirements set forth in the acceptance criteria of this report due to the buckle in the outer closure lid which resulted form the impact of the crush plate drop test. Upon examination of the test package it was determined that there was to much spacing between the vertical stiffeners and top closure bolts making the top closure point to weak to pass the crush test considering the weight of the package. This was based largely upon the results from the successful 55 gallon testing. In order to correct the design difficulties in the 110 gallon version it has been decided to reduce the spacing of the top closure bolts and add additional stiffeners and bolts to the package design of the 110 gallon version.

Attachment E

Training & Equipment Calibration Records

(8 Pages)

Starett 100' Tape Measure Calibration Record



CENTURY INDUSTRIES

D42

Calibration Record of Measurement and Test Equipment

Page 1 of 1

Equipment No: S/N 08461846 Description: 100 Ft. Tape

Frequency: 5 Years Location: Office

Calibrated by: Starrett Company ☐ CPI ☑ Outside Lab For Certification see File No:

CALIBRATION INSTRUCTIONS:

Testing is conducted in accordance with ISO 17025, ISO Guide 25, ANSI/NCSL Z540-1 and Mil-STD-45662A and shall be traceable to N.I.S.T.

RESULTS: Acceptable N.I.S.T. Test No. 821/271887

BY: The L.S. Starrett Company

DUE DATE: November 17, 2013

DATE CALIBRATED: November 17, 2008

E-1

Starrett®

The L.S. Starrett Company
121 Crescent Street
Athol, MA 01331-1915 USA
Tel.: 978 249-3551
Fax.: 978 249-8495
www.starrett.com

ATTN: QUALITY ASSURANCE
MCMASTER-CARR SUP CO
6100 FULTON IND BLVD
ATLANTA GA 30336-2853

NOVEMBER 17, 2008

STANDARD LETTER of CERTIFICATION

THIS IS TO CERTIFY THAT THE ITEM LISTED BELOW MEETS THE REQUIREMENTS OF ACCURACY OF THE APPLICABLE SPECIFICATION ON DATE OF SHIPMENT.

STANDARDS AND EQUIPMENT USED FOR INSPECTION ARE CERTIFIED ACCURATE WITH REFERENCE TO 68 DEGREES F, TRACEABLE TO MASTER STANDARDS AT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, WASHINGTON, D.C. CALIBRATION IS PERFORMED WITH TRANSFER STANDARDS WHICH ARE PROGRESSIVELY MORE ACCURATE IN THE ORDER OF 4: 1.

WE ATTEST THAT OUR MEASURING AND TEST EQUIPMENT, AND CALIBRATIONS PERFORMED ON THE ITEM (S) LISTED BELOW, ARE IN ACCORDANCE WITH ISO 17025, ISO GUIDE 25, ANSI/NCSL Z540-1 AND MIL-STD-45662A.

YOURS VERY TRULY,
THE L. S. STARRETT COMPANY

Candace Sheffield

DEXTER J. CARLSON,
CHIEF INSPECTOR

YOUR ORDER NO.	OUR ORDER NO.	TOOL	SPECIFICATION
QA-87917960	1335247	530-100 TAPE S/N 08461846	GGG-T-106F NIST HANDBOOK #44

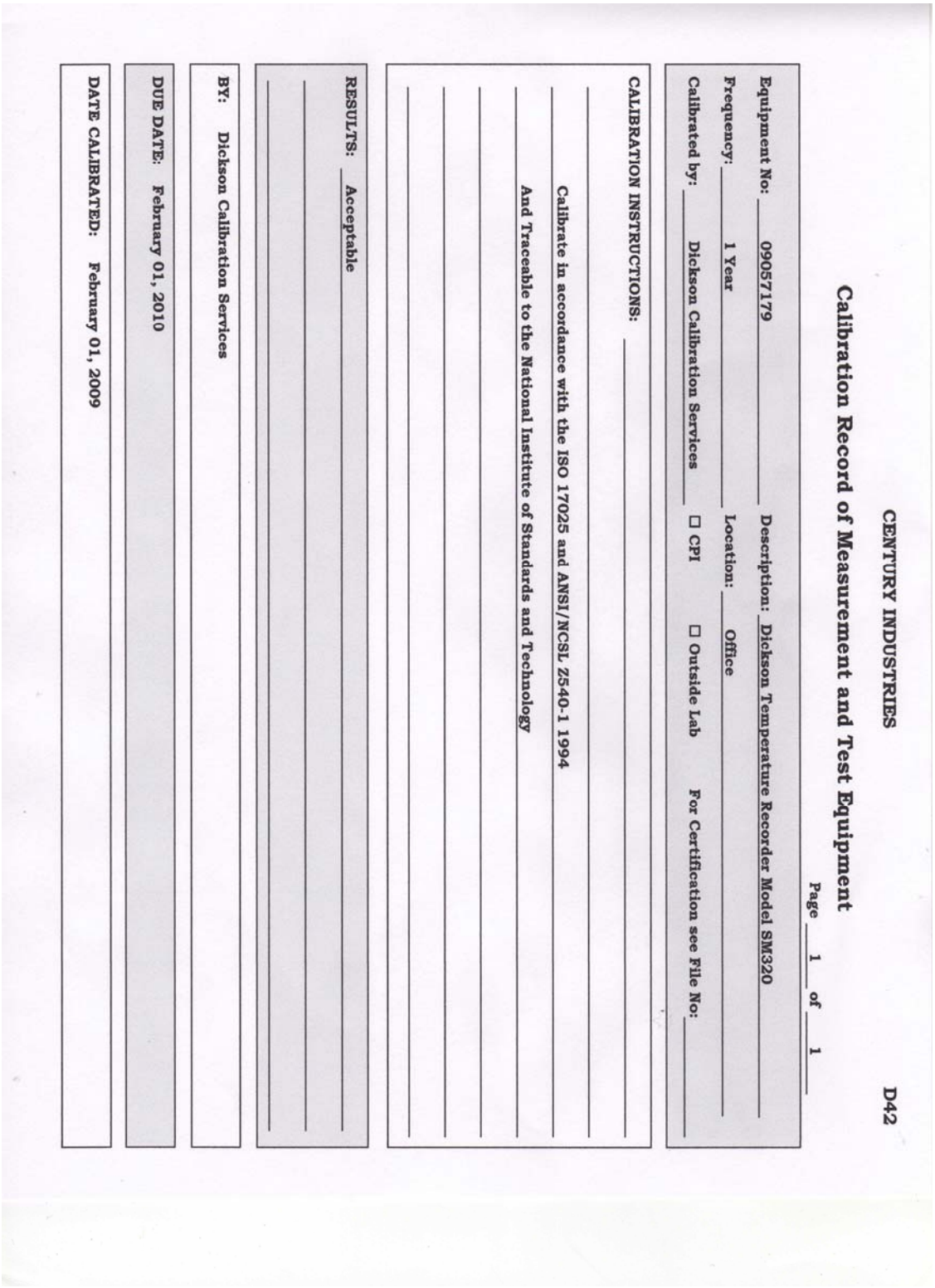
N.I. S.T. TEST NO.
821/271887

ACCURACY-WHEN THE TAPE IS SUPPORTED ON A HORIZONTAL SURFACE, AND PULLED WITH A TENSION OF 10 POUNDS AT A TEMPERATURE OF 68 DEGREES FAHRENHEIT, THE OVERALL LENGTH WILL NOT BE IN ERROR BY MORE THAN .100" IN 100' OR LESS.

The estimated uncertainties reflect a Confidence Probability of approximately 95%.

E-2

Calibration Record for Dickson Data Thermometer



CENTURY INDUSTRIES D42

Calibration Record of Measurement and Test Equipment

Page 1 of 1

Equipment No: 09057179 Description: Dickson Temperature Recorder Model SM320

Frequency: 1 Year Location: Office

Calibrated by: Dickson Calibration Services ☐ CPI ☐ Outside Lab For Certification see File No:

CALIBRATION INSTRUCTIONS:

Calibrate in accordance with the ISO 17025 and ANSI/NCSL Z540-1 1994

And Traceable to the National Institute of Standards and Technology

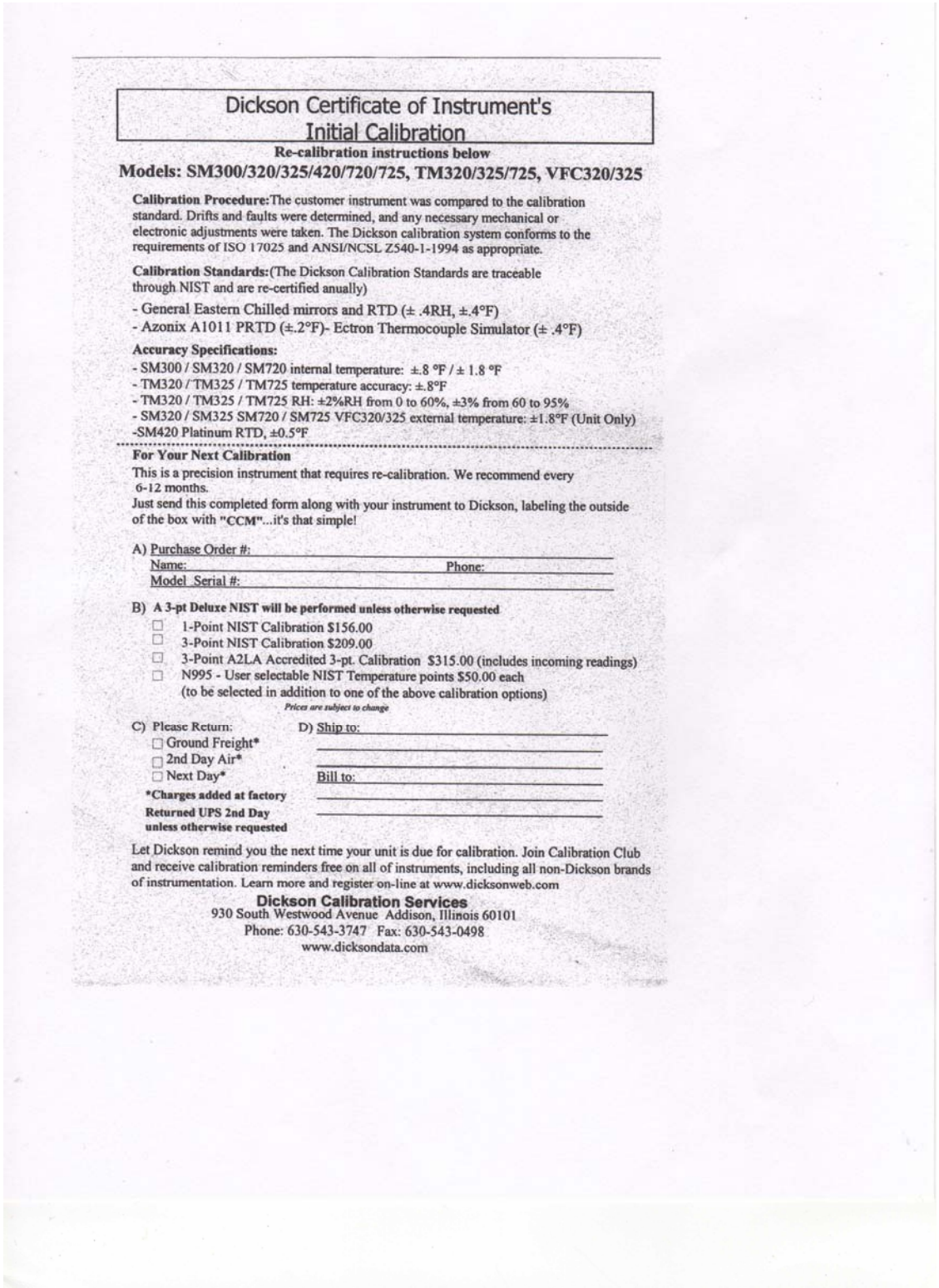
RESULTS: Acceptable

BY: Dickson Calibration Services

DUE DATE: February 01, 2010

DATE CALIBRATED: February 01, 2009

E-3



Dickson Certificate of Instrument's Initial Calibration

Re-calibration instructions below

Models: SM300/320/325/420/720/725, TM320/325/725, VFC320/325

Calibration Procedure: The customer instrument was compared to the calibration standard. Drifts and faults were determined, and any necessary mechanical or electronic adjustments were taken. The Dickson calibration system conforms to the requirements of ISO 17025 and ANSI/NCSL Z540-1-1994 as appropriate.

Calibration Standards: (The Dickson Calibration Standards are traceable through NIST and are re-certified anually)

- General Eastern Chilled mirrors and RTD (± .4RH, ±.4°F)
- Azonix A1011 PRTD (±.2°F)- Ectron Thermocouple Simulator (± .4°F)

Accuracy Specifications:

- SM300 / SM320 / SM720 internal temperature: ±.8 °F / ± 1.8 °F
- TM320 / TM325 / TM725 temperature accuracy: ±.8°F
- TM320 / TM325 / TM725 RH: ±2%RH from 0 to 60%, ±3% from 60 to 95%
- SM320 / SM325 SM720 / SM725 VFC320/325 external temperature: ±1.8°F (Unit Only)
- SM420 Platinum RTD, ±0.5°F

For Your Next Calibration

This is a precision instrument that requires re-calibration. We recommend every 6-12 months.

Just send this completed form along with your instrument to Dickson, labeling the outside of the box with **"CCM"**...it's that simple!

A) Purchase Order #: _____

Name: _____ Phone: _____

Model Serial #: _____

B) **A 3-pt Deluxe NIST will be performed unless otherwise requested**

- ☐ 1-Point NIST Calibration $156.00
- ☐ 3-Point NIST Calibration $209.00
- ☐ 3-Point A2LA Accredited 3-pt. Calibration $315.00 (includes incoming readings)
- ☐ N995 - User selectable NIST Temperature points $50.00 each (to be selected in addition to one of the above calibration options)

Prices are subject to change

C) Please Return:

- ☐ Ground Freight*
- ☐ 2nd Day Air*
- ☐ Next Day*

***Charges added at factory**

Returned UPS 2nd Day unless otherwise requested

D) Ship to: _____

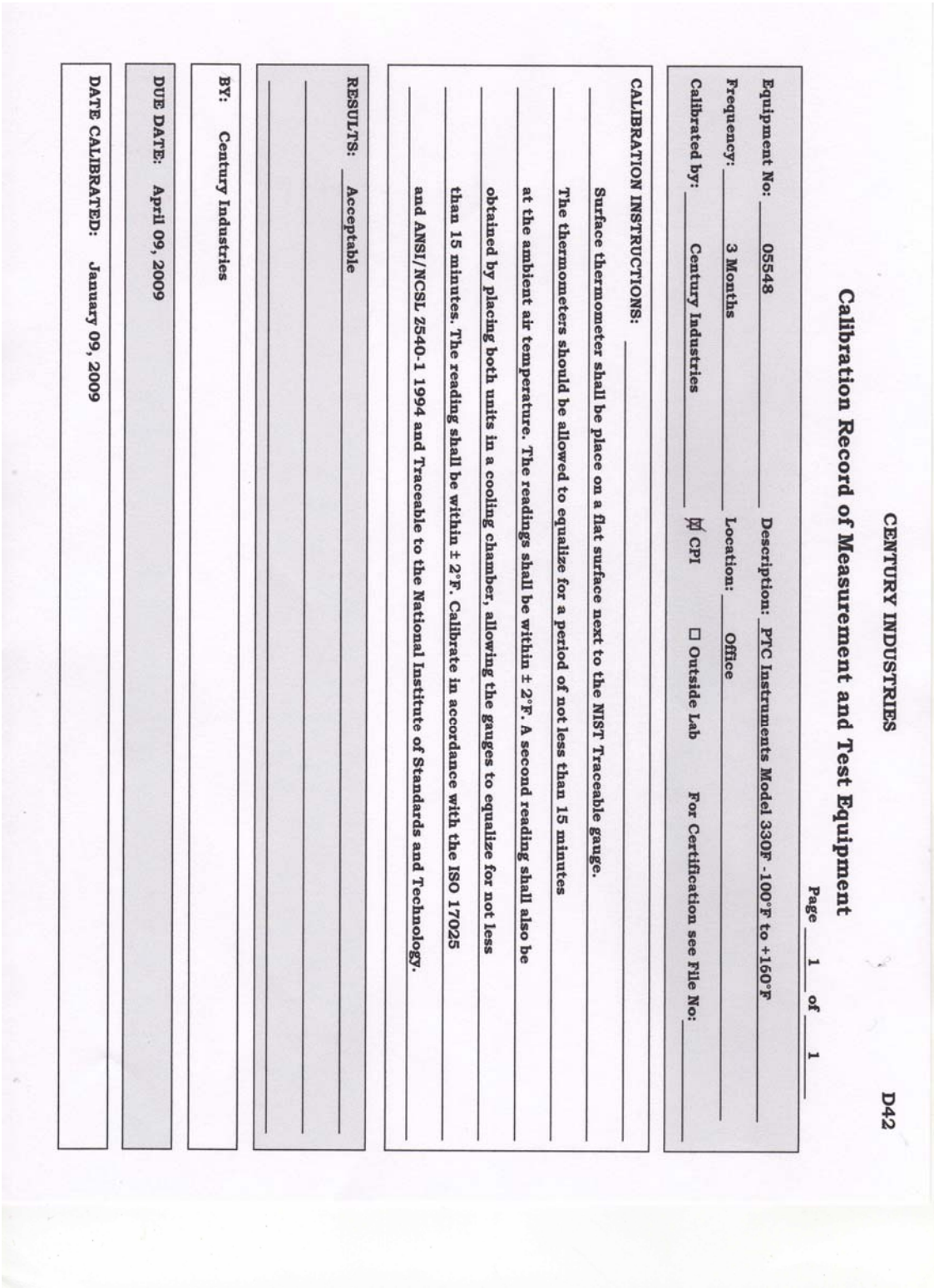
Bill to: _____

Let Dickson remind you the next time your unit is due for calibration. Join Calibration Club and receive calibration reminders free on all of instruments, including all non-Dickson brands of instrumentation. Learn more and register on-line at www.dicksonweb.com

Dickson Calibration Services
930 South Westwood Avenue Addison, Illinois 60101
Phone: 630-543-3747 Fax: 630-543-0498
www.dicksondata.com

E-4

Calibration Record for PTC Surface Thermometer



CENTURY INDUSTRIES D42

Calibration Record of Measurement and Test Equipment

Page 1 of 1

Equipment No: 05548 Description: PTC Instruments Model 330F -100°F to +160°F

Frequency: 3 Months Location: Office

Calibrated by: Century Industries ☒ CPI ☐ Outside Lab For Certification see File No:

CALIBRATION INSTRUCTIONS:

Surface thermometer shall be place on a flat surface next to the NIST Traceable gauge.

The thermometers should be allowed to equalize for a period of not less than 15 minutes

at the ambient air temperature. The readings shall be within ± 2°F. A second reading shall also be

obtained by placing both units in a cooling chamber, allowing the gauges to equalize for not less

than 15 minutes. The reading shall be within ± 2°F. Calibrate in accordance with the ISO 17025

and ANSI/NCSL Z540-1 1994 and Traceable to the National Institute of Standards and Technology.

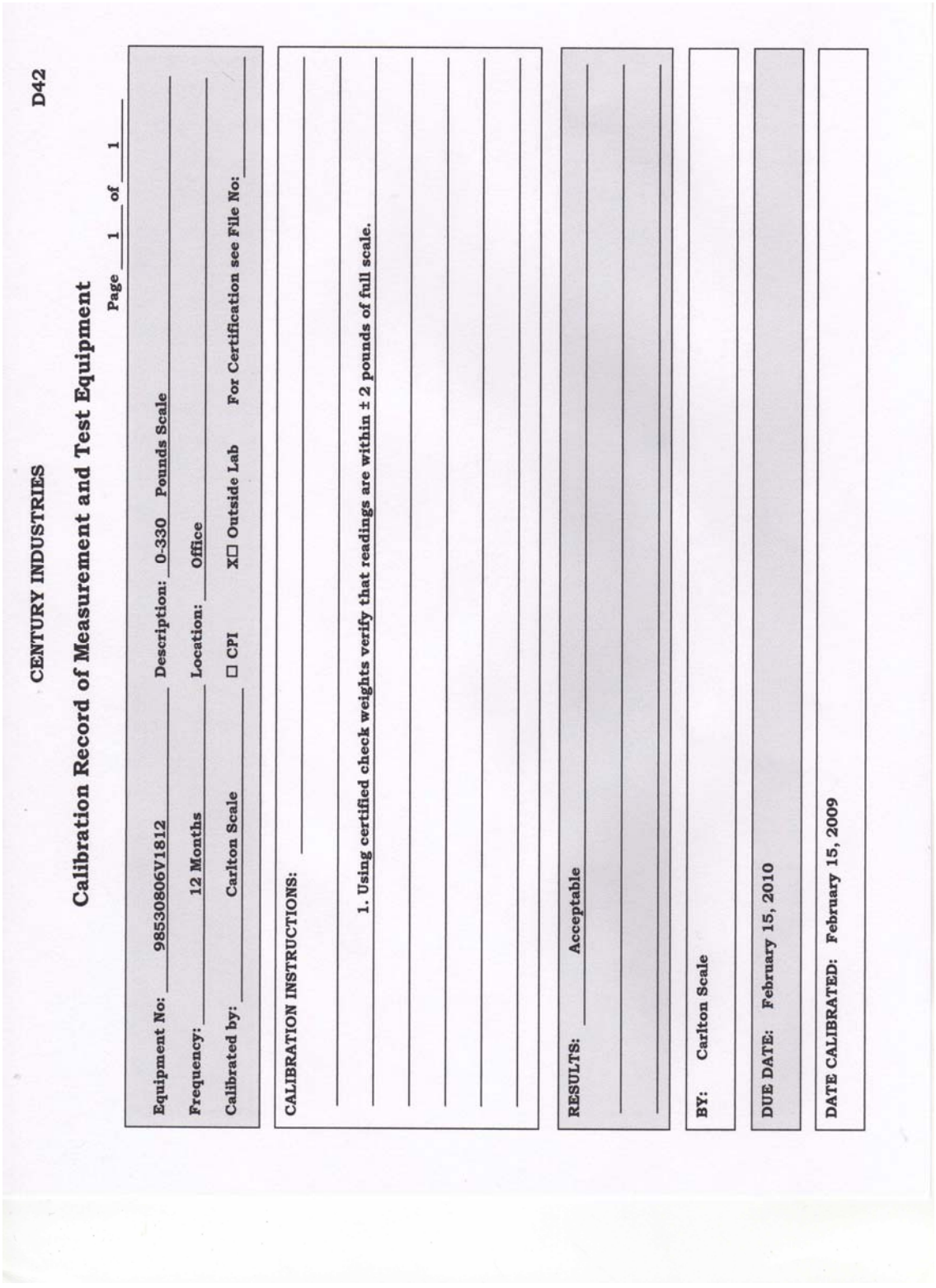
RESULTS: Acceptable

BY: Century Industries

DUE DATE: April 09, 2009

DATE CALIBRATED: January 09, 2009

Floor Scale



CENTURY INDUSTRIES D42

Calibration Record of Measurement and Test Equipment

Page 1 of 1

Equipment No: 985308006V1812 Description: 0-330 Pounds Scale

Frequency: 12 Months Location: Office

Calibrated by: Carlton Scale ☐ CPI X☐ Outside Lab For Certification see File No:

CALIBRATION INSTRUCTIONS:

1. Using certified check weights verify that readings are within ± 2 pounds of full scale.

RESULTS: Acceptable

BY: Carlton Scale

DUE DATE: February 15, 2010

DATE CALIBRATED: February 15, 2009

Indoctrination or Training Session Outline D52

Century Industries
P.O. Box 17084
Bristol, VA 24209
423-646-1864

Page 1 of 1

Title **TEST SPECIFICATION & TEST PLAN FOR THE VERSA-PAC SHIPPING CONTIANER** **Type:** ☑ Indoct. ☑ Training **Recommended Min. Duration:** 40 min.	**Dept** Testing Assistants **Outline No** 4F **Rev.** 0 **APPROVED:** Will M. Hall 2-25-09 **Department Manager** **Date** Will M. Hall 2-25-09 **QA Manager** **Date**

1. **Review duties and responsibilities per:**

   TS-001 Rev. 0 – Versa-Pac Test Specification

   TP-001 Rev. 0 – Versa-Pac Shipping Container Test Plan

E-7

Session Record **D50**

TEST PERSONNEL

Department

Century Industries

P.O. Box 17084
Bristol, VA 24209
423-646-1864

Position/Job Classification: Test Assistant

Outline Number: 4F **Date Completed** 2-25-09 **Duration** 1 HR.

Remarks:

Instructor 2-25-09 Date

The following Personnel have satisfactorily completed the above indoctrination or training outline:

Employee	Employee
Steve Salla	
Jamie Butler	
Dawn Seller	
Teddy Bruce	
Mark Osborne	
Heather Little	