

LEUPA

Type B(U) Package to Contain Fissile Substances

**TESTS CARRIED OUT ON SPECIMENS
OF THE DESIGN OF TYPE B(U)
PACKAGE TO TRANSPORT
RADIOACTIVE MATERIAL
FINAL REPORT**

Made by

INAP

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REVISION SHEET		Document No.: 0908-LE02-3BEIN-008			
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Válido - Uso Interno

1 PURPOSE

1. To describe in a detailed way all destructive-accumulative tests carried out on the specimens of type B(U) package design for the transport of radioactive materials in order to be approved by ARN (Nuclear Regulatory Authority).

2 SCOPE

1. Conditions of specimens of type B(U) packages, series numbers 01 and 02, before and after each test, are described in detail.
2. The application of tests stated in Standard AR 10.16.1 "Transport of Radioactive Materials" Revision 2, was considered due to the classification of "Type B(U) Package" for all means of transport: land, sea and air of fissile substances, and with what was agreed with the ARN –Nuclear Regulatory Authority– during previous contacts.

3 LOCATIONS

1. The assembly and tests of specimens subject to approval tests took place in INVAP workshops in the city of San Carlos de Bariloche (Province of Rio Negro) and in the Technological Complex Pilcaniyeu of the CNEA, with INVAP qualified technical personnel, INVAP safety personnel, and QA INVAP personnel, together with the presence of ARN – Transport personnel.

4 REFERENCE DOCUMENTATION

- [1] ARN. *Transport of Radioactive Materials*. Standard AR 10.16.1. Rev. 2. Argentine Republic: ARN, 2011.
- [2] 0908-LE02-3BSIN-006 "Specification of Type B(U) Package Assembly for Approval Testing".
- [3] 0908-LE02-3BSIN-002 "Specification of Validation Tests".

5 SPECIMENS USED IN TESTS

1. Two (2) LEUPA specimens were used for all tests.
2. The LEUPA specimen series No. 01 and 02 were made according with Specification No. 0908-LE02-3BSIN-006.
3. Tests on specimen series No. 01 and 02 were made following descriptions in Specification No. 0908-LE02-3BSIN-002.

6 TESTS

Tests were carried out in three (3) stages:

1. Stage 1: Making of LEUPA specimen series No. 01 and 02 on which tests were performed (Specification No. 0908-LE02-3BSIN-006).
2. Stage 2: Tests for Normal Conditions of Transport as in Standard AR10.16.1 – Rev. 2 of ARN.
3. Stage 3: Tests Accident Conditions during Transport by Land, by Sea and by Air, as to Standard AR10.16.1 – Rev. 2 of ARN.

NOTE: The acceptance criteria of tests were taken from Specification 0908-LE02-3BSIN-002 and can be seen in Item 10 – Page 27.

6.1 STAGE 1: Specimen Assembly

6.1.1 Specimen LEUPA N°01

1. In this stage the cleansing of the 4 (four) inner cans was visually checked, and the Pb pellets were loaded in each of them following Specification No. 0908-LE02-3BSIN-006.
2. The four inner cans were placed inside the container of inner cans, the spiral gasket was placed and the bolts with the torque requested in Specification No. 0908-LE02-3BSIN-006 were mounted (see Picture 1:and ¡Error! No se encuentra el origen de la referencia.).

Picture 1: Inner cans



Picture 2: Container cover



3. The intermediate cover and the external cover were placed; they were both bolted with required torques in Specification No. 0908-LE02-3BSIN-006 (see Picture 3: and Picture 4:).

Picture 3: Intermediate cover



Picture 4: Package



4. Once sealed, the specimen was marked with the generator required in Specification No. 0908-LE02-3BSIN-002.

6.1.2 Specimen LEUPA N°02

1. In this stage the cleansing of the 4 (four) inner cans was visually checked, and the Pb pellets were loaded in each of them following Specification No. 0908-LE02-3BSIN-006.
2. The four inner cans were placed inside the container of inner cans, the spiral gasket was placed, and the bolts with the torque requested in Specification No. 0908-LE02-3BSIN-006 were mounted.

3. The intermediate cover and the external cover were placed; they were both bolted with required torques in Specification No. 0908-LE02-3BSIN-006.
4. Once sealed, the specimen was marked with the generator required in Specification No. 0908-LE02-3BSIN-002.

6.2 STAGE 2: Tests for Normal Conditions of Transport

6.2.1 Spraying with Water – (Paragraph 721 – AR 10.16.1 – Rev. 2)

1. Specimen LEUPA 01 was placed on the ground on plugs, so that water could drain and not get in the test area (see Picture 5:).

Picture 5: Package prepared for spraying water test



2. The spraying system was mounted as stated in specification 0908-LE02-3BSIN-002 and the test was performed with the water spraying for more than one (1) hour.

6.2.1.1 Test Report

1. Once the test was finished, there was more than 5 cm of water inside the container.
2. The specimen LEUPA 01 did not suffer any alteration in its external structure, and there was no water in its inside.
3. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered to be satisfactory, and it was released for the following test.

6.2.2 Piling Up – (Paragraph 723 – AR 10.16.1 – Rev. 2)

1. The specimen LEUPA 01 was vertically placed with its base on a flat surface with no deformities.
2. A 2399 kg load was placed on it, and it was left there for 43 hs. (see Picture 6:).

Picture 6: Package prepared for piling test



3. The weight of specimen LEUPA 01 is of 473 kg, and so is the charge placed on it, verified by a cell charge.

6.2.2.1 Test Report

1. During inspection, it was, visually and dimensionally, proved that specimen LEUPA 01 had suffered no kind of deformation in its structure.
2. After certifying and evaluating the suffered damages by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the following test.

6.2.3 Free Drop – (Paragraph 722 – AR 10.16.1 – Rev. 2)

1. The specimen LEUPA 01 was taken to the test facility where the target and the gantry are for lifting the loads with its lifting system.
2. Before starting mechanical tests, a visual inspection took place, verifying that specimen LEUPA 01 had no damage in its structure.
3. Before starting mechanical tests, there were lifting tests as well as those for the automatic release hook.
4. The specimen LEUPA 01 was set in position, held by the lifting system and with the automatic release hook.
5. The specimen was secured with a rope to prevent it from oscillating and the 23° drop angle was verified twice.
6. The specimen was lifted by means of the lifting device and once in place, there followed the verifying of the 1.2 m height established in Specification No. 0908-LE02-3BSIN-002 and in the required Standard AR 10.16.1 – Rev. 2 (see Picture 7:).

Picture 7: Package on position (free drop test)



7. The specimen was released, hitting into target, it produced the flattening of the inferior ferrule at the bottom of the container (see Picture 8:).

Picture 8: Package damage (free drop test)



6.2.3.1 Test Report

1. Visual inspection showed a flattening of the inferior ferrule at the bottom of the specimen of around 290 mm in length and the falling of two (2) bolts in the same place.
2. No insulating thermal material was released.
3. There were no further damages in other parts of the specimen.
4. After certifying and evaluating the suffered damages by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the following test.

6.2.4 Penetration – (Paragraph 724 – AR 10.16.1 – Rev. 2)

1. The LEUPA specimen was horizontally placed in the middle of the test target and gantry and it was secured by means of wooden plugs to prevent movement.
2. The 6 kg bar was secured in the automatic release hook and it was lifted to the established height in Specification No. 0908-LE02-3BSIN-002, and required according with Standard AR 10.16.1 – Rev. 2 (See ¡Error! No se encuentra el origen de la referencia.).

Picture 9: Package prepared for penetration test



3. The 1 m drop height was verified by means of a witness specially prepared, and with a tape measure.
4. The bar which crashed into the specimen was freed, it left a small mark (see Picture 10:).

Picture 10: Mark in the package (penetration test)



6.2.4.1 Test Report

1. In visual inspection it could be seen that the 6 kg bar left on the specimen a small mark of around 14 mm diameter and 3 mm in depth.
2. The drop of the bar produced no further damage in the specimen structure.
3. The drop of the bar did not make any release in the insulating material.
4. The damage on the specimen was minimum.
5. After certifying and evaluating the damages suffered by the LEUPA specimen 01, the test was considered satisfactory; it was then released for accident condition tests.

6.3 STAGE 3: Tests for Accident Conditions during Transport by Land, by Sea and by Air

6.3.1 Drop I – (Paragraph 727 a – AR 10.16.1 – Rev. 2)

1. This series of tests is started with specimen LEUPA 01 with small damages produced in previous stages described in point 6.2.
2. The specimen LEUPA 01 was set in position, held by the lifting system and the automatic release hook.
3. The specimen was secured with a rope to avoid oscillation and the drop angle of 23° was checked twice (see Picture 11:).

Picture 11: Package on position (drop I)



4. The specimen was lifted by means of the lifting device and once in place, there followed the verifying of 9.25 m height, higher than the one established in Specification No. 0908-LE02-3BSIN-002 and required by Standard AR 10.16.1 – Rev. 2.
5. The specimen was released, hitting onto the target in the position checked before being lifted, it produced a flattening on its bottom (see Picture 12:).

Picture 12: Package damage (drop I)



6.3.1.1 Test Report

1. In the inspection following the test, a deformation on the inferior part of the bottom, where the impact was produced, could be seen.
2. This deformation produced a cave-in of around 75 mm at the bottom of the specimen LEUPA 01.
3. It could also be seen that two (2) bolts were cut off from the bottom and another one at the upper part due to the rebounding of the specimen.
4. During inspection it was verified that all the welds of the specimen were intact, we can therefore infer that the cut-off bolts do not imply an important damage.
5. After certifying and evaluating the damages suffered by the LEUPA specimen 01, the test was considered satisfactory; it was then released for the following test.

6.3.2 Drop II – (Paragraph 727 b – AR 10.16.1 – Rev. 2)

1. To perform this test a solid circular penetrator was mounted at the centre of the target and the test gantry.
2. The specimen LEUPA 01 was placed in a horizontal position with the automatic release hook and it was lifted by means of the lifting device up to a height of 1 m, requested by Specification No. 0908-LE02-3BSIN-002 and the one required in Standard AR 10.16.1 – Rev. 2 (see ¡Error! No se encuentra el origen de la referencia.).

Picture 13: Package prepared for drop II test



3. After verifying the drop height, the specimen was dropped, hitting on the cylindrical penetrator which produced a dent on its central area (see Picture 14:).

Picture 14: Package damage (drop II)



6.3.2.1 Test Report

1. Once the test was finished, there was a visual inspection of the specimen, the damage was verified and evaluated.
2. The impact made a circular mark of around 220 mm and a depth of 30 mm (see PHOTO 15).

Picture 15: Package after drop



3. No insulating material was released.
4. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the next test.

6.3.3 Drop III – (Paragraph 727 c – AR 10.16.1 – Rev. 2)

1. For this test of dynamic flattening, a plate, duly prepared of 529 kg in weight, was placed.
2. The specimen was horizontally positioned at the centre of the target and the test gantry, fixed by wood plugs to avoid movement (see Picture 16:).

Picture 16: Plate



3. The 529 kg plate was fixed by means of an automatic release hook and it was lifted up to the 9 m height described in Specification No. 0908-LE02-3BSIN-002 and required as to Standard AR 10.16.1 – Rev. 2 (see Picture 16:).
4. Once the drop height was verified, the plate was dropped landing on the specimen producing a flattening of the surface (see Picture 17:).

Picture 17: Package damage (drop III)



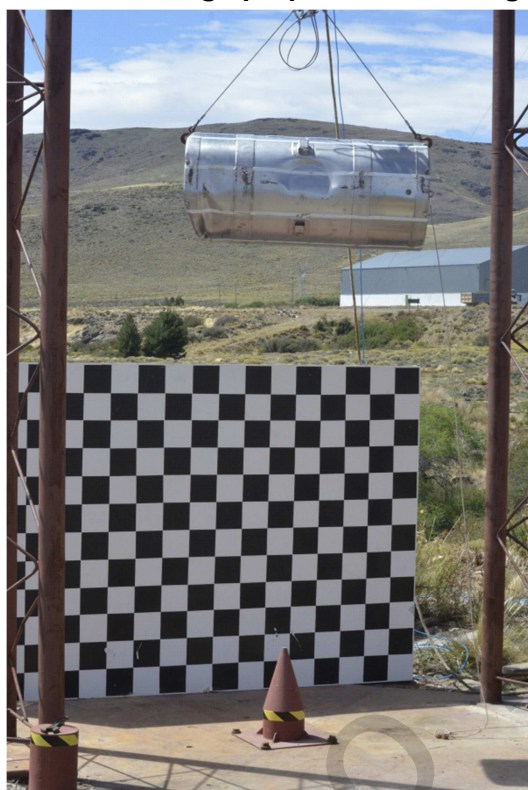
6.3.3.1 Test Report

1. After the drop was finished, a visual inspection of the damages produced, verified a slight flattening at the impact area.
2. There was also a small release of insulating material through the pressure release holes.
3. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the next test.

6.3.4 Drilling – Tearing – (Paragraph 735 b – AR 10.16.1 – Rev. 2)

1. For this test the solid conical penetrator was mounted in the centre of the target and the test gantry.
2. The specimen LEUPA 01 was placed horizontally with the automatic release hook and it was lifted up to 3 m height, requested in Specification No. 0908-LE02-3BSIN-002, and as required by Standard AR 10.16.1 – Rev. 2 (see Picture 18:).
3. After verifying the height of the drop, the specimen was dropped onto the conic penetrator producing a penetration in the central area (see Picture 19:).

Picture 18: Package prepared for drilling – tearing test



Picture 19: Package damage (drilling – tearing test)



6.3.4.1 Test Report

1. Once the test was finished, a visual inspection of the specimen was carried out which verified and evaluated the damages produced during test.
2. The impact made a conical hole of around 140 mm in diameter and 180 mm in depth.

3. There was release of insulating material in the impact area.
4. No damages were seen in the inner structure of the package.
5. After the test a situational analysis was performed, and the continuity of tests was evaluated.
6. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the next test.

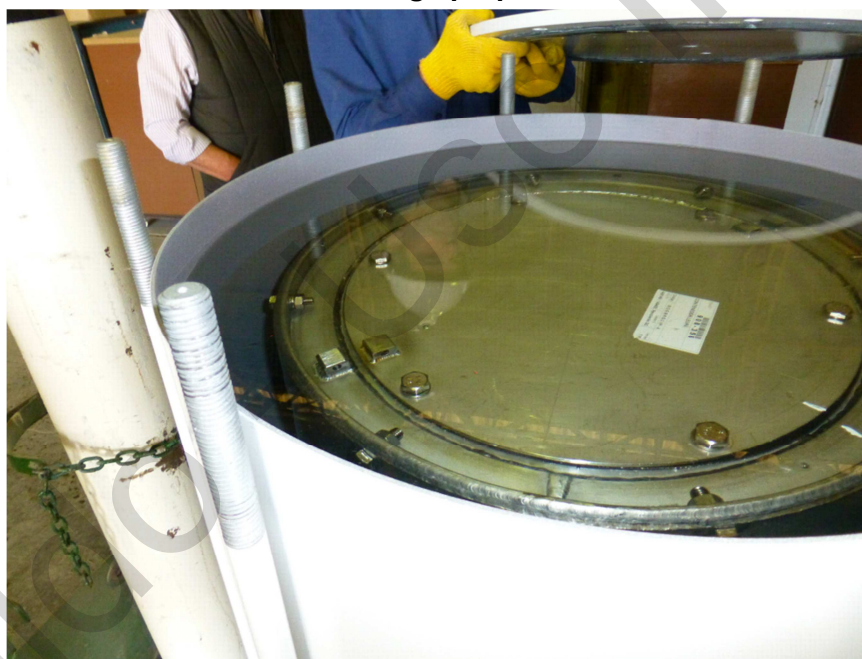
6.3.5 Impact – (Paragraph 737 – AR 10.16.1 – Rev. 2)

1. This test was made in a field according with what is demonstrated in the Technical Specification. No. 0908-LE01-3ASIN-026.

6.3.6 Water Immersion – (Paragraph 729 – AR 10.16.1 – Rev. 2)

1. For this test the specimen LEUPA 02 was used, prepared as described in point 6.1.2.
2. The test tank was placed in a flat surface, and the specimen LEUPA 02 was introduced inside.
3. The test tank was filled with ambient temperature clean water until it covered the specimen LEUPA 02 completely, the tank was closed and the bolts fixed to it so as to be later pressurized (see Picture 20:).

Picture 20: Package prepared for immersion test



4. The tank was pressurized with a manometric pressure of 2 kg/cm².

6.3.6.1 Test Report

1. After 3:30 pm the test tank was depressurized and the cover was removed.
2. The specimen LEUPA 02 was taken out from the test tank and its disassembly started.
3. Once the cover was removed, water could be seen in the first compartment, the second cover was removed and the second compartment was wet.
4. When the cover of the container of inner cans was removed, it could clearly be seen they were not wet, and both, the inner cans as well as their load, were in perfect state.
5. After certifying and evaluating the damages suffered by the specimen LEUPA 02, the test was considered satisfactory.

6.3.7 Reinforced Thermal – (Paragraph 736 – AR 10.16.1 – Rev. 2)

1. For this test on specimen LEUPA 01, instruments were set so as to be able to follow up and record its behaviour.
2. The specimen was completely disassembled and permanent sensors were placed in the four (4) inner cans, in accordance with Specification No. 0908-LE02-3BSIN-002
3. Specimen LEUPA 01 was reassembled respecting all the procedures and torques established in Specification No. 0908-LE02-3BSIN-006 (see Picture 21:).

Picture 21: Inner cans



4. Four (4) thermocouples were placed as indicated in Specification No. 0908-LE02-3BSIN-006 (see Picture 22:).

Picture 22: Thermocouples



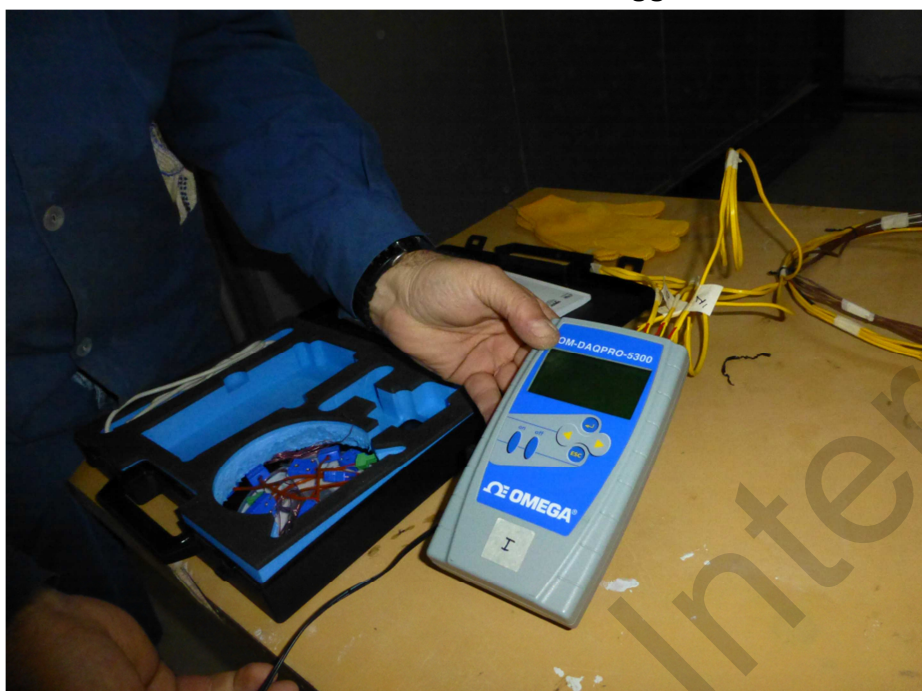
5. The fully equipped specimen was put into the test oven (see Picture 23:).

Picture 23: Package prepared for thermal test



6. The thermocouples were connected to a multi-channel data logger to read registers from the four thermocouples simultaneously (see Picture 24:).

Picture 24: Data logger



7. The oven was closed and turned on. After 1:30 hours it reached the test temperature established in Specification No. 0908-LE02-3BSIN-002, and required by Standard AR 10.16.1 – Rev. 2.
8. This oven temperature was kept at 800 °C +/- 5 °C during 1 hour.

6.3.7.1 Test Report

1. After the ending of the test, the specimen was left for cooling during more than 20 hours.
2. With visual inspection the change of colour in specimen LEUPA 01 was observed, the gasket of the external cover was damaged; and thermocouples were removed.
3. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for the last test.

6.3.8 Water Infiltration – (Paragraph 733 – AR 10.16.1 – Rev. 2)

1. The specimen LEUPA 01 already cooled was placed inside an immersion test tank.
2. The immersion test tank was filled above the upper border of specimen LEUPA 01, there was a waiting time till the thermal insulator was completely impregnated with water, then it was refilled with water above the upper border.
3. The tank was closed, the cover secured and it was pressurized at 1.1 kg/cm².

6.3.8.1 Test Report

1. After 2:00 p.m. pressure was at 0.9 kg/cm².
2. The specimen LEUPA 01 was taken out of the immersion test tank, thus ending the immersion test.
3. After certifying and evaluating the damages suffered by the specimen LEUPA 01, the test was considered satisfactory, and the specimen was released for disassembly and final inspection.

6.3.9 Reinforced Water Immersion – (Paragraph 730 – AR 10.16.1 – Rev. 2)

1. This test did not take place in the field due to the fact that it is demonstrated in Technical Specification No. 0908-LE02-3BSIN-004.

6.4 Disassembly – Inspection

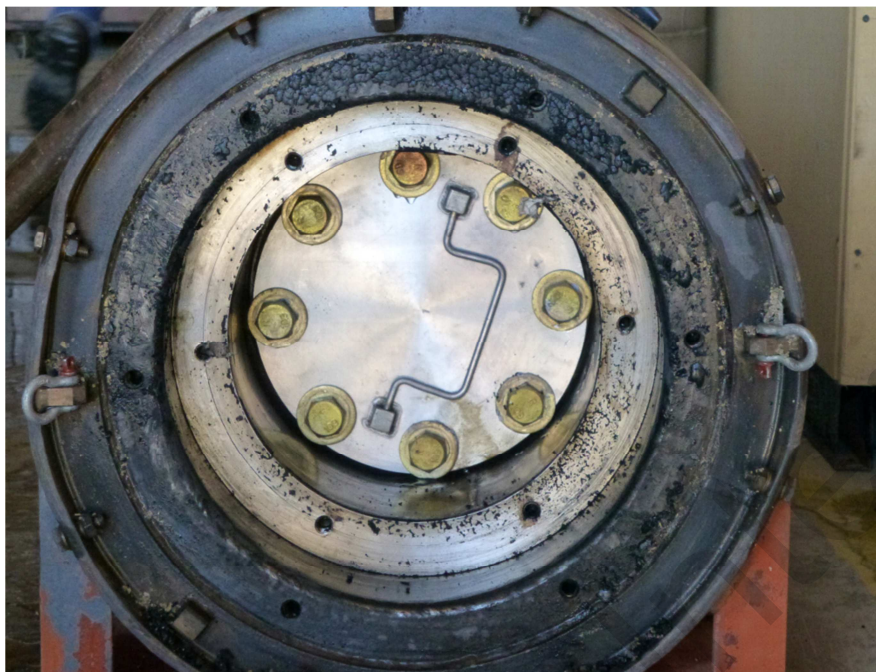
1. Once the water infiltration test was over, and the specimen had been taken out of the test tank, it was placed on the thermal test cradle so as to start its final disassembly.
2. The bolts were removed without any inconvenience and the first cover was removed.
3. It could be seen that the joint was destroyed, disintegrated in parts and the first compartment fully wet.
4. Afterwards, bolts of intermediate cover were easily removed (see Picture 25:).

Picture 25: Intermediate cover after tests



5. The joint was burnt; it had not lost its form and was adhered to the container flange.
6. The intermediate cover was deformed, and some parts were slightly swollen.
7. It could be seen that the second compartment was wet, but the flange of the container of the inner cans was in perfect conditions (see Picture 26:).

Picture 26: Spiral gasket after tests



8. The bolts of the flange were removed, and it could be seen that they had kept the same torque (approx. 60/70 Nm).
9. When the flange was removed, it could clearly be observed that its state was perfect, as well as the gasket, and the inner cans.

Picture 27: Primary containment flange after tests



10. The four (4) inner cans were taken out and their perfect state was verified.
11. The temperature in their outer surfaces was between 90 °C and 110 °C (see Picture 28:).

Picture 28: Inner cans after tests



6.4.1 Disassembly Report

1. As a result of all the destructive tests made in accordance with Specification No. 0908-LE02-3BSIN-002, and Standard AR 10.16.1 Revision 2 of ARN, it could be seen that the content of the inner cans was fully preserved inside them (see).

Picture 29: Inner cans



Picture 30: Content of inner cans



7 FINAL CONCLUSION

1. Destructive tests carried out in accordance with Specifications for Acceptance Tests of specimens of the type B(U) package design to contain radioactive material No. 0908-LE02-3BSIN-002, and Standard AR 10.16.1 Revision 2 of ARN were considered as approved, due to the satisfactory results obtained.

8 APPLICABLE DRAWINGS

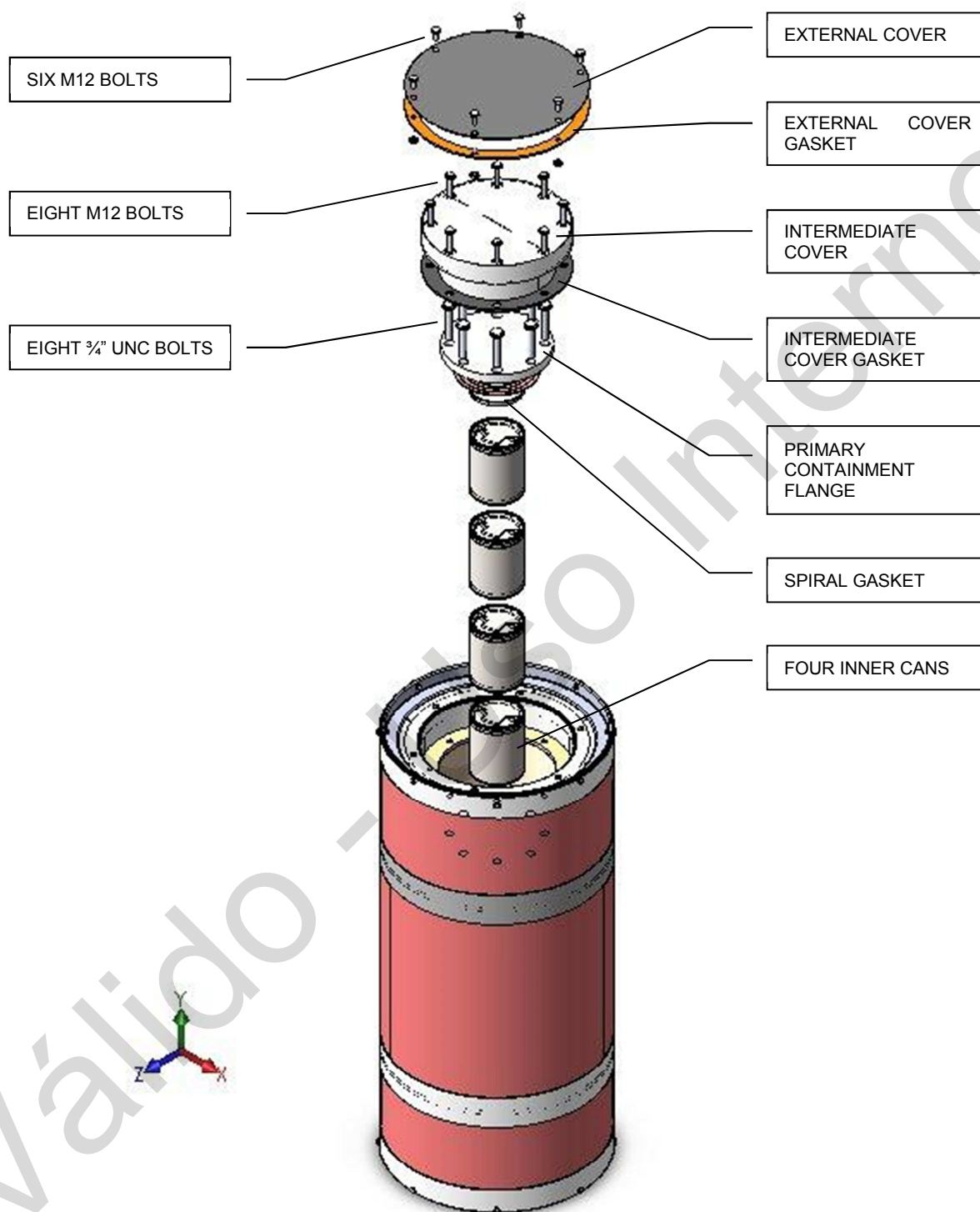
Drawing	Title
0908-LE01-3ASIN-004	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGE – GENERAL ASSEMBLY
0908-LE01-3ASIN-005	LOW ENRICHED URANIUM PACKAGE (LEUPA) – CONTAINER OF INNER CANS
0908-LE01-3ASIN-006	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – CADMIUM CHAMBER
0908-LE01-3ASIN-007	LOW ENRICHED URANIUM PACKAGE (LEUPA) – INNER CAN
0908-LE01-3ASIN-008	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – INTERMEDIATE COVER
0908-LE01-3ASIN-009	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – EXTERNAL COVER
0908-LE01-3ASIN-010	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY
0908-LE01-3ASIN-015	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – TYPE “A” AND “B” PLATES
0908-LE01-3ASIN-016	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – FLANGE

Drawing	Title
0908-LE01-3ASIN-017	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – WARNING PLATE
0908-LE01-3ASIN-018	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – NAME PLATE
0908-LE01-3ASIN-019	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGE – MAIN BODY – DESIGN AND MANUFACTURE PLATE
0908-LE01-3BASIN-020	LOW ENRICHED URANIUM PACKAGE (LEUPA) – GASKET SET AND RUBBER SUPPLEMENT

8.1 ENGINEERING MODIFICATIONS

Modification No.	Applicable Drawing
0908-LE01-IN-001	0908-LE01-3ASIN-006-B / 0908-LE01-3ASIN-005-B
0908-LE01-IN-002	0908-LE01-3ASIN-008-B
0908-LE01-IN-003	0908-LE01-3ASIN-010-B / 0908-LE01-3ASIN-015-B
0908-LE01-IN-004	0908-LE01-3ASIN-007-B
0908-LE01-IN-005	0908-LE01-3ASIN-006-B
0908-LE01-IN-006	0908-LE01-3ASIN-006-B
0908-LE01-IN-007	0908-LE01-3ASIN-005-B
0908-LE01-IN-008	0908-LE01-3ASIN-010-B
0908-LE01-IN-009	0908-LE01-3ASIN-010-B
0908-LE01-IN-010	0908-LE01-3ASIN-007-B
0908-LE01-IN-011	0908-LE01-3ASIN-040-B / 0908-LE01-3ASIN-010-B

9 SPECIMEN – LEUPA PACKAGE – GENERAL VIEW



10 ACCEPTANCE CRITERIA OF TESTS

ACCEPTANCE CRITERIA IN ACCORDANCE WITH SPECIFICATION No. 0908-LE02-3BSIN-002			
Point	Test	AR 10.16.1 – Rev. 2	Acceptance Criteria
6.1	SPRAYING WITH WATER	Paragraph: 721	<ul style="list-style-type: none"> *- Paragraph 657 a) is non-applicable since the criteria is $\leq 10^{-6}$ A2/h and in this case for uranium with U-235 up to 20%, A2 is without limits. (1) *- There is no structural deformation nor visible damages in the specimen.
6.2	FREE DROP	Paragraph: 722a	<ul style="list-style-type: none"> *- Paragraph 657 a) is non-applicable since criteria is $\leq 10^{-6}$ A2/h and in this case for uranium with U-235 up to 20%, A2 is without limits. (1) *- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA. *- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.
6.3	PENETRATION	Paragraph: 724	<ul style="list-style-type: none"> *- Paragraph 657 a) is non-applicable since the criteria is $\leq 10^{-6}$ A2/h and in this case for uranium with U-235 up to 20%, A2 is without limits. (1) *- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA. *- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.
6.4	PILING UP	Paragraph: 723	<ul style="list-style-type: none"> *- Paragraph 657 a) is non-applicable since the criteria is $\leq 10^{-6}$ A2/h and in this case for uranium with U-235 up to 20%, A2 is without limits. (1) *- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA. *- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.

7.1.1	DROP I	Paragraph: 727 a	<p>*- Paragraph 657 b) is non-applicable since the criteria is $\leq A2/\text{week}$ and in this case for uranium U-235 up to 20%, A2 is without limits. (2)</p> <p>*- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA.</p> <p>*- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.</p>
7.1.2	DROP II	Paragraph: 727 b	<p>*- Paragraph 657 b) is non-applicable since the criteria is $\leq A2/\text{week}$ and in this case for uranium U-235 up to 20%, A2 is without limits. (2)</p> <p>*- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA.</p> <p>*- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.</p>
7.1.3	DROP III	Paragraph: 727 c	<p>*- Paragraph 657 b) is non-applicable since the criteria is $\leq A2/\text{week}$ and in this case for uranium U-235 up to 20%, A2 is without limits. (2)</p> <p>*- The test has been passed because it can be visually verified that there is no leakage of thermal insulation of the cover of specimen LEUPA.</p> <p>*- Little leakage of thermal insulation will be acceptable if rubber caps are expelled because of impact to release inner pressure.</p>
7.1.4	DRILLING – TEARING	Paragraph 735 b	<p>*- No structural damages were present in the inner cans, which could ease the leakage of the material contained in them. (3)</p> <p>*- Little leakage of thermal insulation will be acceptable due to the impact.</p>
7.1.5	IMPACT	Paragraph: 737	*- See technical Specification No. 0908-LE02-3ASIN-005. (3)
7.2	WATER IMMERSION	Paragraph: 729	<p>*- Paragraph 657 b) is non-applicable since the criteria is $\leq A2/\text{week}$ and in this case for uranium U-235 up to 20%, A2 is without limits. (2)</p> <p>*- The test has been passed because it can be verified that the inner cans and the container of the inner cans preserve their original state and no water has got inside them. (3)</p>
7.3	THERMAL REINFORCED	Paragraph: 736	*- No leakage out of the inner cans, whatever the content may be. (3)
7.4	INFILTRATION IN WATER	Paragraph: 733	*- No leakage out of the inner cans, whatever the content may be. (3)

7.5	REINFORCED WATER IMMERSION	Paragraph: 730	*- See technical specification No. 0908-LE02-3ASIN-004.
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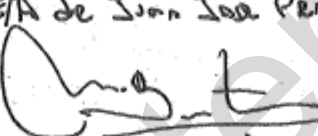
- (1) Sub-criticality of packages as to paragraphs 679 b) and 680.
- (2) Sub-criticality of packages as to paragraphs 679 c) y 680.
- (3) Sub-criticality of packages as to paragraphs 680.

11 ANEXX – TESTS REPORTS

PLANILLA PARA ARMADO – CARGA DE GRANALLA

Nº SERIE 01


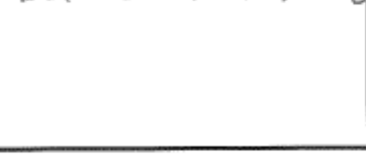
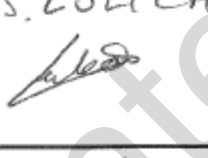
ENSAYOS PARA APROBACION BULTO B(U)																					
INVAP	ARN																				
ARN - NORMA AR 10.16.1 - REV 2																					
CONTENEDOR MODELO : LEUPA	REGISTRO N° 01																				
ENSAYO : Armado - Carga de Granalla de Pb	PARRAFO : 721																				
1 - ESTADO INICIAL : LIMPIO IDENTIFICADOS COMO 1, 2, 3 y 4 CONTROL VISUAL: SATISFACTORIO	FOTOS : LEUPA - 006/007 FILMACION :																				
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Condiciones Previas</th> <th style="width: 20%;">Peso Vacio</th> <th style="width: 20%;">Carga Pb</th> <th style="width: 20%;">Peso Total</th> </tr> </thead> <tbody> <tr> <td>Recipiente 1</td> <td>1682g</td> <td>10334g</td> <td>12026g</td> </tr> <tr> <td>Recipiente 2</td> <td>1650g</td> <td>10350g</td> <td>12000g</td> </tr> <tr> <td>Recipiente 3</td> <td>1653g</td> <td>10347g</td> <td>12010g</td> </tr> <tr> <td>Recipiente 4</td> <td>1639g</td> <td>10361g</td> <td>12000g</td> </tr> </tbody> </table>		Condiciones Previas	Peso Vacio	Carga Pb	Peso Total	Recipiente 1	1682g	10334g	12026g	Recipiente 2	1650g	10350g	12000g	Recipiente 3	1653g	10347g	12010g	Recipiente 4	1639g	10361g	12000g
Condiciones Previas	Peso Vacio	Carga Pb	Peso Total																		
Recipiente 1	1682g	10334g	12026g																		
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Recipiente 3	1653g	10347g	12010g																		
Recipiente 4	1639g	10361g	12000g																		
2 - ESTADO FINAL: CARGADO CON GRANALLA DE PLOMO CONTROL VISUAL: SATISFACTORIO	FOTOS : LEUPA 008/ 009/010/011/012/ 013/014/015/016/ 017/018/019/020. FILMACION :																				
Sensores de Temperatura N/A Stickers N/A Crayon N/A																					

ELEMENTOS QUE INTERVIENEN :		
Recipiente Interior Plano N° 0908-LE01-3ASIN 007		
Especific 0908-LE01-3BSIN-006 - Item 5.2.1		
BALANZA OHAUS EB-SERIES		
INTEGRACION Y ENSAYO		
ITEM: BA-I & E-016 Prot. 200711-Vto 24/7/2013		
PERSONAL PRESENTE		
RESPONSABLE	ENSAYOS - INVAP	QA - INVAP
 NESTOR GONZALEZ	 NESTOR GONZALEZ	 E/A de Juan Jose Pereyra
FECHA: 15/02/2013	HORA: 09:00	

PLANILLA PARA ARMADO – CARGA DE GRANALLA

N° Serie 02

ENSAYOS PARA APROBACION BULTO B(U) - LEUPA													
INVAP	ARN												
ARN - NORMA AR 10.16.1 - REV 2													
CONTENEDOR MODELO : LEUPA	REGISTRO N° 01												
ENSAYO : Armado - Carga de Granalla de Pb													
1 - ESTADO INICIAL : LIMPIOS Y SIN DAÑOS VISIBLES CONTROL VISUAL: OK	PARRAFO : FOTOS : OK FILMACION : NO												
Condiciones Previas <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Recipiente 1</td> <td style="width: 35%;">LIMPIOS SIN DAÑOS</td> <td style="width: 50%; text-align: right;">1652 g</td> </tr> <tr> <td>Recipiente 2</td> <td>u u u</td> <td style="text-align: right;">1987 g</td> </tr> <tr> <td>Recipiente 3</td> <td>u u u</td> <td style="text-align: right;">1666 g</td> </tr> <tr> <td>Recipiente 4</td> <td>u u u</td> <td style="text-align: right;">1652 g</td> </tr> </table>		Recipiente 1	LIMPIOS SIN DAÑOS	1652 g	Recipiente 2	u u u	1987 g	Recipiente 3	u u u	1666 g	Recipiente 4	u u u	1652 g
Recipiente 1	LIMPIOS SIN DAÑOS	1652 g											
Recipiente 2	u u u	1987 g											
Recipiente 3	u u u	1666 g											
Recipiente 4	u u u	1652 g											
2 - ESTADO FINAL: RECIPIENTES LLENOS LISTOS PARA CARGA #1 - 12.000 #2 - 12000 #3 - 12420 CONTROL VISUAL: #4 - 12000 OK	FOTOS : OK FILMACION : NO												
Sensores de Temperatura <div style="border: 1px solid black; height: 150px; width: 100%; position: relative;"> <div style="position: absolute; top: 0; left: 0; right: 0; bottom: 0; border-left: 1px solid black; border-right: 1px solid black; transform: rotate(180deg);"></div> </div>													
Torques													

ELEMENTOS QUE INTERVIENEN : Recipiente Interior Plano N° 0908-LE01-3ASIN 007 Especific 0908-LE01-3BSIN-006 - Item 5.2.1 BALANZA, BA-18E-016 VTO 24-7-13		
PERSONAL PRESENTE		
RESPONSABLE	ENSAYOS - INVAP	QA - INVAP
R. GIRAUD 	SORGO GALBAUD 	S. ZULICH 
FECHA: 9/4/13		HORA: 16:50

12.1 REGISTRO 01

ENSAYOS PARA APROBACION BULTO B(U)	
INVAP	ARN
ARN - NORMA AR 10.16.1 - REV 2	
CONTENEDOR MODELO : LEUPA	REGISTRO N° 01
ENSAYO : Armado	PARRAFO :
1 - ESTADO INICIAL : Limpio y Vacío. CONTROL VISUAL: OK	FOTOS : SI FILMACION : SI
<div style="text-align: right; font-size: small;">Cantidades Magnitudes Cumple</div> <p>SE CARGARON LOS CONTENEDORES 1, 2, 3, 4 CON PESO DE ACUERDO A LA PLANILLA - CARGA DE GRANALLA DE Pb.</p>	
2 - ESTADO FINAL: CONTROL VISUAL:	FOTOS : FILMACION :
EVALUACION DE DAÑOS: <p>EL ARMADO SE REALIZO DE ACUERDO A LO ESP. 0908-LE02-38517-006-C. -</p> <p>TORQUE : 5.2.2 - 3 55 Nm 5.2.3 - 2 15 Nm 5.2.3 - 6 15 Nm.</p>	