9m drop test – HS-31x114-Tu Insert Assembly DN3985

Title	9m drop test – HS-31x114-Tu Insert Assembly DN3985	Number	TR 2013/02/04
		Issue	A
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1 Proposal

To conduct 9m drop tests on an Insert Assembly DN3985 as detailed in procedure CP 458 Issue B [Ref. 1].

2 Equipment

- Drop test conducted at Croft's drop test site, utilizing a suitable crane fitted with a release mechanism to drop the test item onto an embedded steel plate target that meets the requirements of 10 CFR 71.73 [Ref. 2].
- Test container housing the Insert Assembly – drawing 2C-6661 [Ref. 3]. Mass of the test container (e.g. body, cork packer, steel impact plate, lid and fixings) - 40.535kg.
- Measuring equipment – proprietary tape measure
- Bubble leak test rig (ISN 010) with calibrated pressure gauge (CC0032 – next calibration 5/2/2014), and ethylene glycol as the test liquid.
- Scales – CC0027 – next calibration 28/8/2013
- Still and movie cameras

3 Components tested

Insert Assembly, serial number 3985/001 – GRC 2098

O-ring containment seal - GRC 2066

The Insert Assembly's cavity contained a steel cavity filler and water coloured with red dye to simulate liquid contents filling 50% of the remaining cavity; as detailed below.

4 Pre drop test details

- Still photographs taken.
- Figure 1 shows the Insert Assembly and cavity filler prior to assembly.
- Figure 2 shows the cavity filler and liquid contents in situ.
- Figure 3 shows the alignment of the match marks of the assembled Insert Assembly.
- Figure 4 shows the proposed impact point.
- Appendix A shows the leak test results prior to drop test.
- Appendix B shows a summary of the mass of the tested items, (see section 6 - Post drop test summary - for comments).
- The following table details the mass of the items dropped:

Insert Assembly 3987/0002 with cavity filler and liquid contents.	7.787 kg
Mass of test container including polystyrene support structure.	40.605 kg
Total mass dropped.	48.392 kg

Figure 1 – Insert Assembly and cavity filler

Figure 2 – Contents in situ

Figure 3 - Match marks prior to drop test

Figure 4 - Indicated drop point prior to drop test

5 Drop test details

- Still photographs and movies taken during drop test.
- Figure 5 shows the test container with the cork packing and impact plate.
- Figure 6 shows the insert assembly within the test container supported by the polystyrene packing prior to the drop test.
- Figures 7 and 8 show the tape measure used for the 9m measurement.
- Figure 9 shows the typical setup employed, the test container at the drop height with the bottom of the tape measure off of the ground showing that the actual drop height is greater than 9m.
- Figure 10 shows the opened test container after the drop test, no indication of red dye leakage.

Figure 5 - test container (lid not shown)

Figure 6 - Insert assembly in test container

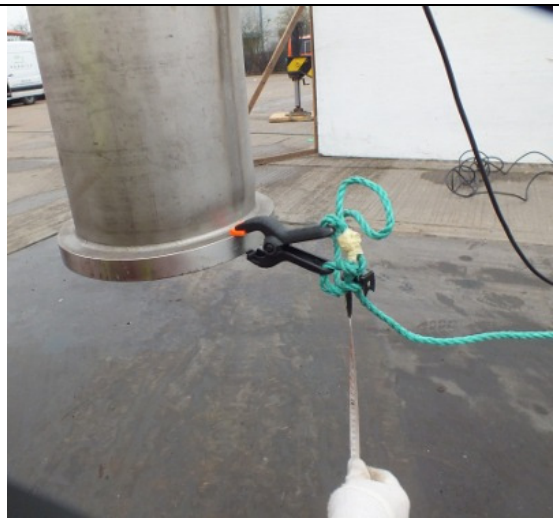

Figure 7 - tape measure attached to bottom of test container

Figure 8 - tape measure showing 9m measurement

Figure 9 - test container at height prior to drop

Figure 10 - container opened post drop

6 Post drop test details

- Still photographs taken.
- Figure 11 shows no obvious damage at the impact point that wasn't present prior to the drop test.
- Figure 12 shows the match marks after drop.
- Figure 13 indicates that there was no distortion to the lid.
- Figure 14 shows the opened Insert Assembly, and the retained liquid contents.
- Figure 15 indicates no obvious damage to the inside of the Insert Lid that wasn't present prior to the drop test.
- Figure 16 indicates no obvious damage to the inside of the Insert Body.
- There was no obvious damage elsewhere to the Insert Assembly.
- Appendix C shows the leak test results after the drop test.
- Appendix B shows a summary of the mass of the tested items. The results indicate no loss of liquid contents.

Figure 11 - showing no damage at impact point

Figure 12 - showing match marks after drop

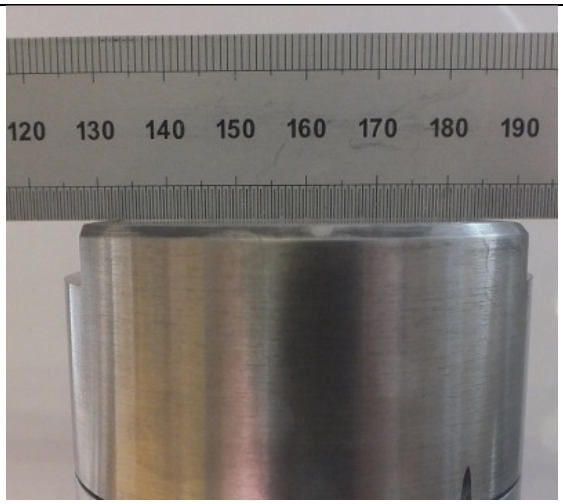

Figure 13 - showing no distortion to insert lid

Figure 14 - showing opened insert with liquid still contained

Figure 15 - showing inside of insert lid

Figure 16 - showing inside of insert body

7 Summary

- Figure 12 (post drop) indicates no unscrewing of the lid when compared to Figure 3 (pre-drop).
- The leak test results indicate that there were no leaks.
- The liquid was contained within the Insert Assembly.
- There was no obvious damage to the Insert Assembly.

8 References

1. CP 458 Issue B – Procedure for 9m Drop Test of Safkeg-HS Insert Assemblies
2. 10 CFR 71.73 – U.S.NRC Part 71, Packaging and Transportation of Radioactive Materials, Hypothetical accident conditions
3. 2C-6661 issue P3 – Drop test set-up HS Inserts (Appendix D – Drop test container)

9 Appendix A, Form F 213, Vac Bubble Leakage Test Record – Pre 9m drop

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Vac Bubble Leakage Test Record | **Form F213**

Procedure No CP 129

Test Liquid: ETHYLENE GLYCOL

Container Design/Serial No	Pass/Fail	Comments
DN 3985 INSERT Assembly HS-31x114-Tu 3985/001 PRE-9m DROP TEST LEAK TEST		GAUGE CC 0032 - CALIBRATION DUE 05/02/2014 REQUIREMENT <160 mbar ON GAUGE.
UPRIGHT	PASS	BUBBLES, DURING PRESSURE REDUCTION, FROM VENT HOLE PRESSURE HELD AT <100mbar NO BUBBLES, OBSERVED FOR >2 MINUTES
INVERTED	PASS	AS ABOVE, BUT LESS BUBBLES AS TEST LIQUID WAS ALREADY IN THE THREADED AREA. NO BUBBLES, OBSERVED FOR >2 MINUTES

Signature GR. Date 19/2/2013

File ref	F213-Vac Bubble Leakage Test Report	Form Status	Rev 2

10 Appendix B, Mass of tested Insert Assembly

File:///mass of tested inserts.xlsx

Test Item DN	3985
Description	HS-31x114-TU INSERT ASSEMBLY
Serial number	3985/001
Reason	9m DROP TESTS

Mass (kg):-

		Date:	Initials:
Insert Assy. Inc. O-ring	7.419	14/2/2013	GR
Cavity filler	0.341	"	GR
Initial mass inc. liquid	7.785	"	GR
Therefore liquid mass	0.025	"	GR
Mass after leak test 1	7.787	19/2/2013	GR
Mass after drop test	7.787	20/2/2013	GR
Mass after leak test 2	7.788	"	GR

Comments:

COMPILED	GR
DATE	20/2/2013

11 Appendix C, Form F 213, Vac Bubble Leakage Test Record – Post 9m drop

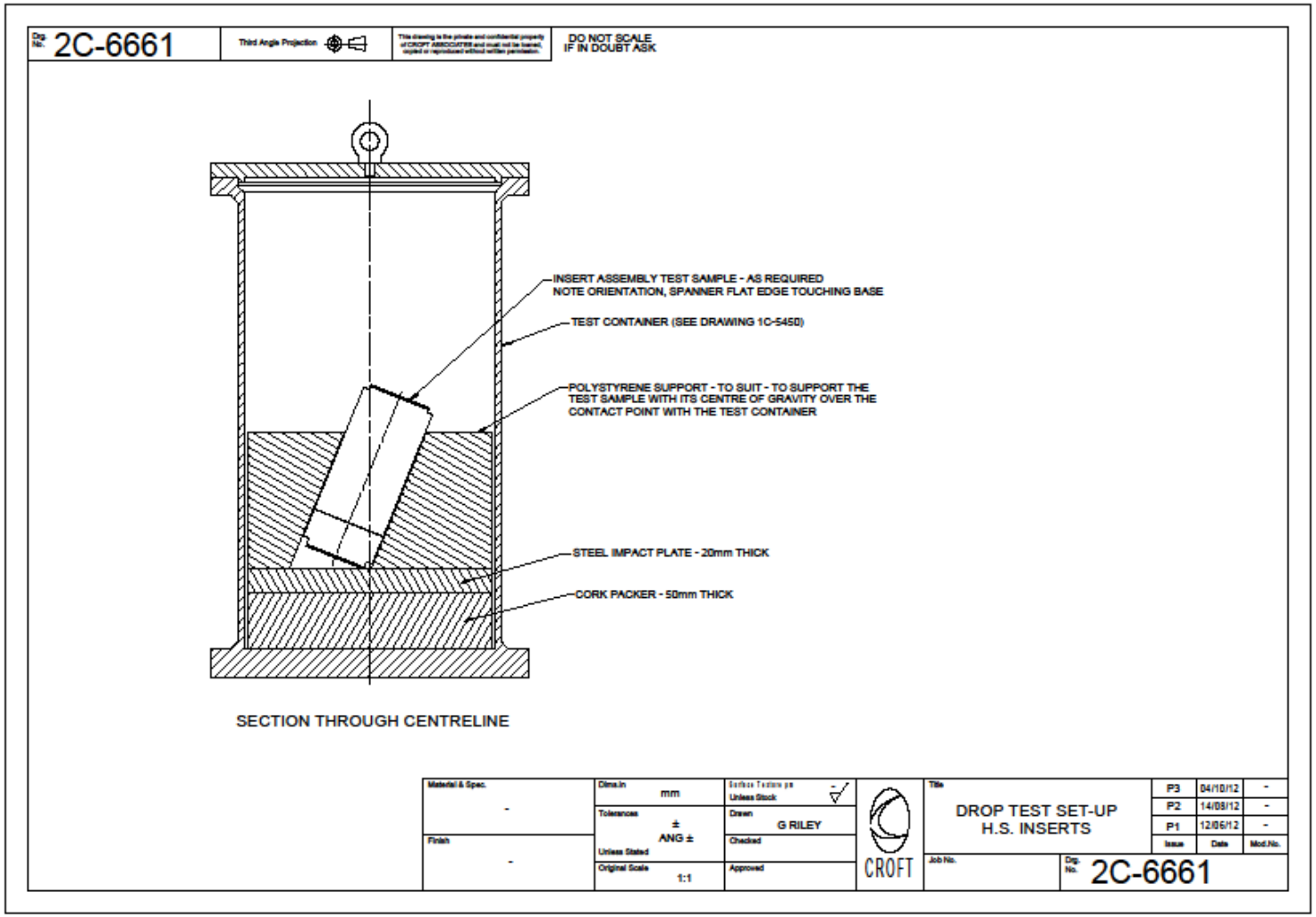
Vac Bubble Leakage Test Record	Form F213

Procedure No CP 129

Test Liquid: ETHYLENE GLYCOL

Container Design/Serial No	Pass/Fail	Comments
DN 3985 INSERT ASSEMBLY (HS – 31x114 – Tu) 3985/001		GAUGE CC0032 - CALIBRATION DUE 05/02/2014
POST 9m DROP TEST LEAK TEST		REQUIREMENT < 100mbar ON GAUGE
UPRIGHT	PASS	PROCESS AS FOR PRE 9m DROP TESTS. < 100mbar, OBSERVED FOR > 2 MINUTES NO BUBBLES
INVERTED	PASS	< 100mbar, OBSERVED FOR > 2 MINUTES NO BUBBLES AND NO INDICATION OF RED DYE LEAKAGE.

Signature [signature] CR Date 20/2/2013

Filename	F213-Vac Bubble Leakage Test Record	Form Status	Rev 2

12 Appendix D, Drop test container