2.12.11 Test Report #1 for Test Plan 186 Rev 1 (minus Sections 8.4 & 8.5)

QSA GLOBAL	Document Number F-E-1808-2 Test Report Cover Sheet	Revision 1

TEST REPORT #1
FOR TEST PLAN 186

Model 880 Pipeliner
Type (B) Transport Package Test Results

10 CFR 71, Packaging and Transportation of Radioactive Materials
Subpart F – Package, Special Form, and LSA-III Tests
Sect 71.71 Normal Conditions of Transport
Sect 71.73 Hypothetical Accident Conditions

Originator	Paul Rice	Date: 12 AUG 2010

APPROVALS		
Engineering		Date: 23 Jun 10
Regulatory		Date: 11 Aug 10
Quality Assurance		Date: 12 Aug 10

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Drop Pad – T10740 38
Puncture Billet – T10143 39
Omega Temperature Gauge – T198776 40
O'Haus Digital Scale – 0009986-6CE 42

Section 1 Introduction

This document describes the mechanical test results for the Model 880 Pipeliner Projector to meet NRC requirements for Type B(U)-96 packages as described in the Code of Federal Regulations, 10 CFR Part 71 , revised as of January 1, 2009.

The test report also covers the criteria stated in the International Atomic Energy Agency (IAEA), Safety Standards Series No. TS-R-1, Regulations for the Safe Transport of Radioactive Material, 1996 Edition, Section VI.

This document describes the test package specifications, testing equipment, testing results, describes the package orientations for the different test specimens and records of the tests performed and results of those tests.

This series of tests evaluated the Pipeliner Jacket assembly mounted on the Model 880 Projector.

Section 2 Construction and Acceptance of Test Specimens

The Model 880 assemblies used for these devices were originally manufactured by QSA Global as production Model 88015.

The assemblies were retrofitted to the PipeLiner configuration by QSA Global production personnel under TMI279.

The PipeLiner retrofit components for these devices were supplied and assembled by IRSS.

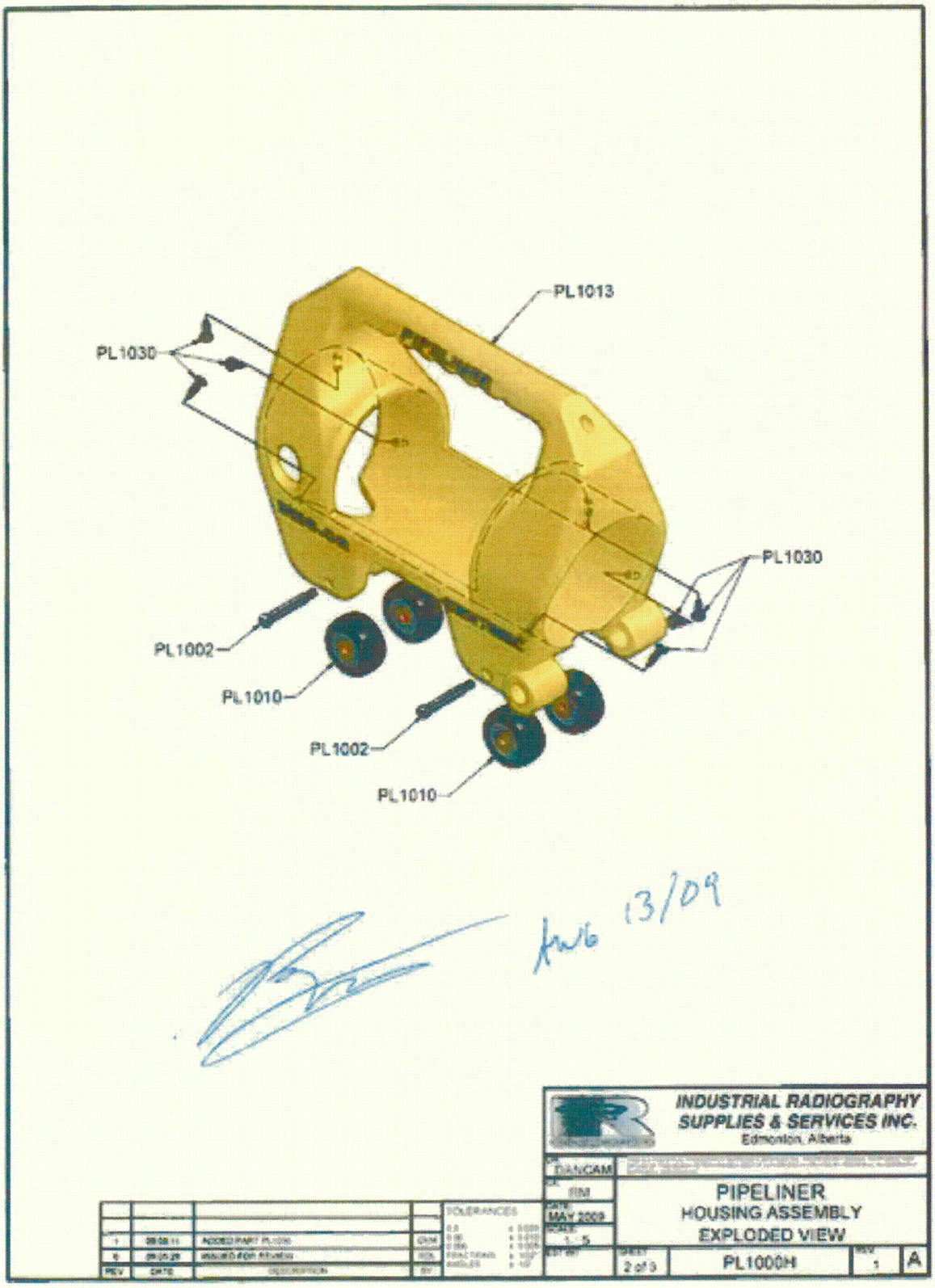
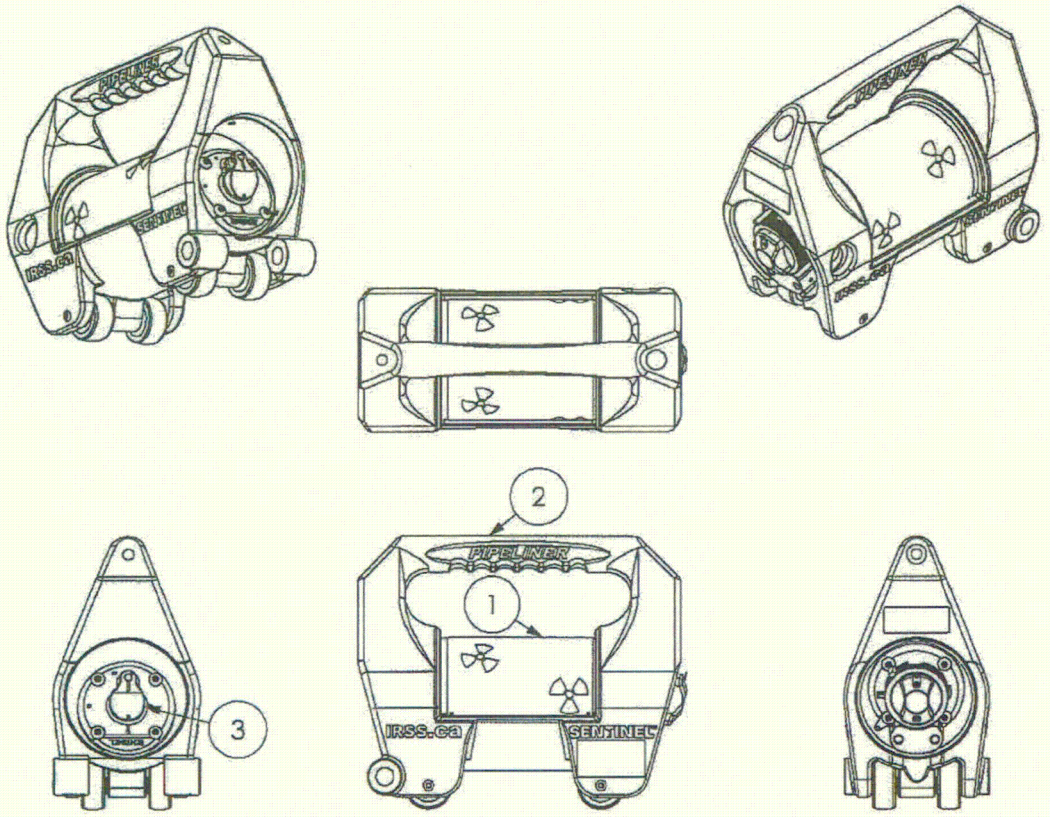


FIGURE 2.1 PIPELINER JACKET ASSEMBLY, IRSS PART NO PL1000H

REVISIONS				
REV.	ERF	DESCRIPTION	APPROVALS	DATE
A	2277	INITIAL RELEASE	SEE TITLE BLOCK	



MAXIMUM ASSEMBLY WEIGHT AS SHOWN: 55 LBS

ITEM	NUMBER	QTY	TITLE
4	424-9	1	SIMULATED SOURCE CAPSULE - NOT SHOWN
3	KIT018	1	FRONT PLATE - DETENT RETROFIT KIT
2	PL1000H	1	PIPELINER JACKET ASSEMBLY
1	88015	1	MODEL 880 150 Ci BODY ASSEMBLY

UNLESS OTHERWISE SPECIFIED:

1. DIMENSIONS ARE IN INCHES.
2. DIMENSIONS APPLY AFTER FINISH.
3. NOTES APPLY TO ALL SHEETS.
4. REMOVE ALL BURR & SHARP EDGES.
5. 63 RMS MAX. SURFACE ROUGHNESS.
6. DO NOT SCALE DRAWING.

TOLERANCES:

FRACTIONAL: ± 1/64
TWO PLACE DECIMAL: ±0.01
THREE PLACE DECIMAL: ±0.005
ANGULAR: MACH ±1° & BEND ±5°

DRAWN: 09 DEC 09
APPR.: 10 Dec 09
MATERIAL: SEE BOM
FINISH: NA
SAFETY CLASS: A
THIRD ANGLE PROJECTION

QSA GLOBAL
40 NORTH AVE. BURLINGTON, MA 01803

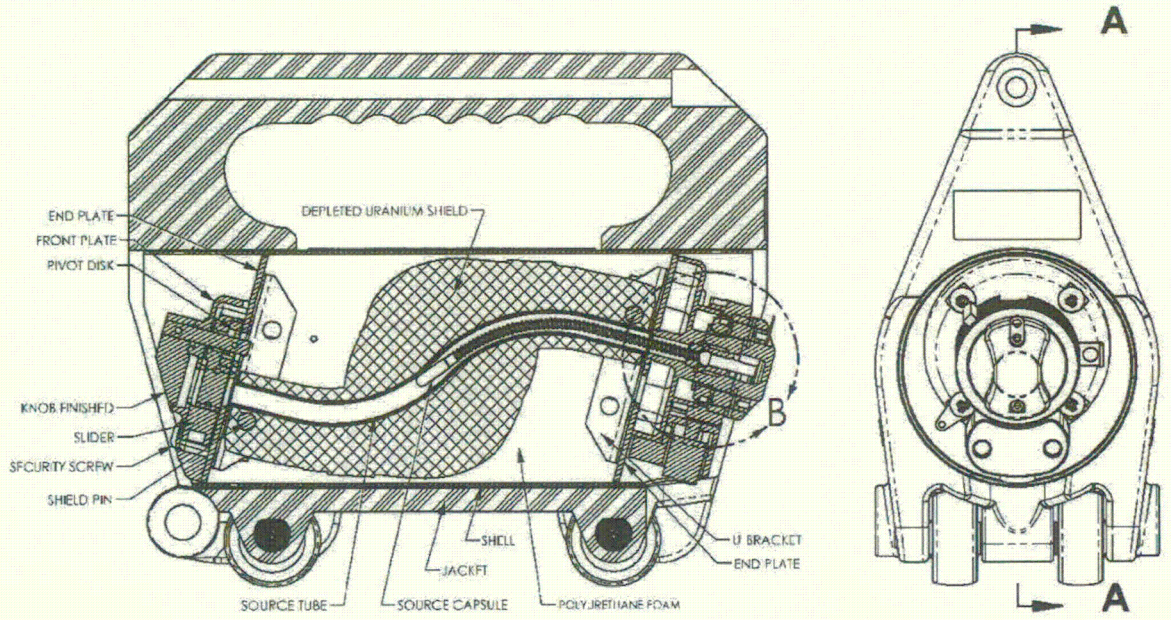
TITLE: PIPELINER TYPE B TRANSPORT DEVICE

SIZE A | DWG. NO. 88095 | REV. A

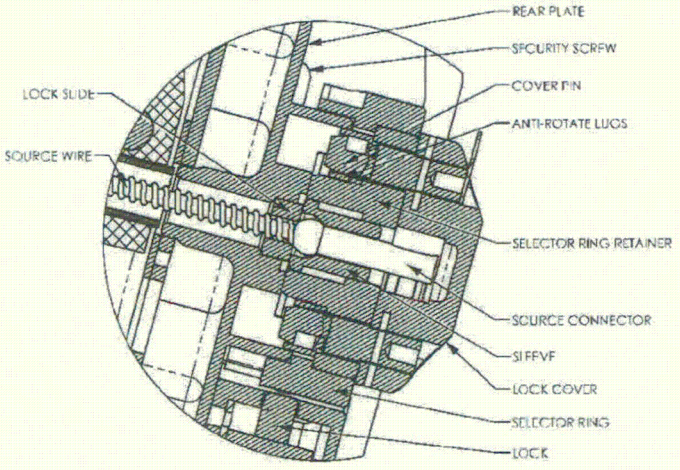
SCALE: 1:6 | SHEET: 1 OF 1

CAD FILE: K:\Product Drawings\880\Solidworks Files\88095.SLDDRW

FIGURE 2.2 MODEL 880 PROJECTOR WITH PIPELINER JACKET, DN 88095 Rev A



SECTION A-A



DETAIL B

FIGURE 2.3 MODEL 880 PROJECTOR WITH PIPELINER JACKET - SECTION VIEWS

Section 3 Test Objectives and Orientations

Objectives

The purpose of this series of tests is to demonstrate that the Model 880 Pipeliner projector complies with the Type B(U)-96 transport package test requirements as described in the Code of Federal Regulations, 10 CFR Part 71, revised as of January 1, 2009 and the International Atomic Energy Agency (IAEA), Safety Standards Series No. TS-R-1, Regulations for the Safe Transport of Radioactive Material, 1996 Edition, Section VI.

Orientations

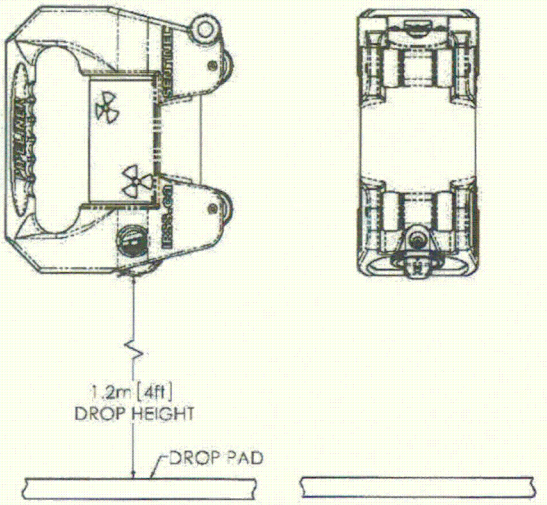
Normal Conditions Test	Para.	Specimen	Diagram
1.2m Drop 1.	71.71(c)(7)	TP186(A)	

FIGURE 10.1.1 NORMAL CONDITIONS - 1.2M DROP 1

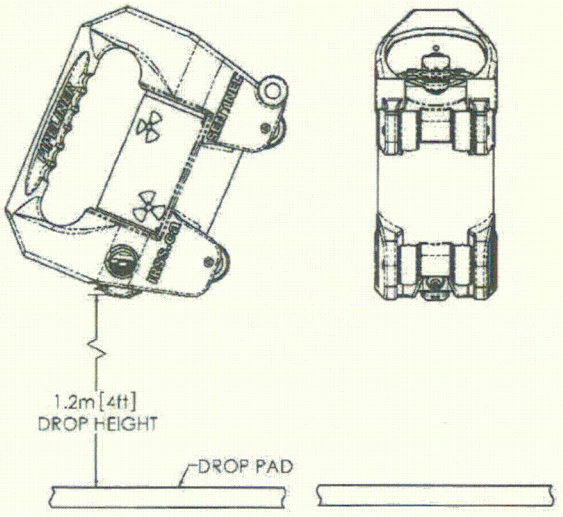
1.2m Drop 2.	71.71(c)(7)	TP186(B)	

FIGURE 10.1.2 NORMAL CONDITIONS - 1.2M DROP 2

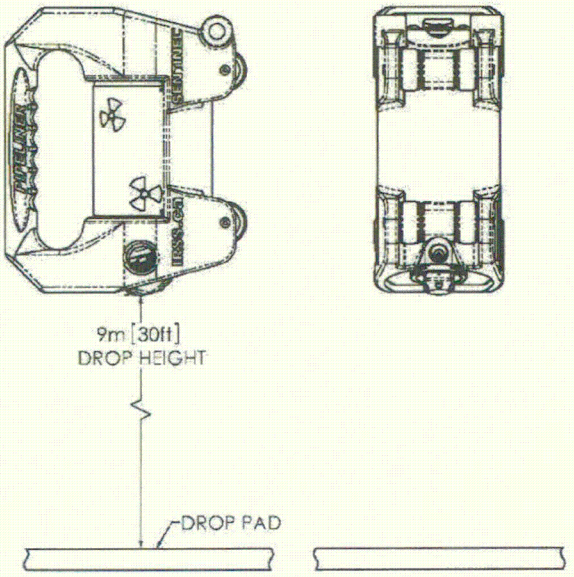
Accident Conditions Test	Para.	Specimen	Diagram
9m Drop 1.	71.73(c)(1)	TP186(A)	

FIGURE 10.2.1 ACCIDENT CONDITIONS - 9M DROP 1

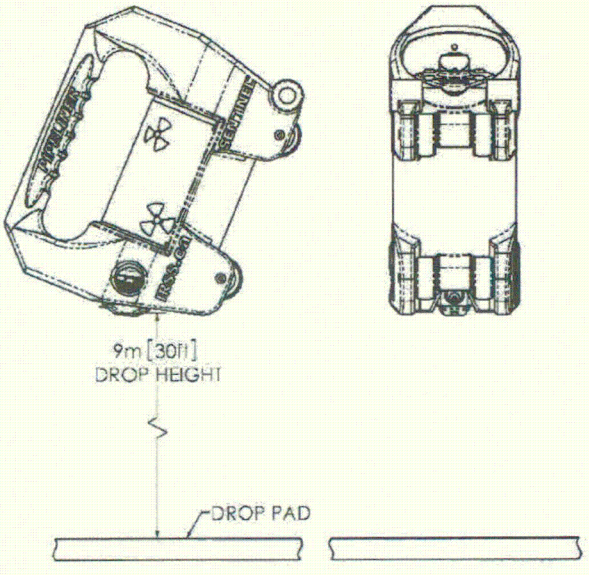
Accident Conditions Test	Para.	Specimen	Diagram
9m Drop 2.	71.73(c)(1)	TP186(B)	

FIGURE 10.2.2 ACCIDENT CONDITIONS - 9M DROP 2

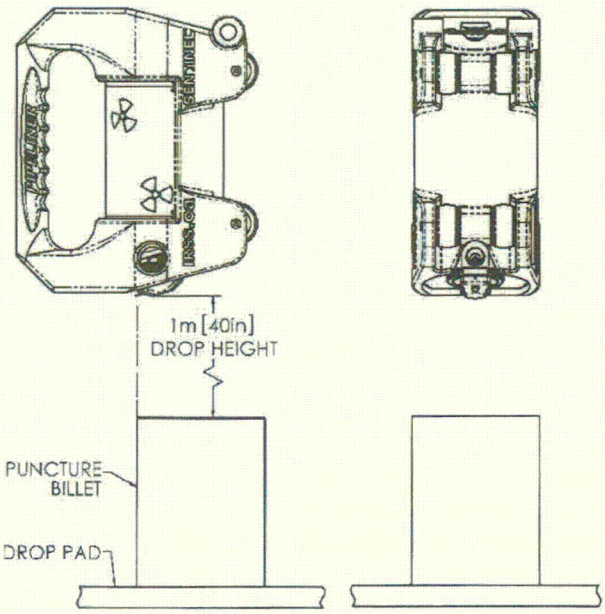
Accident Conditions Test	Para.	Specimen	Diagram
Puncture 1.	71.73(c)(3)	TP186(A)	

FIGURE 10.3.1 ACCIDENT CONDITIONS - PUNCTURE 1

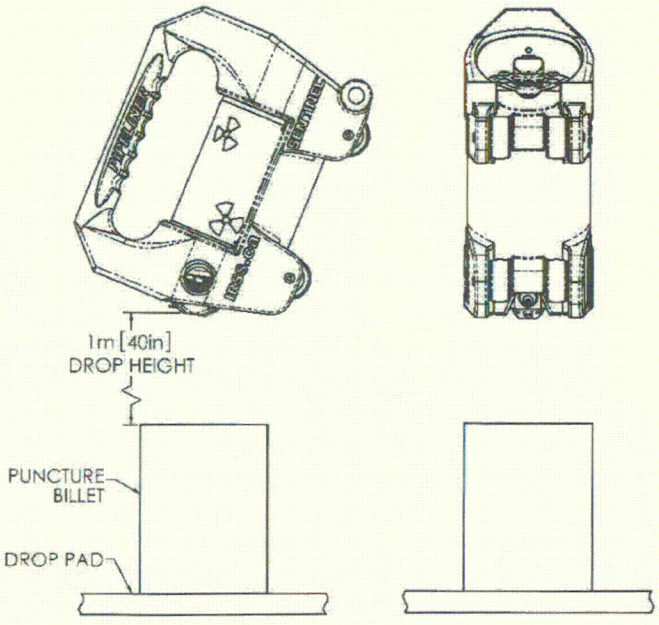
Accident Conditions Test	Para.	Specimen	Diagram
Puncture 2.	71.73(c)(3)	TP186(B)	

FIGURE 10.3.2 ACCIDENT CONDITIONS - PUNCTURE 2

Section 4 Test Data

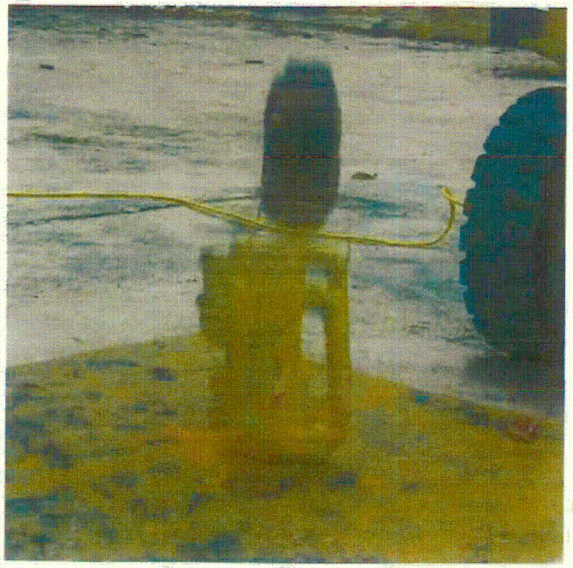
1.2m Free Drop Test Set-up

Serial Number TP186A

Initial setup for TP186A, 4' foot drop test, Pipeliner suspended from fork-truck over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

Pre-Drop

Impact Camera 1



Impact Camera 2

First Bounce

Post drop

Post drop showing damage to rear plate assembly

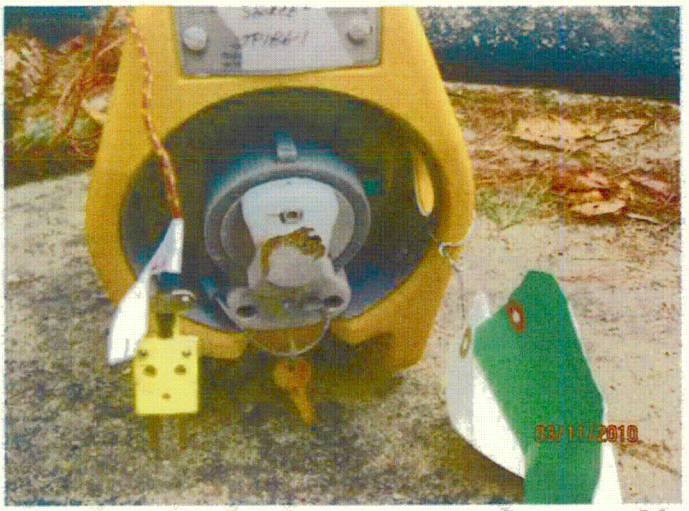
Serial Number TP186B

Initial setup for TP186B, 4' foot drop test, Pipeliner suspended from fork-truck over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

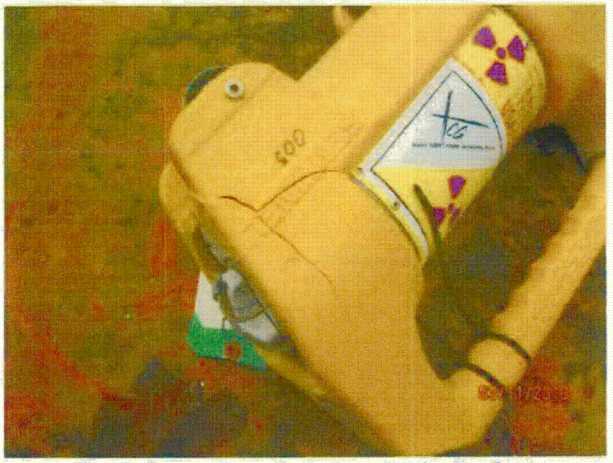
Pre-Drop

Impact

First Bounce



Post drop showing damage to rear plate assembly



Post drop showing cracks in jacket

Post drop showing overall damage to assembly

1.2m Free Drop Test Results

Serial Number TP186A: Impact was as planned, hitting directly on the lock cover with the 880 axis vertical. The impact crushed and cracked the lock cover. It also broke the head off on of one lock cover mounting screw.

Serial Number TP186B; Impact was as planned, hitting directly on the lock cover with the 880 axis 22.5° to the impact surface. The impact dented the lock cover. It also cracked the PipeLiner jacket.

1.2m Free Drop Test Assessment

Both units met the requirements of this test. Although they sustained some damage they remained fully functional and the sources remained in the original location.

9m Free Drop Test Set-up

Serial Number TP186A

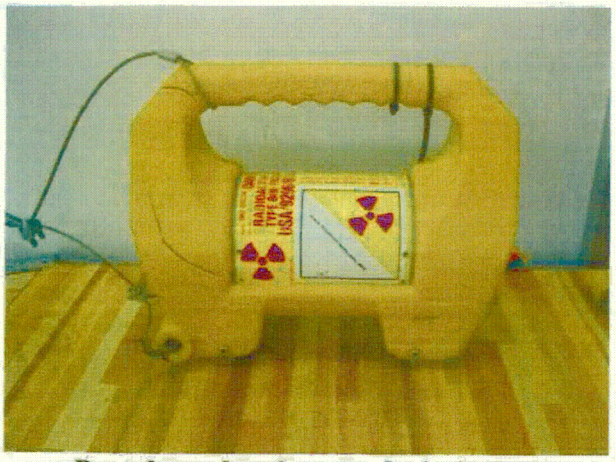
Initial setup for TP186A, 30' foot drop test, Pipeliner suspended from crane over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

Pre-Drop

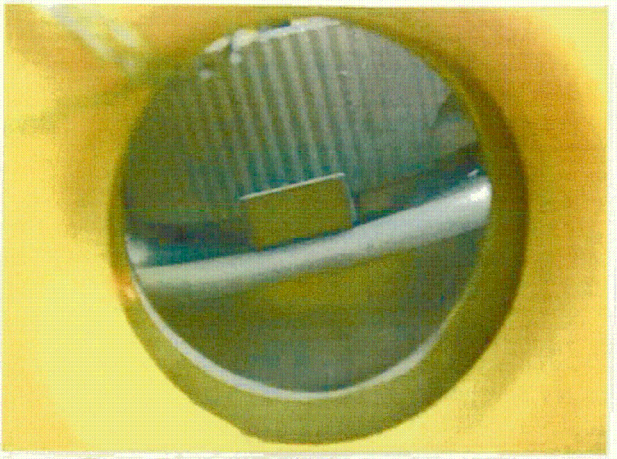
Impact

First Bounce

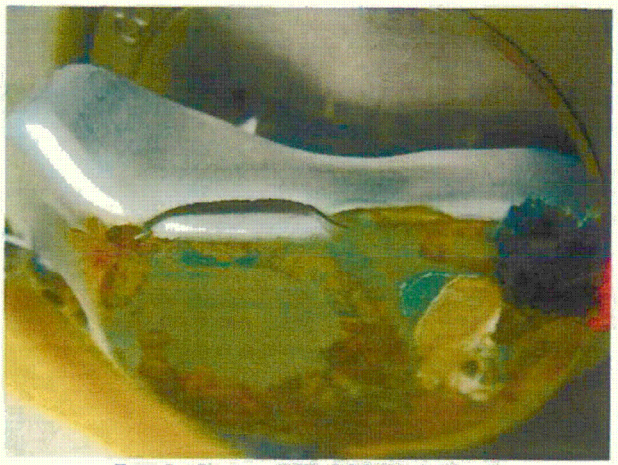
Post-Drop



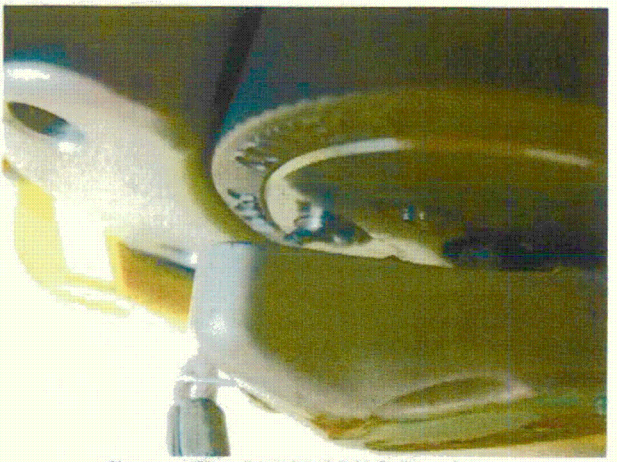
Post drop showing cracks in jacket



Rear Plate PN 88021 bent in 1/8"



Lock Cover PN 88023-1 Broken



Cover Pin PN 88023-2 Broken

Serial Number TP186B

Initial setup for TP186B, 30' foot drop test, Pipeliner suspended from crane over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

Pre-Drop

Pre-Impact

Impact

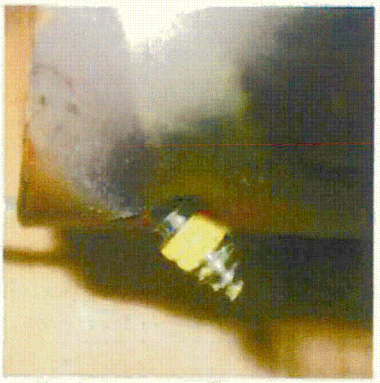
First Bounce

Post-Drop

Post drop showing damage to rear plate assembly

Post drop showing overall damage to assembly

Rear Plate assembly damage



Jacket mounting screw

Jacket mounting screw

9m Free Drop Test Results

Serial Number TP186A; Impact was as planned, hitting directly on the lock cover with the 880 axis vertical. The impact caused numerous cracks in the pipeliner jacket.The lock cover assembly received additional damage including a broken pin, but remained in place. The rear plate casting was bent inward. The source position moved approximately 1/8 inch.

Serial Number TP186B; Impact was as planned, hitting directly on the lock cover with the 880 axis 22.5° to the impact surface. The pipeliner jacket exploded into 5-6 major pieces and numerous smaller pieces. The jacket mounting screws at the front plate end bent the 880 shell. The Rear plate and lock assemblies received additional damage and the 880 shell was bent inward.

9m Free Drop Test Assessment

Both units passed this test.
Serial Number TP186A received additional damage to the lock cover and rear mounting plate assembly causing the source to move, but the source was secure and the shielding appears to be intact.
Serial Number TP186B received damage to the 880 shell and complete loss of the Pipeliner jacket assembly, but the source remained secure and in its original position.

Puncture Test Set-up

Serial Number TP186A

Initial setup for TP186A, 40 inch puncture test, Pipeliner suspended from fork-truck over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

Setup

Pre Drop

1st Impact

1st Bounce

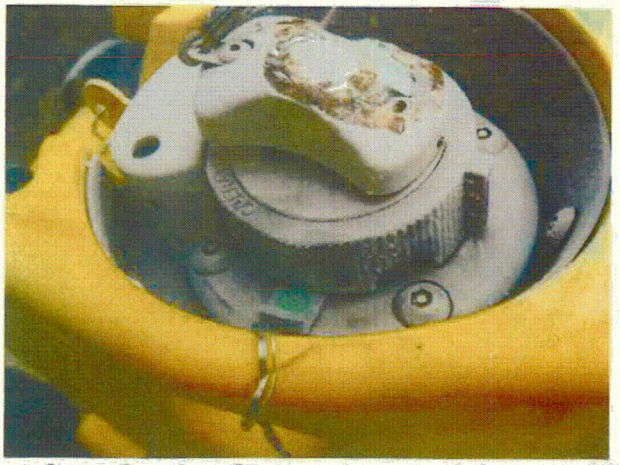
2nd Impact

3rd Impact

Post drop

Post drop showing damage to rear plate assembly

Post drop showing damage to rear plate assembly



Post drop showing damage to rear plate assembly

Post drop showing damage to rear plate assembly

Serial Number TP186B

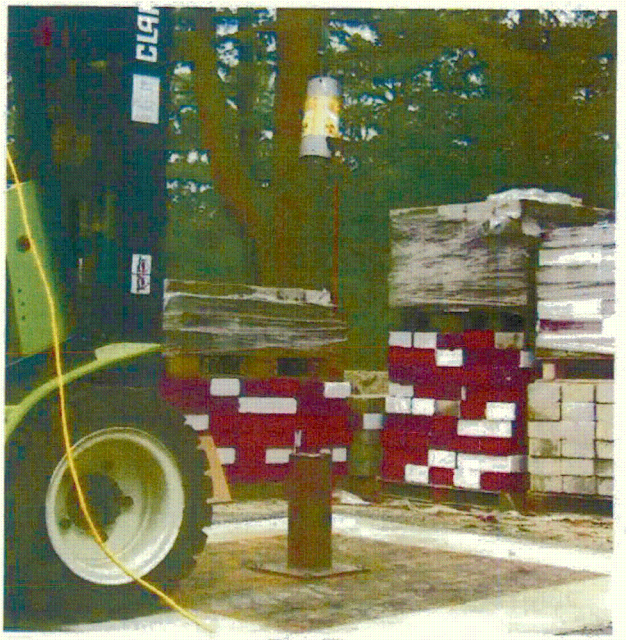
Initial setup for TP186B, 40 inch puncture test, Pipeliner suspended from fork-truck over drop pad QSA Global 40 North Ave Burlington MA site and Post-drop damage.

Test unit TP186B was not cooled for this test. The Pipeliner jacket assembly, the only component made from material not rated for -40° F, was lost as a result of the previous test. As all other components of the device are rated for the full operational range of temperatures, -40° F was no longer considered the worst case condition.

Alignment

Alignment

Setup



Pre Drop

Impact

After Impact

Post drop showing damage to rear plate assembly

Puncture Test Results

Serial Number TP186A; Impact was as planned, hitting directly on the lock cover with the 880 axis vertical. After the initial impact the side of the device impacted the post. The impact caused additional cracking of the pipeliner jacket. The lock cover assembly received additional denting damage but remained in place. The rear plate casting was bent farther inward. Source position has moved approximately an additional 1/16 inch.

Serial Number TP186B; Impact was as planned, hitting directly on the lock cover with the 880 axis 22.5° to the impact surface. The lock assembly was centered over the post. The lock cover assembly received additional denting damage but remained in place. The 880 shell was bent in the areas around the front and rear plates

Puncture Test Assessment

Both units passed this test.

Serial Number TP186A received additional damage to the lock cover and rear mounting plate assembly causing the source to move an additional amount, but the source remained secure and the shielding appears to be intact.

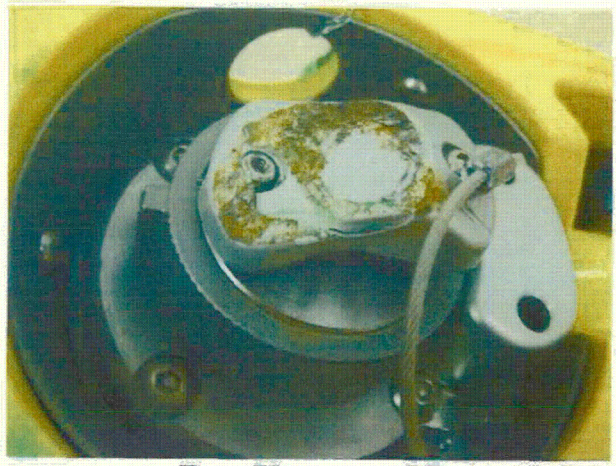
Serial Number TP186B was tested without the Pipeliner jacket assembly, lost during the previous test and at ambient temperature, The lock cover received additional damage and the key lock would no longer operate, but the source remained secure and in its original position.

Section 5 Final Inspection and Assessment

After completion of the drop testing the test units were inspected, disassembled and evaluated for damage prior to profiling.

Serial Number TP186A

Rear Plate assembly overall view



Rear Plate assembly side view

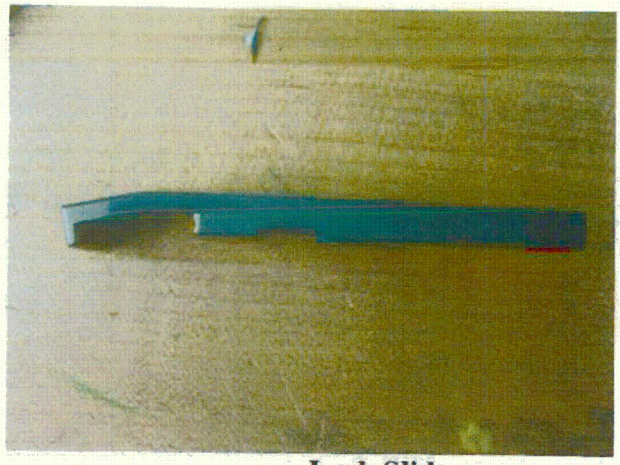
The key lock would not release, the selector ring would not turn and the slide would not move. The lock cover was still in place, but broken. The rear plate was collapsed inward approximately 1/8". The rear plate mounting screws were bent and the threads stripped when removed. The rear plate assembly was frozen in place and required the use of a hammer and pry bar to be removed from the 880.

Lock Cover assembly inside

Lock Cover assembly outside

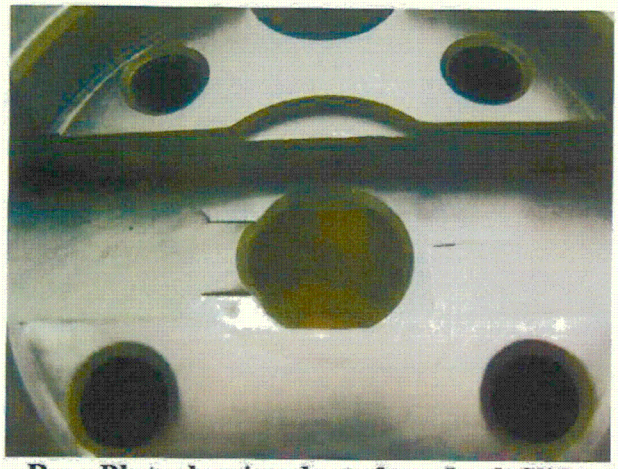
The lock cover was cracked, one screw was broken and one pin was broken. The pin mounting holes were deformed. The lock cover is an aluminum part designed to be sacrificial and protect the source connector and lock assembly.

Key Lock pin

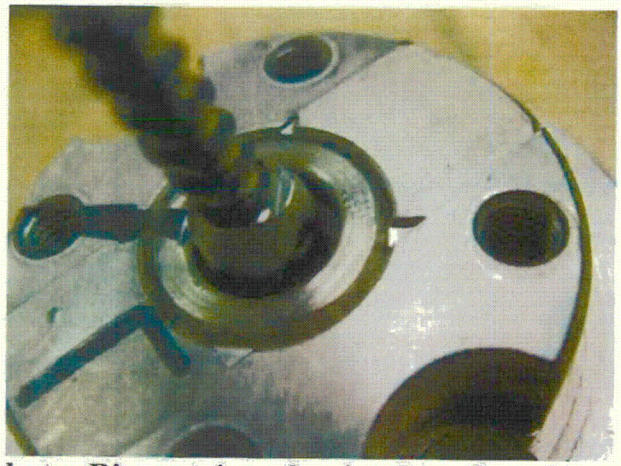


Lock Slide

The key lock pin was deformed and jammed in the selector ring
The lock slide was bent and jammed between the rear plate and the selector ring retainer

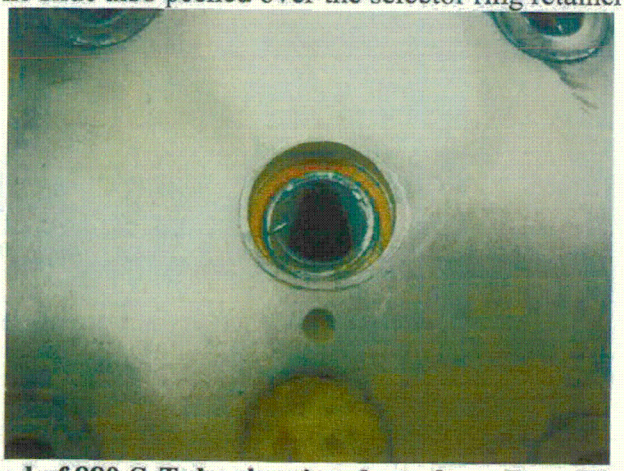


Rear Plate showing dents from Lock Slide

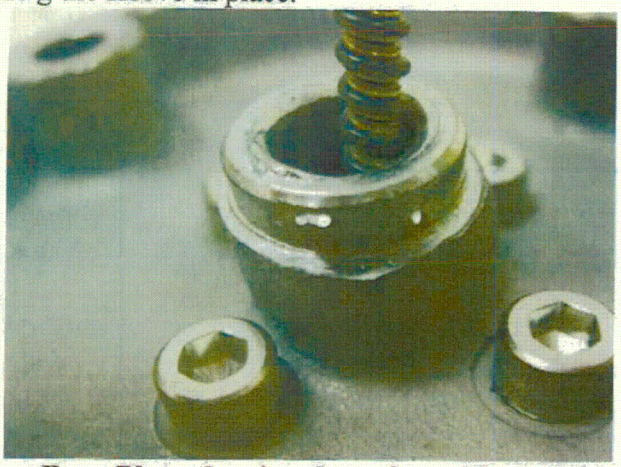


Selector Ring retainer showing dents from Lock Slide

The slide left an impression in the rear plate.
The slide also peened over the selector ring retainer locking the sleeve in place.



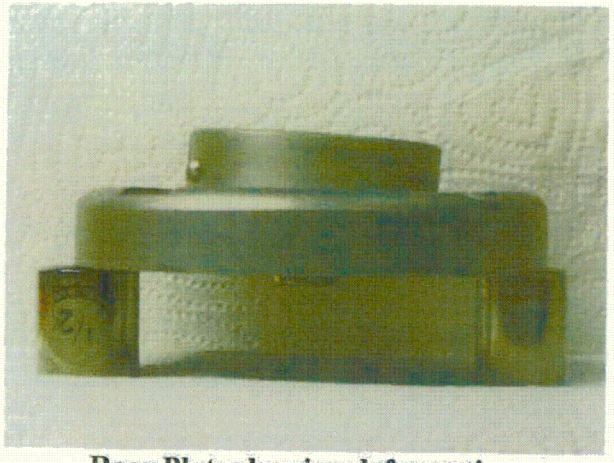
End of 880 S-Tube showing dents from Rear Plate



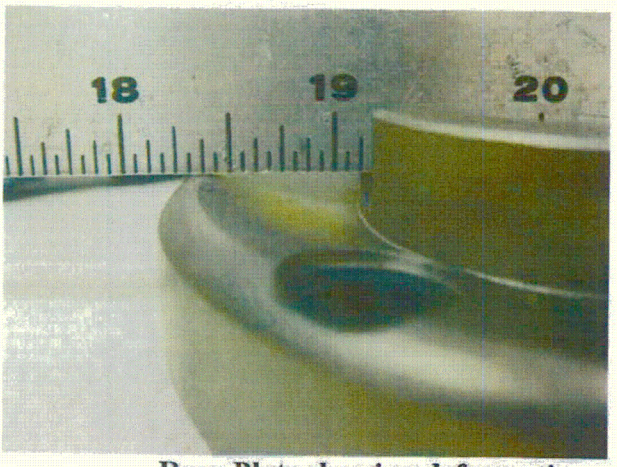
Rear Plate showing dents from 880 S-Tube

The rear plate 'hub' had been forced into the end of the 880 S-Tube. This was the reason the rear plate assembly was difficult to remove. The S-Tube and end plate of the 880 were deformed, note the areas

around the s-tube and mounting screws. The hub of the rear plate was also deformed causing the end of the hub to expand in diameter (Ø.6235 max after removal) and jam in the 880 shell end plate thru hole.



Rear Plate showing deformation



Rear Plate showing deformation

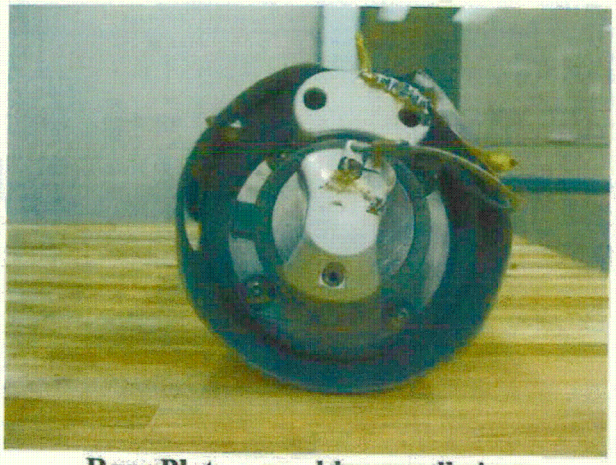
The rear plate was deformed by the impact. The area of greatest deformation was at the section of the selector ring that has clearance for the slide. This was due to the selector ring supporting the remaining section while this section was free to collapse.

Source Wire connector showing bend

Source Wire connector showing bend

The source wire connector was bent due to the collapse of the lock cover assembly. This caused the source to be jammed into the sleeve. A light tap with a hammer was sufficient to remove the source once the rear plate was disassembled. The source wire was intact with both the source and the connecter firmly attached.

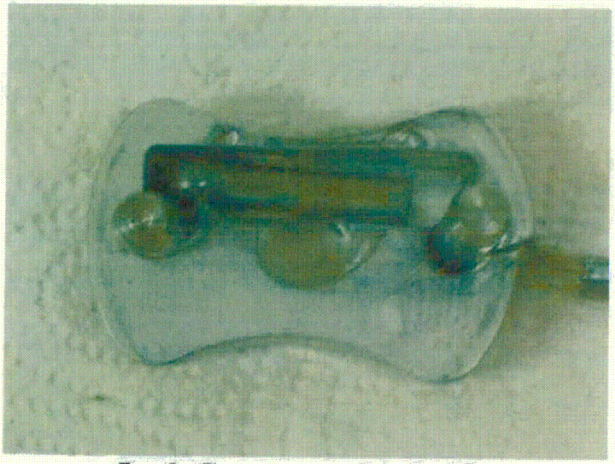
Serial Number TP186B



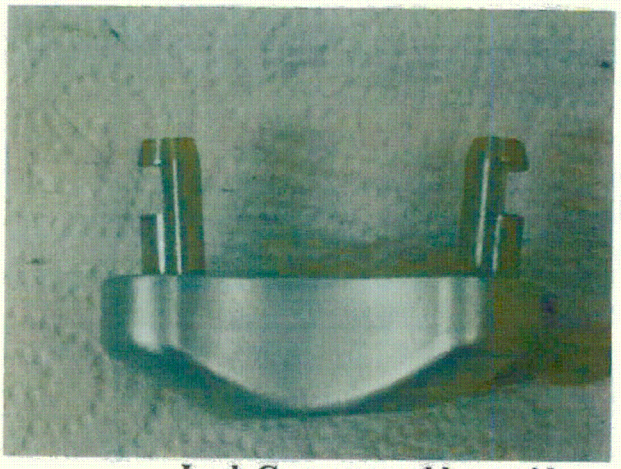
Rear Plate assembly overall view

Rear Plate assembly with lock removed

The key lock would not release so the lock assembly was removed. The Posilock device then functioned correctly.



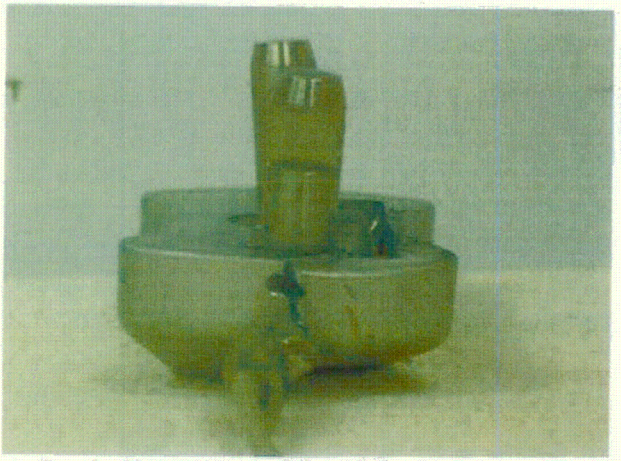
Lock Cover assembly inside



Lock Cover assembly outside

The lock cover assembly was broken and the pins were misaligned.
The lock cover is an aluminum part designed to be sacrificial and protect the source connector and lock assembly.

Lock Cover assembly with crack at screw



Lock Cover assembly with crack at rollpin

Key Lock pin

The key lock pin was deformed and jammed in the selector ring

Section 6 Summary

Serial Number TP186A Although the device received extensive damage and required disassembly to remove the source, the source was secure at all times. The total change in location of the source caused by the damage was approximately 3/16 inch.
The device was reassembled as much as possible, a live source was secured and the device was profiled.

Serial Number TP186B Although the device was damaged and required removal of the key lock assembly to remove the source, the source was secure at all times.
A live source was secured and the device was profiled.

Section 7 Conclusion

Both devices evaluated in this Test Report meet the Type B transport requirements as described in QSA Test Plan 186 and 10 CFR 71, Packaging and Transportation of Radioactive Materials, Subpart F – Package, Special Form, and LSA-III Tests, Sect 71.71 Normal Conditions of Transport and Sect 71.73 Hypothetical Accident Conditions.

After the initial 4 foot drop both units were functional and after all testing was complete the sources were secure in both devices.

For normal conditions of transport (10 CFR 71.43(f) states there should be no loss or dispersal of radioactive contents, no significant increase in external surface radiation levels and no substantial reduction in the effectiveness of the packaging.
IAEA Safety Standards Series No. TS-R-1, Para 622 (b) stipulates that the loss of shielding integrity should not result in more than a 20% increase in the radiation level at any external surface of the package.

For accident conditions 10 CFR 71.51(a) states there should be no escape of radioactive materials greater than A_2 in one week and no external dose rate greater than 1 R/hr at 1m from the external surface with the maximum radioactive contents which the package is designed to carry.

The pre and post test profiles for both test units, attached to this report, are within the acceptance criteria of less than a 20% increase as required by IAEA Safety Standards Series No. TS-R-1, Para 622 (b) and a maximum of 1.0 R/H at 1 meter adjusted dose rate as required by 10 CFR 71.51(a).

Additionally with the exceptions noted below, both devices were tested and passed at -40° F.

Test unit TP186A, the temperature recorded for the 9M free drop test was -39° F. This reading was a surface reading on the Pipeliner jacket handle, the warmest area of the assembly. Readings taken on a reference unit equipped with internal and external temperature sensors indicted that the core temperature of the jacket was 5°-10° F colder than the surface temperature.

Test unit TP186B was not cooled for the puncture test. The Pipeliner jacket assembly, the only component made from material not rated for -40° F, was lost as a result of the previous test. As all other components of the device are rated for the full operational range of temperatures, -40° F was no longer considered the worst case condition for this test.

Section 8 Attachments

Section 8.1 Worksheets

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))		
Test Location: QSA Global, 40 North Ave Burlington, MA		
Step	**Data**	
1. Record test specimen serial number:	TP186B	
2. Record the test specimen weight:	54 lbs	
3. Record the ambient temperature (°C):	66°F (19°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	-43°F (-42°C)	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.1.2	
5. Record drop height.	48 inches (1.22 meters)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: P Rice	PAUL RICE	12 APR 2010
Regulatory Affairs: L. P. [illegible]	C. P. [illegible]	28 Apr 10
Quality Assurance: C. Roughan	C. Roughan	11 May 2010

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186B	Test: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))
Test Date: 11 March 2010	Test Time: 2:00 PM

Describe drop orientation and drop height:

TP186 Figure 10.1.2. Oriented with the 880 axis 22.5° to the impact surface with the Rear Plate assembly down

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis 22.5° to the impact surface.

Describe on-site inspection (damage, broken parts, etc.):

The impact dented the lock cover. It also cracked the PipeLiner jacket.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes** or **No**.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes** or **No**.
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes** or **No**
  If yes, then identify and justify.

- Did sufficient damage occur to warrant additional drop? **Yes** or **No**
- Should testing continue with this test specimen? **Yes** or **No** If yes, next test: TP186 30 foot drop
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes** or **No**

Engineering: [signature] 15APR2010 **Regulatory:** [signature] 28JUN10 **QA:** [signature] 11May2010

Describe any post-test disassembly and inspection:

No dis-assembly was done at this time as additional testing is required on this device

Describe any change in source position (if possible):

Source position is unchanged

Describe results of radiography (if performed):

Not performed

Completed by: [signature] Paul Rice	Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))

Describe and measure (if appropriate) any damage or broken parts, etc.:

The lock cover, PN 88023-1 Rev E, was dented. This is an aluminum part intended to absorb impact and protect the source.
The pipeliner jacket, PN PL1013, cracked thru along 3 lines converging at one of the jacket mounting screws, PN PL1030

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position and had not moved

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

This test will be performed after all testing is complete

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

This test will be performed after all testing is complete

Completed by: PAUL RICE	Date: 12 APR 2010

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test: 9M (30 foot) FREE DROP TEST (10 CFR 71.73(C)(1))		
Test Location: QSA Global, 40 North Ave Burlington, MA		
Step	**Data**	
1. Record test specimen serial number:	TP186B	
2. Record the test specimen weight:	54 lbs	
3. Record the ambient temperature (°C):	66°F (19°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	-43°F (-42°C)	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.2.2	
5. Record drop height.	30 Feet (9.14 meters)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering:	Paul Rice	12 APR 2010
Regulatory Affairs:	L Podolak	28 Jun 10
Quality Assurance:	C. Roughan	4 Aug 2010

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186B	Test: 9M (30 foot) Free Drop Test (10 CFR 71.73(C)(1))
Test Date: 19 March 2010	Test Time: 11:00 AM

Describe drop orientation and drop height:

TP186 Figure 10.2.2. Oriented with the 880 axis 22.5° to the impact surface with the Rear Plate assembly down

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis 22.5° to the impact surface.

Describe on-site inspection (damage, broken parts, etc.):

The pipeliner jacket exploded into 5-6 major pieces and numerous smaller pieces. The jacket mounting screws at the front plate end bent the 880 shell.
The Rear plate and lock assemblies received additional damage and the 880 shell was bent inward.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes or No.**
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes or No.**
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes or No.**
  If yes, then identify and justify.

  The Puncture test will be performed without the jacket assembly and at ambient temperature.
- Did sufficient damage occur to warrant additional drop? **Yes or No.**
- Should testing continue with this test specimen? **Yes or No.** If yes, next test: TP186 1 meter puncture test
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes or No**

Engineering: 15 APR 2010 **Regulatory:** 20 Apr 10 **QA:** 11 May 10

Describe any post-test disassembly and inspection:

No dis-assembly was done at this time as additional testing is required on this device

Describe any change in source position (if possible):

Source position is unchanged

Describe results of radiography (if performed):

Not performed

Completed by: Ron Rice Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 9M (30 foot) Free Drop Test (10 CFR 71.73(C)(1))

Describe and measure (if appropriate) any damage or broken parts, etc.:

The lock cover, PN 88023-1 Rev E, was dented. This is an aluminum part intended to absorb impact and protect the source.
The pipeliner jacket, PN PL1013, was destroyed.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position and had not moved

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

This test will be performed after all testing is complete

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

This test will be performed after all testing is complete

Completed by: Paul Rice	Date: 12 APR 2010

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test:

1 METER (40") PUNCTURE TEST (10 CFR 71.73(C)(3))

Test Location:

QSA Global, 40 North Ave Burlington, MA

Step	**Data**	
1. Record test specimen serial number:	TP186B	
2. Record the test specimen weight:	46 lbs Without jacket	
3. Record the ambient temperature (°C):	40°F (4°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	40°F (4°C) Ambient	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.3.2	
5. Record drop height.	40 Inches (1 meter)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering: [signature]	Paul Rice	12 APR 2010
Regulatory Affairs: [signature]	[signature]	28 Apr 10
Quality Assurance: C. Roughan	C. Roughan	11 Aug 10

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186B	Test: 1 Meter (40") Puncture Test (10 CFR 71.73(C)(3))
Test Date: 26 March 2010	Test Time: 12:15 PM

Describe drop orientation and drop height:

TP186 Figure 10.3.2. Oriented with the 880 axis 22.5° to the impact surface with the Rear Plate assembly down The lock assembly was centered over the post.

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis vertical

Describe on-site inspection (damage, broken parts, etc.):

The lock cover assembly received additional denting damage but remained in place.
The 880 shell was bent in the areas around the front and rear plates

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes** or **No**.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes** or **No**.
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes** or **No**
  If yes, then identify and justify.

  [ ]
- Did sufficient damage occur to warrant additional drop? **Yes** or **No**.
- Should testing continue with this test specimen? **Yes** or **No**. If yes, next test: Profile
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes** or **No**

Engineering: 11 APR 2010 **Regulatory:** 28 JUN 10 **QA:** CMR 11 Aug 10

Describe any post-test disassembly and inspection:

Describe any change in source position (if possible):

Source position is unchanged

Describe results of radiography (if performed):

Completed by: Dan Rice	Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 1 Meter (40") Puncture Test (10 CFR 71.73(C)(3))

Describe and measure (if appropriate) any damage or broken parts, etc.:

Damage was limited to worsening of the damage received in the previous tests.
The lock cover, PN 88023-1 Rev E, was dented.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position. It had not moved.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

Completed by: Paul Rice	Date: 12 APR 2010

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test: 1 METER (40") PUNCTURE TEST (10 CFR 71.73(C)(3))		
Test Location: QSA Global, 40 North Ave Burlington, MA		
Step	**Data**	
1. Record test specimen serial number:	TP186A	
2. Record the test specimen weight:	54 lbs	
3. Record the ambient temperature (°C):	40°F (4°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	-45°F (-43°C)	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.3.1	
5. Record drop height.	40 Inches (1 meter)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering:	Paul Rice	12 APR 2010
Regulatory Affairs:	L. Pickett	28 Jun 10
Quality Assurance: C. Rayhan	C. Rayhan	11 Aug 10

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186A	Test: 1 Meter (40") Puncture Test (10 CFR 71.73(C)(3))
Test Date: 26 March 2010	Test Time: 12:40 PM

Describe drop orientation and drop height:

TP186 Figure 10.2.1. Oriented with the 880 axis normal to the impact surface (vertical) with the Rear Plate assembly down. The lock assembly was centered over the post.

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis vertical

Describe on-site inspection (damage, broken parts, etc.):

The impact caused additional cracking of the pipeliner jacket.
The lock cover assembly received additional denting damage but remained in place.
The rear plate casting was bent farther inward.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes or No.**
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes or No.**
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes or No.**
  If yes, then identify and justify.

- Did sufficient damage occur to warrant additional drop? **Yes or No.**
- Should testing continue with this test specimen? **Yes or No.** If yes, next test: Profile
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes or No**

Engineering: 15 APR 2010 **Regulatory:** 15 APR 2010 **QA:** 11 May 10

Describe any post-test disassembly and inspection:

Describe any change in source position (if possible):

Source position has moved approximately an additional 1/16 inch

Describe results of radiography (if performed):

Completed by: Paul Rice Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 1 Meter (40") Puncture Test (10 CFR 71.73(C)(3))

Describe and measure (if appropriate) any damage or broken parts, etc.:

Damage was limited to worsening of the damage received in the previous tests.
The lock cover, PN 88023-1 Rev E, was dented and cracked. One pin, PN 88023-2, was broken.
The rear plate casting, PN88021, was bent inward causing the lock slide, PN88024, to be bent. The key lock, PN 66001-11, would not release. The selector ring, PN 88026, would not turn and the lock slide would not move.The pipeliner jacket, PN PL1013, was cracked in multiple places, but was largely intact.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position. It had moved a total of approximately 3/16 inch due to the deformation of the rear plate.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

Completed by: Paul Rice	Date: 12 APR 2010

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test: 9M (30 foot) FREE DROP TEST (10 CFR 71.73(C)(1))		
Test Location: QSA Global, 40 North Ave Burlington, MA		
Step	**Data**	
1. Record test specimen serial number:	TP186A	
2. Record the test specimen weight:	54 lbs	
3. Record the ambient temperature (°C):	57°F (14°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	-39°F (-39°C)	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.2.1	
5. Record drop height.	30 Feet (9.14 meters)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering:	Paul Rice	12 APR 2010
Regulatory Affairs:	L. P. Nick	28 Jun 10
Quality Assurance: C. Roughan	C. Roughan	11 May 2010

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186B	Test: 9M (30 foot) Free Drop Test (10 CFR 71.73(C)(1))
Test Date: 19 March 2010	Test Time: 9:30 AM

Describe drop orientation and drop height:

TP186 Figure 10.2.1. Oriented with the 880 axis normal to the impact surface (vertical) with the Rear Plate assembly down

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis vertical

Describe on-site inspection (damage, broken parts, etc.):

The impact caused numerous cracks in the pipeliner jacket.
The lock cover assembly received additional damage including a broken pin, but remained in place.
The rear plate casting was bent inward.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes** or **No**.
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes** or **No**.
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes** or **No**
  If yes, then identify and justify.

  [ ]
- Did sufficient damage occur to warrant additional drop? **Yes** or **No**
- Should testing continue with this test specimen? **Yes** or **No**. If yes, next test: TP186 1 meter puncture test
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes** or **No**

Engineering: 16 APR 2010 **Regulatory:** 28 APR **QA:** 11 May 10

Describe any post-test disassembly and inspection:

No dis-assembly was done at this time as additional testing is required on this device

Describe any change in source position (if possible):

Source position has moved approximately 1/8 inch

Describe results of radiography (if performed):

Not performed

Completed by: PAUL RICE	Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 9M (30 foot) Free Drop Test (10 CFR 71.73(C)(1))

Describe and measure (if appropriate) any damage or broken parts, etc.:

The lock cover, PN 88023-1 Rev E, was dented and cracked. One pin, PN 88023-2, was broken. The rear plate casting, PN88021, was bent inward causing the lock slide, PN88024, to be bent. The key lock, PN 66001-11, would not release. The selector ring, PN 88026, would not turn and the lock slide would not move.
The pipeliner jacket, PN PL1013, was cracked in multiple places.

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position. It had moved approximately 1/8 inch due to the deformation of the rear plate.

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806.

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

This test will be performed after all testing is complete

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

This test will be performed after all testing is complete

Completed by: Paul Rice	Date: 12 APR 2010

WORKSHEET 15.2 DROP & PUNCTURE TEST CHECKLIST

Test: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))		
Test Location: QSA Global, 40 North Ave Burlington, MA		
Step	**Data**	
1. Record test specimen serial number:	TP186A	
2. Record the test specimen weight:	54 lbs	
3. Record the ambient temperature (°C):	65°F (18°C)	Instrument S/N: T198776
3. Record the test unit temperature (°C):	-45°F (-43°C)	Instrument S/N: T198776
4. Identify set-up orientation figure:	TP186 Figure 10.1.1	
5. Record drop height.	48 inches (1.22 meters)	
6. Photograph set-up in at least two perpendicular planes. ✓		
7. Begin video recording of the test so that impact is recorded. ✓		
8. Release the test specimen. ✓		
9. Stop the video recorder. Ensure the point of impact and orientation specified in the plan has been achieved. ✓		
10. Record the damage to the test specimen. Use a separate sheet and attach, if needed. ✓		
11. Engineering, Regulatory Affairs and Quality Assurance make a preliminary assessment relative to 10 CFR 71. Record the assessment on a separate sheet and attach.		

Test witnessed by (Signature)	**Print Name**	**Date**
Engineering:	Paul Rief	12 APR 2010
Regulatory Affairs:	L. Pinkston	28 Jan 10
Quality Assurance: C Roughan	C Roughan	11 May 10

WORKSHEET 15.3 DROP & PUNCTURE TEST DATA SHEET

Test Unit Model/Serial No.: Model 88095 S/N TP186A	Test: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))
Test Date: 11 March 2010	Test Time: 1:30 PM

Describe drop orientation and drop height:

TP186 Figure 10.1.1. Oriented with the 880 axis normal to the impact surface (vertical) with the Rear Plate assembly down

Describe impact (location, rotation, etc.):

Impact was as planned, hitting directly on the lock cover with the 880 axis vertical

Describe on-site inspection (damage, broken parts, etc.):

The impact crushed and cracked the lock cover. It also broke the head off on of one lock cover mounting screw.

On-site test assessment:

- Was the test performed in accordance with 10 CFR 71, IAEA TS-R-1 1996, and this test plan? **Yes or No.**
- Does the test specimen meet the requirements of 10 CFR 71 and IAEA TS-R-1 1996 for this test? **Yes or No.**
- Are any changes to subsequent drop orientations needed to achieve maximum damage? **Yes or No.**
  If yes, then identify and justify.

- Did sufficient damage occur to warrant additional drop? **Yes or No.**
- Should testing continue with this test specimen? **Yes or No.** If yes, next test: TP186 30 foot drop
- Will the test specimen pass the thermal test based on the accumulated damage assessment? **Yes or No**

Engineering: 15 APR 2010 **Regulatory:** **QA:** 11 Aug 10

Describe any post-test disassembly and inspection:

No dis-assembly was done at this time as additional testing is required on this device

Describe any change in source position (if possible):

Source position is unchanged

Describe results of radiography (if performed):

Not performed

Completed by: Phil Rice Date: 12 APR 2010

WORKSHEET 15.4 TEST INSPECTION DATA SHEET

Test Specimen Serial No.: Model 88095 S/N TP186A	Last Test Performed: 1.2m (4-foot) Free Drop Test (10 CFR 71.71(c)(7))

Describe and measure (if appropriate) any damage or broken parts, etc.:

The lock cover, PN 88023-1 Rev E, was crushed and cracked. This is an aluminum part intended to absorb impact and protect the source.
One screw, PN SCR159, connecting a cover pin PN 88023-2 to the cover broke. The cover remained attached to the Rear Plate assembly

Describe and measure (if appropriate) any signs of permanent strain or deformation:

See the attached photos

Describe the condition of the simulated source wire assembly.

The source wire was still locked in position and had not moved

Reassemble the package using a representative active source, making sure that the source position and the package configuration is the same as they were immediately after the last test.

Measure and record a radiation profile of each test specimen in accordance with QSA Global Work Instruction WI-Q-1806. ✓

Compare the pre-test dose levels with post-test dose levels at the surface of the package and at 1 meter from the surface of the package.

This test will be performed after all testing is complete

Is a radiograph required to inspect for hidden component damage or failure? If radiography is performed, describe any damage or failures found.

This test will be performed after all testing is complete

Completed by: Ben Rice	Date: 12 APR 2010