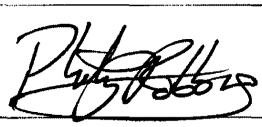
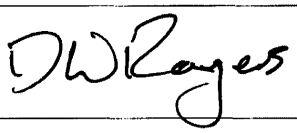
REVISS Services
Technical and Manufacturing Group

Test Report No. RTR 250

3981/01
1.0m Punch Test – Angled Side

Author:		**Reviewer:**	
Name	P J G Robbins	Name	D W Rogers
Signature		Signature	
Date	03/07/09	Date	03/07/09

1. PURPOSE AND SCOPE

The purpose of this document is to record the performance of the R7021 specimen, 3981/01, in an IAEA drop test for Type B radioactive materials package designs. The full test programme is discussed, justified and detailed in the test plan, RTM 118.

2. DESCRIPTION

2.1 DESIGN

The outer components of the R7021, a cylindrical, insulated jacket, a top shield (with energy absorbing structures and insulation), and a pallet, are constructed predominantly from carbon steel. There is also a stainless steel grill around the top of the jacket to restrict access to hot surfaces. The flask is a stainless steel, lead shielded, upright, finned cylinder with a conventional plug type closure in the top and thermal insulation built into its top and bottom corners. The closure has a vent point and the cavity has a drain tube to allow the flask to be operated in ponds as well as in cells. The cylindrical cavity holds encapsulated radioactive material (solid cobalt metal) in a basket. Although primarily intended to carry Special Form capsules, the flask has a containment system as it may also be used to carry non-Special Form encapsulated cobalt. The closure and the vent and drain plugs are therefore equipped with testable O-ring seals. In addition, to prevent the migration of coarse solids outside the shielded volume, the top of the drain tube is fitted with a mesh filter and a spring gasket is used to seal the gap under the closure around the top of the cavity.

2.2 TEST

1.0 m Punch Test – Angled Side (Drop 16, RTM 118). Drop II test for Type B packages (paras. 656 & 727(b), TS-R-1).

2.3 TEST INTENT

To penetrate the jacket and damage the drain plug.

2.4 PASS/FAIL CRITERIA

The pallet, top shield and jacket shall be secure in order for the specimen to continue to the next test. For internal inspection see IR 0675.

2.5 TARGET

The R8085 target (Drawing No R8085/001) consists of a 50mm thick steel plate bonded to reinforced concrete of dimensions 4m square x 3m deep set flush with the ground. The total mass, 113000 kg, exceeds the RTM 118 minimum requirement of 45000 kg by 150%.

The punch (Drg. No. R8099/002) met RTM 118 requirements and was securely fastened to the target with four M24 screws. The punch was extended by 100mm to 600mm (by welding on a section from a second punch) to avoid any risk of the specimen contacting the target (Figure 4).

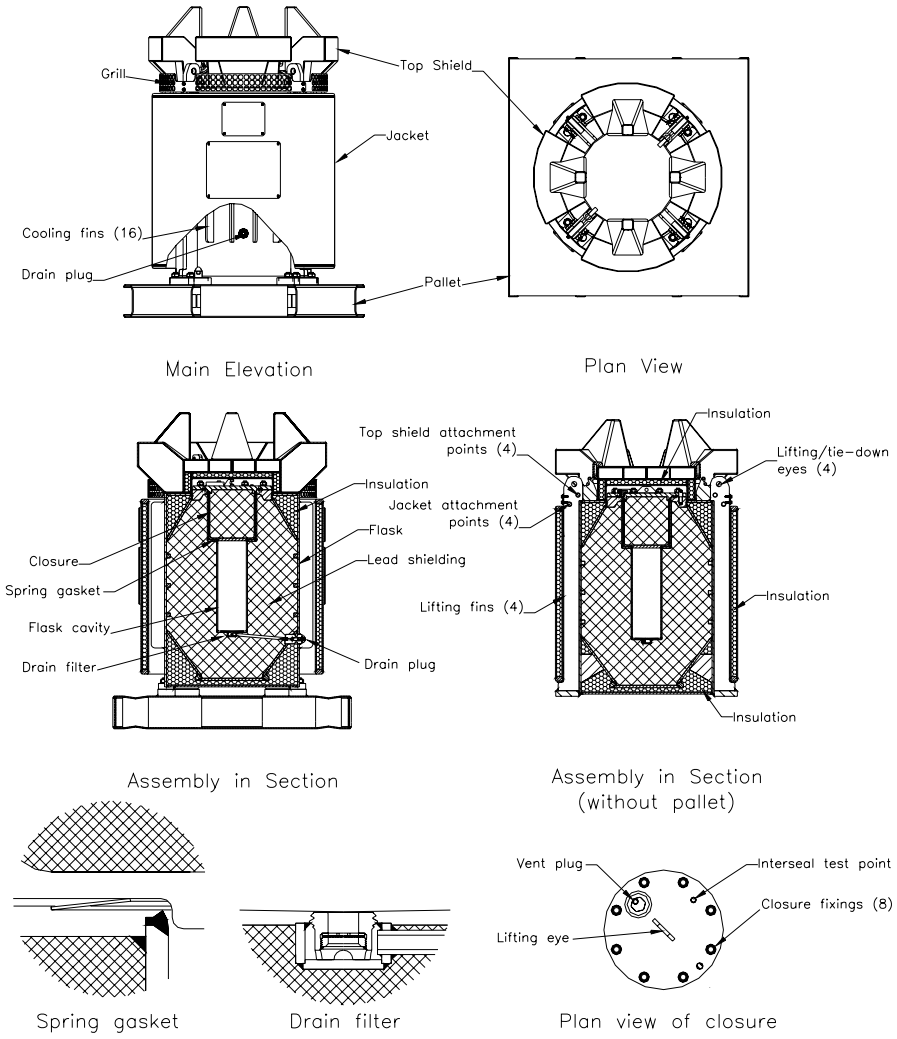


Figure 1: R7021 Constructional Details

2.6 SPECIMEN DETAILS (SEE ALSO IR 0674)

- Identity: 3981/01.
- Contents: A basket containing 48 stainless steel rods.
- Weight: 4374 kg.
- Existing Damage: See IR 0674 & RTRs 244 to 249.

2.7 TEST PROCEDURE

As the weight of the container assembly was less than the design maximum gross weight (4500kg), the drop height was increased pro rata to compensate. The test height was therefore (4500/4374) x 1.0 = 1.030m.

The specified angle was 35º from the horizontal and the impact point 120mm from the base of the jacket however, on review with the DfT engineer, these were changed to 37º and 90mm to

maximise the likelihood of the punch damaging the drain plug (see also CF757C).

The test was conducted in accordance with OP 225. All key actions were recorded on the test record sheet (attached).

3. RESULTS

- The test was executed correctly (Figures 2, 3, 5 6). The angle measured on the jacket was 37.0º from the horizontal (Figure 7).
- The pallet, jacket, top shield and grill were all securely attached (Figure 8).
- The outer skin of the jacket was indented to a depth of approximately 85mm with no cracking or shearing (Figures 9-11). The inner skin was clear of the drain plug by approximately 10mm.
- The punch showed no significant damage (Figure 12).
- No other damage was visible externally.

See Illustrations for photographic record.

4. CONCLUSIONS

The R7021 test specimen, 3981/01, was fit to continue to the next test.

5. REFERENCES

- IR 0674: 3981/01 Assembly Prior to Accident Conditions Drop Testing, REVISS Services (UK) Ltd.
- IR 0675: 3981/01 Inspection After Accident Conditions Drop Testing, REVISS Services (UK) Ltd.
- OP 225: Drop Testing Procedure, REVISS Services (UK) Ltd.
- R8085/001 issue B: Drop Test Target, REVISS Services (UK) Ltd.
- R8099/002 issue A: Drop Test Punch, REVISS Services (UK) Ltd.
- RTM 118: Test Plan for the R7021 Transport Container, REVISS Services (UK) Ltd.
- RTR 244: 1.0m Punch Test – Angled Inverted, REVISS Services (UK) Ltd.
- RTR 245: 1.0m Punch Test – Angled Inverted, REVISS Services (UK) Ltd.
- RTR 246: 9.0m Free Drop Test – Angled Inverted, REVISS Services (UK) Ltd.
- RTR 247: 1.0m Punch Test – Angled Inverted, REVISS Services (UK) Ltd.
- RTR 248: 1.0m Punch Test – Angled Side, REVISS Services (UK) Ltd.
- RTR 249: 9.0m Free Drop Test – Side Horizontal, REVISS Services (UK) Ltd.
- CF757C: Deviations from Drop Test Plan, RTM 118 issue 2, REVISS Services (UK) Ltd.
- TS-R-1: Safety Standards Series, Regulations for the Safe Transport of Radioactive Material 1996 Edition (As amended 2003), IAEA, Vienna.

6. ATTACHMENTS

RTR 250: Drop Test Checklist, REVISS Services (UK) Ltd.

7. ILLUSTRATIONS

page

Figure 2: Test action sequence – Angle 1

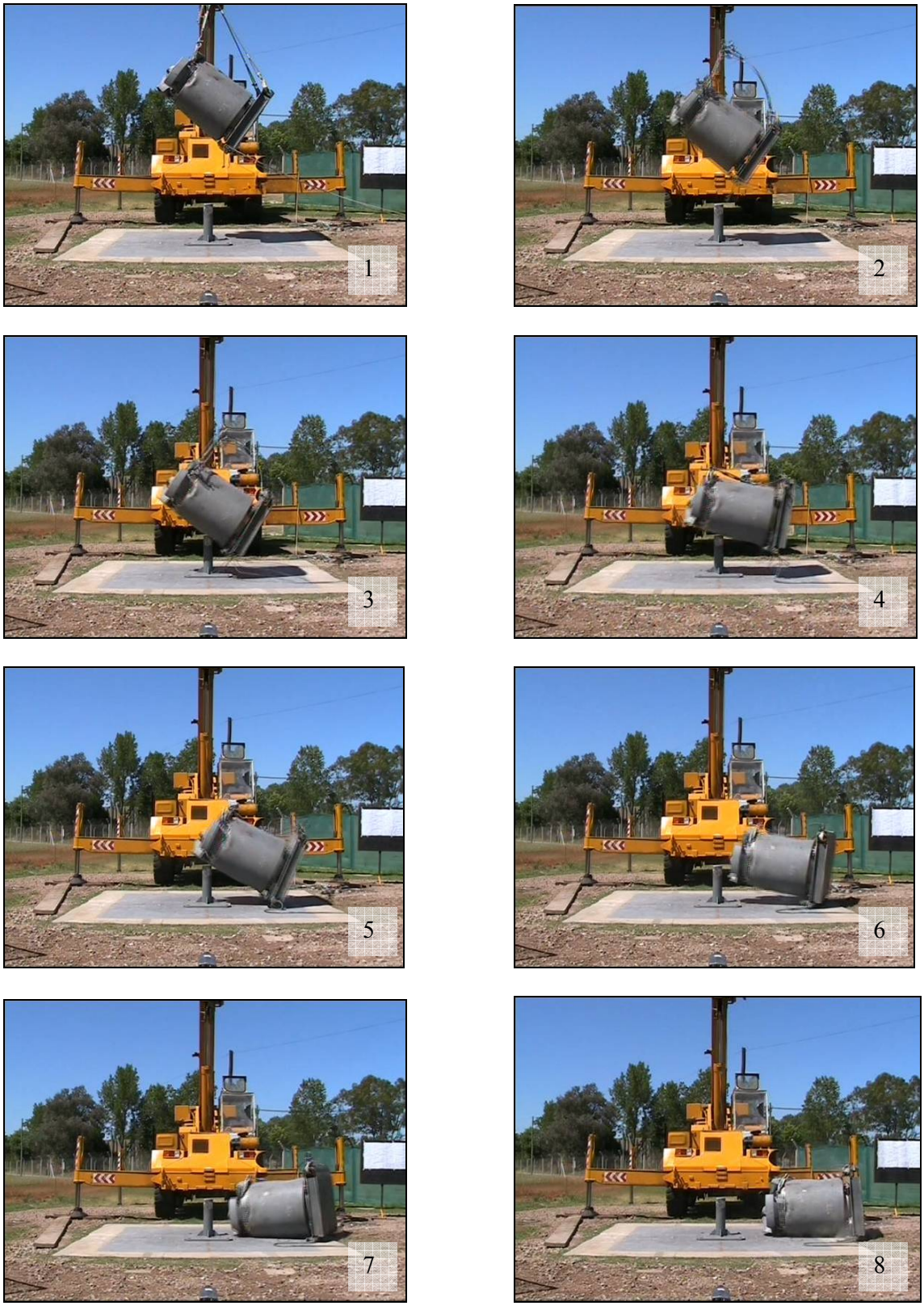


Figure 3: Test action sequence – Angle 2

Figure 4: Extended punch

Figure 5: Above target

Figure 6: 1.030m above target (with height gauge)

Figure 7: Inclinometer readings (2 planes)

Figure 8: After drop

Figure 9: Impact point and jacket indentation

Figure 10: Measurement of indentation

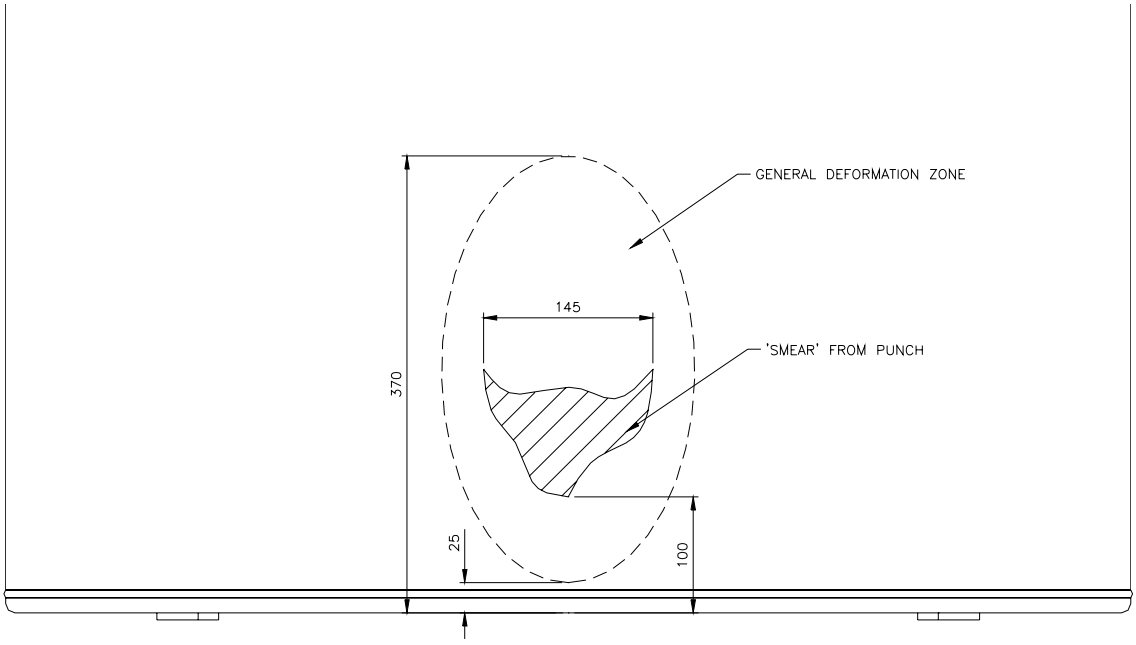


Figure 11: Punch damage

Figure 12: Punch after test

Reviss Services (UK) Ltd **Drop Test Checklist (OP225)**	RTR: 250 Date: 21/11/08
Test Description: 1-0m Punch Test : Angled Side over Drain Plug (IAEA Type B).	
1. Confirm all personnel are aware of safety rules	✓
2. Test Plan/issue	RTM 118 issue 2, Drop 16.
3. Specimen Design/Serial No/Drg No.	3981/01 (top shield 02).
4. Height gauge Identity/Drg No.	1-030m (28083/005 issue A).
5. Target Identity/Drg No.	28085/001 issue B
6. Punch Identity/Drg No.	28099/002 issue A. *
7. Penetration bar Identity/Drg No.	N/A
8. Other Inclinometer : Bosch DNM 60L	(cal. due 30/09/09).
9. Specimen prepared correctly	See RTR 249.
10. Specimen orientated correctly	37.0° ±0.2° on jacket to pallet **
11. Photograph just above target	✓
12. Raise to correct height	✓ 1-030m.
13. Release specimen	✓
14. Photograph in situ	✓
15. Photograph damage	✓
16. Confirm correct execution of drop	✓ Impact point 10mm above aiming mark Acceptable.
17. Pass/Fail (if, applicable see Test Plan)	Pass (fit to continue).

18. Notes

* Extended by 100mm to 600mm using section from second punch to avoid any risk of pallet contacting ground before package stops descending.
* Dimension "120" to aiming mark changed to 90mm to ensure impact with corner of drain plug. 35° changed to 37° to maintain CoG over point of impact (see also CF757C).
- Outer skin of jacket indented to a depth ~ 85mm (no cracking or shearing. Inner skin clear of drain plug by ~ 10mm.
- No other damage visible externally.
- Pallet, jacket, top shield and grill securely attached.

19. Signed: D W Rogers	Date: 21/11/08
20. Witnessed: Michael Nixon	Date: 21/11/08