

LEUPA
TYPE B(U) PACKAGES FOR FISSILE MATERIALS

**LEUPA SPECIFICATION OF APPROVAL
TESTS FOR TYPE B(U) PACKAGE FOR
FISSILE MATERIALS**

Prepared by:

IN/AP

May 14, 2012

Page 1 of 59

SPECIFICATION OF APPROVAL TESTS FOR TYPE B(U) PACKAGE FOR FISSILE MATERIALS

REVISION SHEET		Document No.: 0908-LE02-3BEIN-002- Revision: A		
		DOCUMENT TITLE: SPECIFICATION OF APPROVAL TESTS FOR TYPE B(U) PACKAGES FOR FISSILE MATERIALS		
		Ref. No.:		
		Write name, date and sign		
Revision Letter	Description of the Revision	Prepared by	Reviewed by	Approved by
A	Original	NG	JLA	JCO

TABLE OF CONTENTS

1	PURPOSE	4
2	SCOPE	4
3	FACILITIES	4
4	SPECIMEN TO BE USED FOR TESTS	4
5	INITIAL STATE OF THE SPECIMEN	6
6	TESTS FOR NORMAL TRANSPORT CONDITIONS	6
6.1	Water spray, pursuant to paragraph 721:	6
6.2	Free drop, pursuant to paragraph 722 a):	6
6.2.1	Acceptance criterion for the test according to paragraph 657 a)	9
6.3	Penetration , pursuant to paragraph 724:	10
6.3.1	Acceptance criterion for the test according to paragraph 657 a)	10
6.4	Stacking, pursuant to paragraph 723:	11
6.4.1	Acceptance criterion for the test according to paragraph 657 a)	12
6.5	Sequence of tests for normal transport conditions	12
7	TESTS FOR ACCIDENT CONDITIONS DURING LAND, SEA AND AIR TRANSPORT ...	12
7.1	Mechanical Tests	12
7.1.1	Drop I, pursuant to paragraph 727 a):	12
7.1.1.1	Acceptance criterion for the test according to paragraph 657, paragraph 679 and paragraph 682 c)	13
7.1.2	Drop II, pursuant to paragraph 727 b):	14
7.1.2.1	Acceptance criterion for the test according to paragraphs 675, 679 and 682 c)	15
7.1.3	Drop III, pursuant to section 727 c):	16
7.1.3.1	Acceptance criterion for the test according to paragraphs 657, 679 and 682 c)	18
7.1.4	Puncture-tearing test, pursuant to paragraph 735 b):	18
7.1.4.1	Acceptance criterion for the test according to paragraphs 657, 679 and 682 c)	19
7.1.5	Impact test, Paragraph 737:	20
7.1.5.1	Acceptance criterion for the test	21
7.2	Water immersion test, pursuant to Paragraph 729:	21
7.2.1	Acceptance criterion for the test according to paragraph 657 b)	21
7.3	Enhanced thermal test, pursuant to Paragraph 736:	21
7.3.1	Progress of the test	25
7.3.1.1	Acceptance criterion for the test according to paragraph 736	27
7.4	Water in-leakage test, Paragraph 733:	28
7.4.1	Acceptance criterion for the test according to paragraph 657 b)	28
7.5	Enhanced water immersion test, pursuant to Paragraph 730:	28
7.5.1.1	Acceptance criterion for the test according to paragraph 657 a)	28
7.6	Sequence of tests for accidental transport conditions	28
8	RECORDS AND DOCUMENTATION OF THE TESTS	29
9	APPENDIX 1, VALID DRAWINGS	29
10	APPENDIX 2, ENGINEERING MODIFICATIONS	30
11	APPENDIX 3, VALID DRAWINGS OF TEST ELEMENTS	30
12	APPENDIX 4, TESTS SHEETS	32
12.1	RECORD 01	32
12.2	RECORD 02	34
12.3	RECORD 03	36
12.4	RECORD 04	37
12.5	RECORD 05	39
12.6	RECORD 06	41
12.7	RECORD 07	43
12.8	RECORD 08	45
12.9	RECORD 09	47
12.10	RECORD 10	49
12.11	RECORD 11	52
12.12	RECORD 12	54
12.13	RECORD 13	56

1 PURPOSE

1. Specifying the facilities, devices and auxiliary elements necessary to carry out the tests provided for in Standard AR 10.16.1 "Transport of Radioactive Materials, Rev. 2", necessary for the approval of Type B (U) Packages of fissile materials, called LEUPA, for all means of transport: by land, sea and air.

2 SCOPE

1. The facilities, devices and auxiliary elements necessary to carry out:
 - a) "Tests carried out for the purposes of proving the capacity to withstand normal transport conditions".
 - b) "Tests carried out for the purposes of proving the capacity to withstand accident conditions during transport".
2. In the case of the LEUPA, given its classification as "Type B (U) Package", and as agreed with the ARN -Nuclear Regulatory Authority - in previous communications, the tests provided for in Standard 10.16.1 Transport of radioactive materials, Rev. 2, apply for all means of transport of fissile materials: by land, water and air.

3 FACILITIES

1. Spraying, immersion, stacking and drop tests shall be carried out at CNEA's facilities in Pilcaniyeu (Province of Río Negro).
2. The thermal test shall be carried out at CNEA's facilities in Pilcaniyeu (Province of Río Negro).
3. The details of the facilities to be used shall be stated in the related sections of each test to be carried out.

4 SPECIMEN TO BE USED FOR TESTS

1. One only specimen shall be used for all the tests in this specification. The LEUPA specimen is identified with serial number 00.
2. In the prototype package, the fissile material shall be simulated using 2 mm lead pellets.

Lead blasting material is used because it is a high density material available in the market, and the difference with uranium is compensated by adding more material until the predefined weight is achieved.

The system would be conservative from a structural standpoint, since the containers will be fuller than if they carried U.

Taking 80% of the theoretical bulk density, approximately 42% of the volume available would be complete with U, vs. approximately 70% when loaded with Pb.

The lead pellets are placed on heat sealed cylindrical polyethylene film bags approximately 200 micron thick. Polyethylene bags are slightly smaller than the interior of Internal Containers in order to place them inside. The mass of each bag is approximately 12.5 kg +/- 0.5 kg, comparable to the simulated fissile material.

3. Generatrices 0°/45°/90°/135°/180°/225°/270°/ 315°/ and 360° shall be marked with indelible ink outside the test bulk (see drawing 0908-LE01-3ASIN-010 and figure 02 below to see angle references), in white. Each one of those 9 generatrices shall be marked with the related angle, with approximately 2 mm height characters. If generatrices are interrupted by

warning, design and manufacturing, identification plates and sling hooks, they shall be discontinued in those areas.

4. The differences between the final specimen to be certified and the prototype used in the test are the abovementioned lead pellets used instead of the fissile material, the existence of thermocouples (see fig. 19) in the prototype model and the marked generatrices. The remaining characteristics of both bulks meet the exact same engineering specifications.

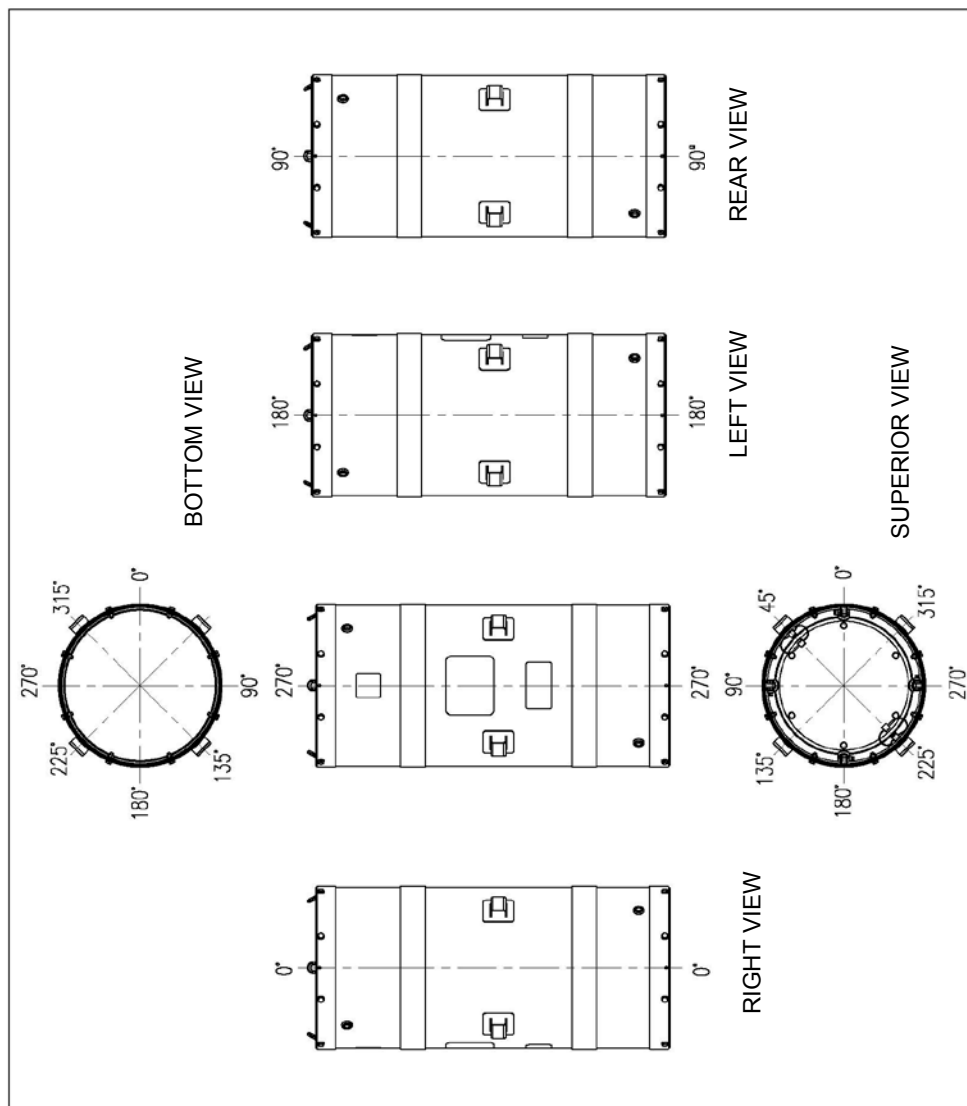


Figure 1

5 INITIAL STATE OF THE SPECIMEN

1. The specimen shall be completely closed and ready for tests pursuant to the instructions in document 0908-LE02-3BEIN-006 "LEUPA – Assembly of the Specimen for Approval Tests."

6 TESTS FOR NORMAL TRANSPORT CONDITIONS

6.1 WATER SPRAY, PURSUANT TO PARAGRAPH 721:

1. Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"721. Water spray test: The specimen shall be subject to water spray simulating exposure to approximately 5 cm/h rain, for at least one hour."

2. To carry out the test, the elements shall be allocated as follows: the LEUPA specimen shall be in the center of the test area, with four sprinklers with horizontal discharge, 90° from each other, 1.6 m high and 0.75 m away from the vertical axis of the LEUPA specimen.
3. The duration of the test shall be one hour and 5 cm of water.
4. After that condition is met, pursuant to paragraph 720, a maximum period of 2 hours shall elapse from the end of the water spray test to the following test.
5. The surface of the test area, approximately 3 m x 3 m, shall be flat and clean, made of steel, concrete or similar to avoid mud.
6. The water used shall be drinking water from the water supply system, with no recirculation. The discharge shall allow all the cylinder encasement and upper face of the LEUPA specimen to receive the spraying.
7. Four containers to verify the accumulation of 5 cm during the test shall be installed next to the LEUPA specimen, at floor level and under the water spray. The containers shall be 90° away from each other and 45° from the vertical planes where the sprayers are located, approximately 10 cm away from the LEUPA. The mathematical average of the four containers is considered in the verification.
8. The water must drain outside the test area to avoid accumulation.
9. The acceptance criterion is that stated in paragraph 657 a)
10. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The test shall be recorded with photographs and videos, as stated in section 8.

6.2 FREE DROP, PURSUANT TO PARAGRAPH 722 A):

1. Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"722. Free drop test: The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested:

"a) The height of drop measured from the lowest point of the specimen to the upper surface of the target shall be not less than the distance specified in Table 14 for the applicable mass. The target shall be as defined in paragraph 717."

"717. The target for the drop test specified in paragraphs 705, 722, 725 a), 727 and 735 shall be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase damage to the specimen."

2. To carry out the test, the target used for drop tests of other packages, such as the "Guri" package shall be used. The target is at the CNEA's facilities in Pilcaniyeu (Province of Río

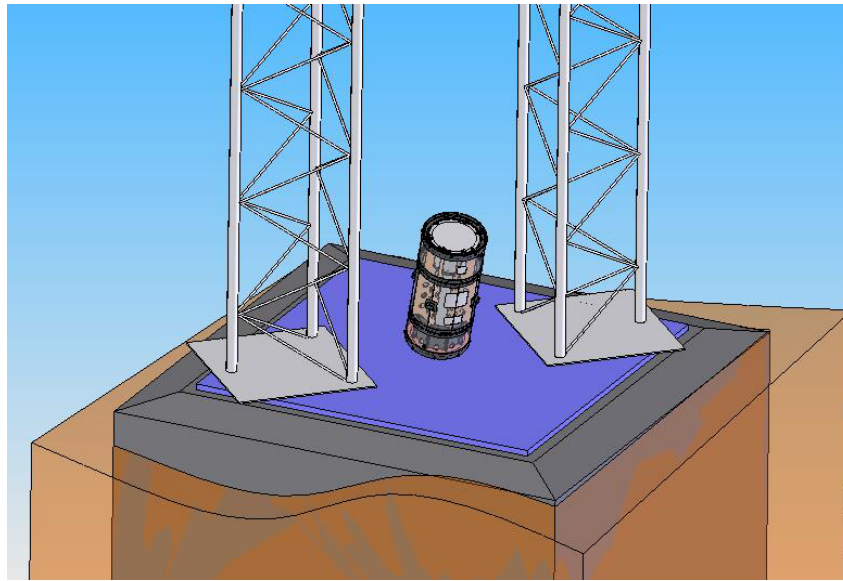
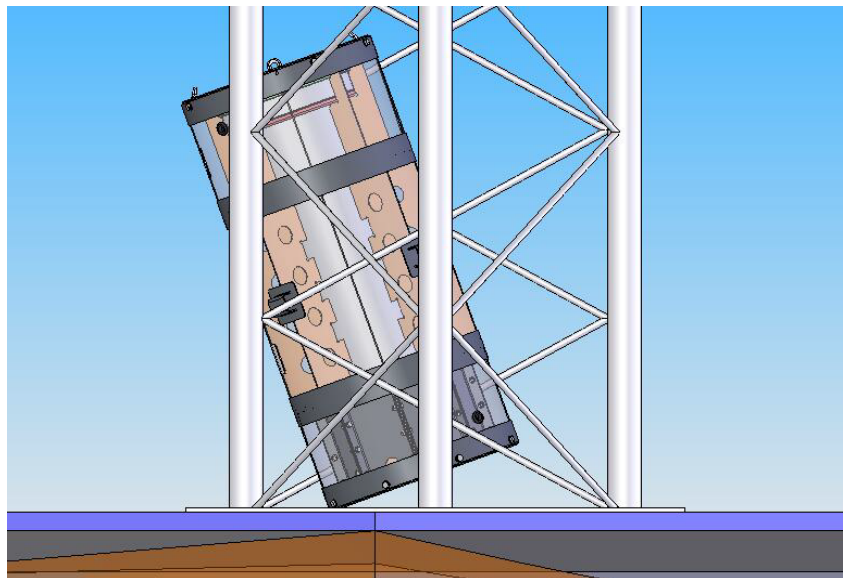
Negro) and consists of a concrete cube, with 4 m each side, set on rocky ground with no fissures. On the upper side (impact side) it has a 3m side and 5 cm width carbon steel plate firmly set. The target described meets the requirements stated in section 717.

See drawing 0908-LE02-3ASIN-006



Figure 2

3. A reticulated gantry holding a pulley, a steel cable and a hook is placed on the target. The cable is pulled by an electronic gear mounted above floor level (left of the photograph, not visible), to lift loads of up to 2 tons. The chain gear we can see in the photograph mounted on the beam will not be used.
4. The free height from the target to the hook is 11.4m.
5. The LEUPA specimen has an approximate gross mass of 480 kg, and therefore, according to Table 14, a drop height of 1,2 m applies for the test. The height shall be measured from the bottom part of the specimen.
6. Regarding what is stated in the standard, "**The specimen shall drop onto the target so as to suffer maximum damage...**", given the structural characteristics of the specimen, the thermal insulation used and the location of the center of gravity, it is established that the most unfavorable impact is that produced when the LEUPA specimen drops from an initial tilted position of approximately $20^{\circ} \pm 5^{\circ}$ in relation to the vertical, with its load end on the top part.- Refer to Technical Specification 0908-LE02-3BEIN-003.
7. In figure 3 below we can see the arrangement of the test upon impact. In figure 4 we see a side view of the impact.

**Figure 3****Figure 4**

8. To achieve the initial tilted position, the specimen shall be suspended from the shackles in item 01 of drawing 0908-LE01-3AEIM-004 using slings with different lengths to achieve the desired tilting. Also, control ropes can be used to avoid rotation of the specimen caused by the wind. Control ropes can be fixed to the 4 sling hooks in the LEUPA specimen at mid-height.
9. Other auxiliary items for lifting, such as shackles, loops, rings, etc. shall be verified to support the weight of the LEUPA specimen (480 kg.)
10. To allow for a sudden release of the specimen and initiate the drop, the device indicated in drawing 0908-LE02-3ASIN-012 shall be used (refer also to figure 5). The load is released by activating the pneumatic cylinder incorporated to the hook. The operation of the device shall be verified through a set of tests that are not within the scope of this specification.



Figure 5

11. The height from the bottom of the specimen to the target shall be verified prior to carrying out the test using a spreader built on a 2" x 2" wooden brace, cut at a length of 120 +5/-0 cm. The spreader shall be painted red and have the number 120 written clearly in indelible ink.
12. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

6.2.1 Acceptance criterion for the test according to paragraph 657 a)

1. The test shall be considered approved if, after the impact, it is visually verified that there are no leaks from the thermal insulation in the encasement of the LEUPA specimen.
2. Small-sized leaks in the thermal insulation shall be admissible if the rubber plugs are expelled upon impact to release internal pressure (see engineering modification 0908-LE01-IN-009).
3. After verifying the foregoing, the following test may be carried out.
4. Paragraph 657 a) does not apply because the criterion is $\leq 10^{-6} A_2/h$ and in this case for uranium with U-235 up to 20%, A_2 has no limit.
5. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

6.3 PENETRATION , PURSUANT TO PARAGRAPH 724:

1 Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"724. Penetration test: The specimen shall be placed on a rigid, flat, horizontal surface which will not move significantly while the test is being carried out.

a) A bar 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, onto the center of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.

b) The height of drop of the bar measured from its lower end to the intended point of impact on the upper surface of the specimen shall be 1 m".

2 The test shall be carried out by placing the specimen horizontally on the target as shown in Figure 3.

3 The construction drawing of the bar is drawing 0908-LE02-3ASIN-003. The displayed bar weighs approximately 6 kg.

4 In figures 6 and 7 we can see the arrangement of the test.

5 The impact area is defined as that which is located at mid-height of the LEUPA, over generatrix 0°. The impact shall be a radial impact.

6 Wooden or similar wedges shall be used (not shown in the figure) to avoid rotation of the specimen on the target.

7 The height from the top of the specimen to the bottom of the penetration bar shall be verified prior to performing the test using a spreader built on a 2" x 2" wooden brace, cut at a length of 100 +5/-0 cm. The spreader shall be painted red and have the number 100 written clearly in indelible ink.

8 The penetrating bar shall be supported with a small diameter rope tied to a beam specifically installed for this test on the gantry, at an intermediate height of 2.5 m. The beam shall support the weight of the bar and its accessories (approximately 10 kg). The bar is released by simply releasing the rope. It shall be verified that the rope will not slow-down the drop when released or alter the free drop path. As an alternative and at the discretion of the person in charge of the test, the fast release hook in drawing 0908-LE02-3ASIN-012 can be used.

9 Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The bar drop shall be recorded with photographs and videos, as stated in section 8.

6.3.1 Acceptance criterion for the test according to paragraph 657 a)

1 The same provisions stated for the test pursuant to section 722 (a) apply.

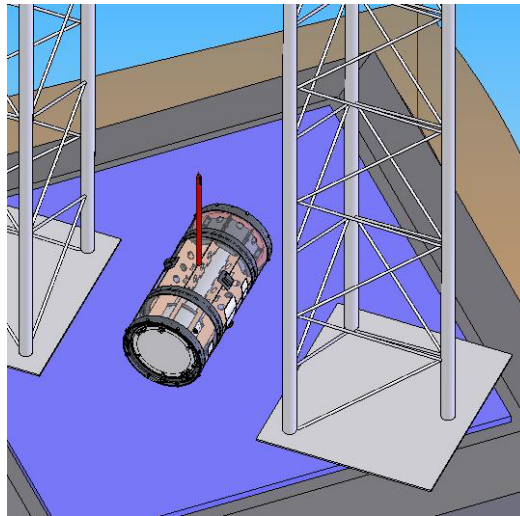


Figure 6

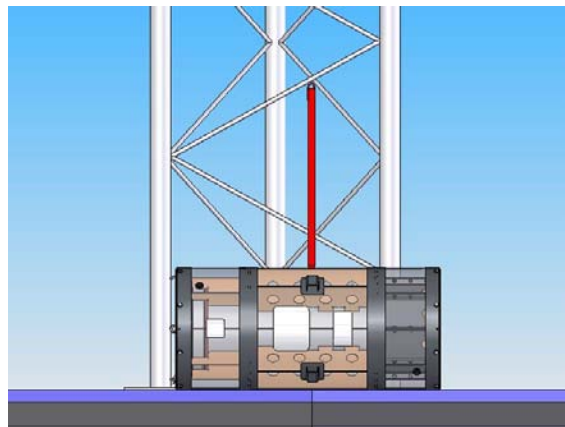


Figure 7

2. Paragraph 657 a) does not apply because the criterion is $\leq 10^{-6} A_2/h$ and in this case for uranium with U-235 up to 20%, A_2 has no limit.

6.4 STACKING, PURSUANT TO PARAGRAPH 723:

1. Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

723. Stacking test: Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 h, to a compressive load equal to the greater of the following:

a) A total weight equal to 5 times the maximum weight of the package; and

b) The equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would typically rest.

2. The test shall be carried out by placing the specimen in vertical position with the base on the target or any other flat surface with no deformation.
3. A 2400 kg load shall be placed steadily on top and left there for 24 h.
4. Given that the container can NOT be stacked, placing 5 times the mass of the specimen for this test is very conservative.

6.4.1 Acceptance criterion for the test according to paragraph 657 a)

1. The test shall be considered approved if, after the stacking, it is visually verified that there are no deformations or leaks from the thermal insulation in the encasement of the LEUPA specimen.
2. Small-sized leaks in the thermal insulation shall be admissible if the rubber plugs are discharged upon stacking to release internal pressure (see engineering modification 0908-LE01-IN-009).
3. Paragraph 657 a) does not apply because the criterion is $\leq 10^{-6} A_2/h$ and in this case for uranium with U-235 up to 20%, A_2 has no limit.
4. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The test shall be recorded with photographs and videos, as stated in section 8.

6.5 SEQUENCE OF TESTS FOR NORMAL TRANSPORT CONDITIONS

- 1 Pursuant to the provisions in standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2" the sequence shall be as follows:
 - a) Water spray test, pursuant to the provisions in 6.1.
 - b) Free drop test pursuant to 6.2. shall be carried out after completion of the abovementioned Water spray test.
 - c) Penetration test pursuant to the provisions in 6.3. shall be carried out after completion of the abovementioned Water spray test.
 - d) Stacking Test pursuant to the provisions in 6.4.

7 TESTS FOR ACCIDENT CONDITIONS DURING LAND, SEA AND AIR TRANSPORT

7.1 Mechanical Tests

- 1 To carry out the following tests, the same specimen used to test normal transport conditions shall be used.

7.1.1 Drop I, pursuant to paragraph 727 a):

- 1 Transcription of paragraph 727 a), Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"727 a) For drop I, the specimen shall drop onto the target so as to suffer maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target shall be 9 m. The target shall be as defined in paragraph 717."

- 2 To carry out this test, the same target, arrangement of lifting means and the same release device described in the free drop test pursuant to section 722 (a) shall be used (see section 6.2).
- 3 The LEUPA specimen shall be lifted using the electrical gear mounted at floor level.
- 4 The height between the lower part of the specimen and the target shall be verified using a rope tied to the specimen so that a 900 +20/-0 cm section hangs freely on the lower part, with the end of the rope free in the air almost touching the target. The free end of the rope shall be tied to a small weight to maintain vertical position to avoid movement caused by the wind.

- 5 The test may be carried out when there is no wind or when the specimen, hanging 9m down, does not oscillate.
- 6 The maximum damage impact, similar to the provisions for the free drop test pursuant to section 722 (a), is established as the impact caused by a drop with the specimen tilted by approximately 23° with respect to the vertical axis, with the load end upwards. The initial position of the LEUPA package shall be rotated by 180° with respect to the vertical axis, in relation to that used for the free drop test pursuant to section 722 (a), to avoid superposition of damages from both tests. This way, the impact for the test of each drop pursuant to section 727 a) shall be on the 90° generatrix.

7.1.1.1 Acceptance criterion for the test according to paragraph 657, paragraph 679 and paragraph 682 c)

1. The test shall be considered approved if, after the impact, it is visually verified that there are no leaks from the thermal insulation in the encasement of the LEUPA specimen.
2. Small-sized leaks in the thermal insulation shall be admissible if the rubber plugs are expelled upon impact to release internal pressure (see engineering modification 0908-LE01-IN-009).
3. After verifying the foregoing, the following test may be carried out.
4. Paragraph 657 a) does not apply because the criterion is $\leq 10^{-6} A_2/h$ and, in this case, for uranium with U-235 up to 20%, $A_2 e$ has no limit.
5. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

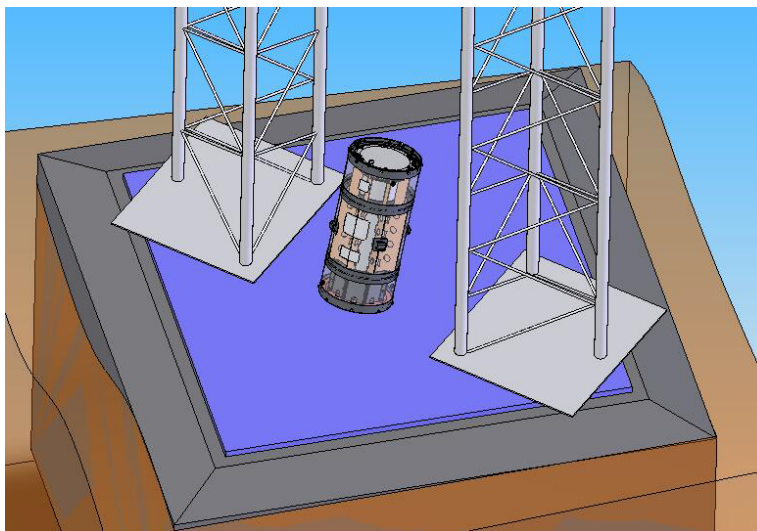


Figure 8

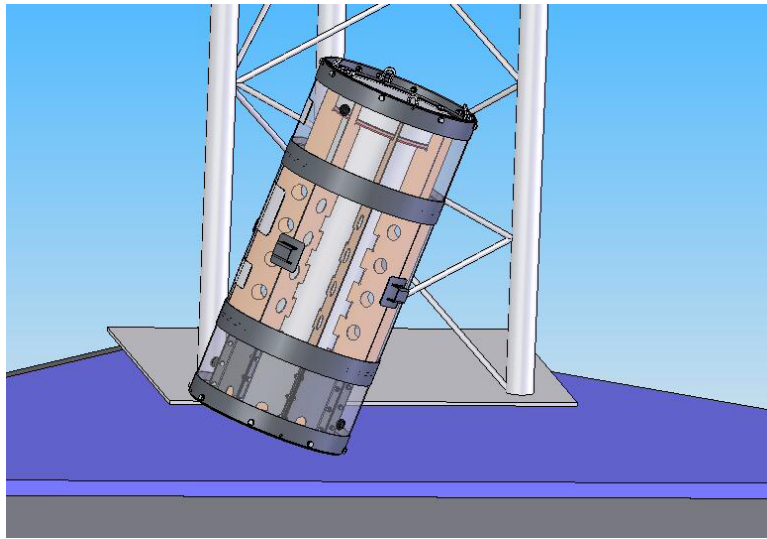


Figure 9

7.1.2 Drop II, pursuant to paragraph 727 b):

- 1 Transcription of section 727 b), Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"727 b) For drop II, the specimen shall drop so as to suffer maximum damage onto a bar rigidly mounted perpendicularly to the target. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar shall be 1 m. The bar shall be of solid mild steel of circular section, 15.0 ± 0.5 cm in diameter and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage shall be used. The upper end of the bar shall be flat and horizontal with its edge rounded off to a radius of not more than 6 mm. The target on which the bar is mounted shall be as described in paragraph 717.

- 2 To carry out this test, the same target and the same release device described in the free drop test pursuant to section 722 (a) shall be used.
- 3 The construction drawing of the penetration bar is drawing 0908-LE02-3ASIN-004. The bar shall be welded in the center of the metal platform as we can see in drawing 0908-LE02-3ASIN-006.
- 4 For the test, the LEUPA shall be launched in a horizontal position, so that the impact is on the center, on the 180° generatrix.
- 5 To verify the height from the specimen to the bar, the 100 cm spreader previously used in the penetration test pursuant to section 724 shall be used.
- 6 The arrangement of the test is laid out in figures 10 and 11.
- 7 Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

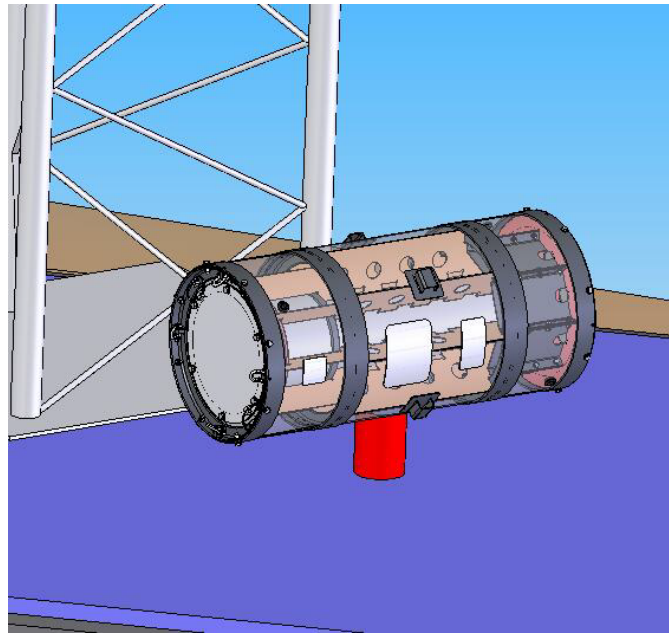


Figure 10

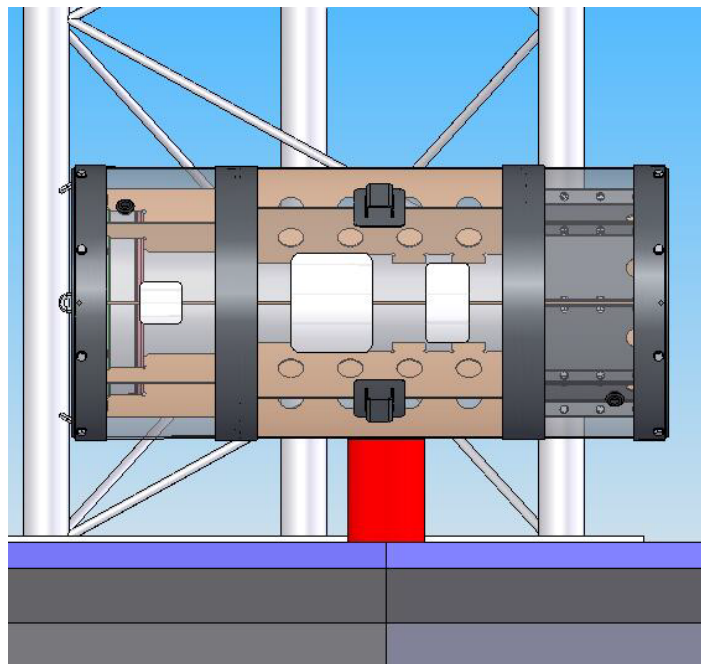


Figure 11

7.1.2.1 Acceptance criterion for the test according to paragraphs 675, 679 and 682 c)

1. The test shall be considered approved if, after the impact, it is visually verified that there are no leaks from the thermal insulation in the encasement of the LEUPA specimen.
2. Small-sized leaks in the thermal insulation shall be admissible if the rubber plugs are expelled upon impact to release internal pressure (see engineering modification 0908-LE01-IN-009).
3. After verifying the foregoing, the following test may be carried out.

4. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

7.1.3 Drop III, pursuant to section 727 c):

- 1 Transcription of paragraph 727 c), Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"727 c) For drop III, the specimen shall be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 m onto the specimen. The mass shall consist of a solid mild steel plate 1 m × 1 m and shall fall in a horizontal attitude. The height of the drop shall be measured from the underside of the plate to the highest point of the specimen. The target on which the specimen rests shall be as defined in paragraph 717."

- 2 To carry out this test, the same target and the same release device described in the free drop test pursuant to section 722 (a) shall be used; see section 6.2.
- 3 The construction drawing for the plate is drawing 0908-LE01-3ASIN-005. The plate is 63.5 mm thick to provide the 500 kg weight provided for by the standard.
- 4 In figure 12 we see the set composed of the plate, eye bolts, slings, central ring and fast release device.



Figure 12

- 5 For the test, the LEUPA shall be in a horizontally altitude above the target, resting on the 180° generatrix, the area receiving the drop damage pursuant to paragraph 727 b). Wooden or similar wedges shall be used to avoid rotation.
- 6 To lift the plate, 4 M16 eye bolts shall be used pursuant to DIN 580 or similar standard, with a minimum 0.8 ton load carrying capacity each. The lifting hook shall be connected to the

eye bolts with 500 kg minimum capacity slings, forming a maximum angle of 45° between them.

- 7 To verify the height from the specimen to the plate, a rope freely hanging from the underside of the plate shall be used. The hanging rope section shall be 900 +20/-0 cm, and the lower end of the rope shall be almost touching the LEUPA. The free end of the rope shall be tied to a small weight to maintain vertical position to avoid movement caused by the wind.
- 8 The test may be carried out when there is no wind or when the plate, hanging from a 9m altitude, does not oscillate.
- 9 In figures 13 and 14 we can see the instant of impact with the LEUPA.
- 10 Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

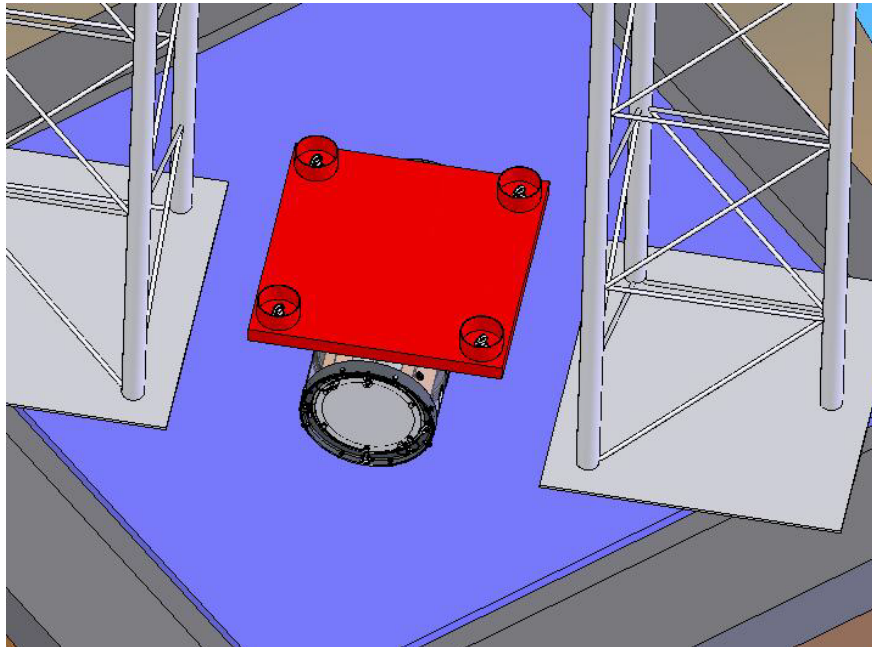


Figure 13

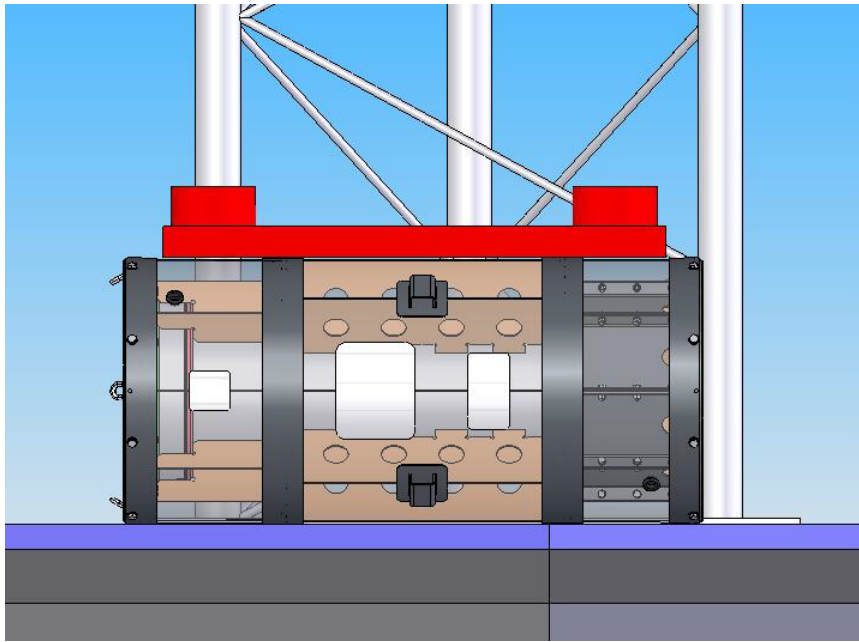


Figure 14

7.1.3.1 Acceptance criterion for the test according to paragraphs 657, 679 and 682 c)

1. The test shall be considered approved if, after the impact, it is visually verified that there are no leaks from the thermal insulation in the encasement of the LEUPA specimen.
2. Small-sized leaks in the thermal insulation shall be admissible if the rubber plugs are expelled upon impact to release internal pressure (see engineering modification 0908-LE01-IN-009).
3. After verifying the foregoing, the following test may be carried out.
4. Paragraph 657 a) does not apply because the criterion is $\leq 10^{-6} \text{ A}_2/\text{h}$ and, in this case, for uranium with U-235 up to 20%, $\text{A}_2 \text{ e}$ has no limit.
5. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

7.1.4 Puncture-tearing test, pursuant to paragraph 735 b):

- 1 Transcription of paragraph 735, Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"735. Puncture-tearing test: The specimen shall be subjected to the damaging effects of a solid probe made of mild steel. The orientation of the probe to the surface of the specimen shall be such as to cause maximum damage at the conclusion of the test sequence specified in paragraph 734 a).

a) The specimen, representing a package having a mass of less than 250 kg, shall be placed on a target and subjected to a probe having a mass of 250 kg falling from a height of 3 m above the intended impact point. For this test the probe shall be a 20 cm diameter cylindrical bar with the striking end forming the frustum of a right circular cone with the following dimensions: 30 cm height and 2.5 cm diameter at the top with its edge rounded off to a radius of not more than 6 mm. The target on which the specimen is placed shall be as specified in paragraph 717.

b) For packages having a mass of 250 kg or more, the base of the probe shall be placed on a target and the specimen dropped onto the probe. The height of the drop, measured

from the point of impact with the specimen to the upper surface of the probe, shall be 3 m. For this test the probe shall have the same properties and dimensions as specified in a), except that the length and mass of the probe shall be such as to cause maximum damage to the specimen. The target on which the base of the probe is placed shall be as specified in paragraph 717".

- 2 This test is required under paragraph 680 for air transport of packages containing fissile materials.
- 3 To carry out this test, the same target and the same release device described in the free drop test pursuant to section 722 (a) shall be used; see section 6.2.
- 4 In drawing 0908-LE02-3ASIN-004 we can see the cone-shaped penetrator. The cone-shaped penetrator shall be welded in the center of the metal platform as we can see in drawing 0908-LE02-3ASIN-006.
- 5 For the test, the LEUPA shall be launched in a horizontal position, similar to the provisions for the drop pursuant to section 727 b), so that the cone-shaped penetrator impacts the central part with radial configuration, on generatrix 90°.
- 6 To verify the height from the specimen to the cone-shaped penetrator, a rope freely hanging from the bottom of the specimen shall be used. The hanging rope section shall be 300 +10/-0 cm, and the lower end of the rope shall be almost touching the penetrator. The free end of the rope shall be tied to a small weight to maintain vertical position to avoid movement caused by the wind.
- 7 The test may only be carried out when there is no wind or when the specimen, hanging from a 3 m altitude, does not oscillate.
- 8 In figures 15 and 16 we can see the LEUPA just before impact with the cone-shaped penetrator.
- 9 Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

7.1.4.1 Acceptance criterion for the test according to paragraphs 657, 679 and 682 c)

The test shall be considered approved if, after the impact, it is verified that:

1. There were no structural damages in the internal containers which may cause leaks of the materials (PL No. 0908-LE01-3ASIN-007).
2. Leaks from the thermal insulation due to the impact shall be admissible.
3. After verifying the foregoing, the following test may be carried out.
4. Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The drop shall be recorded with photographs and videos, as stated in section 8.

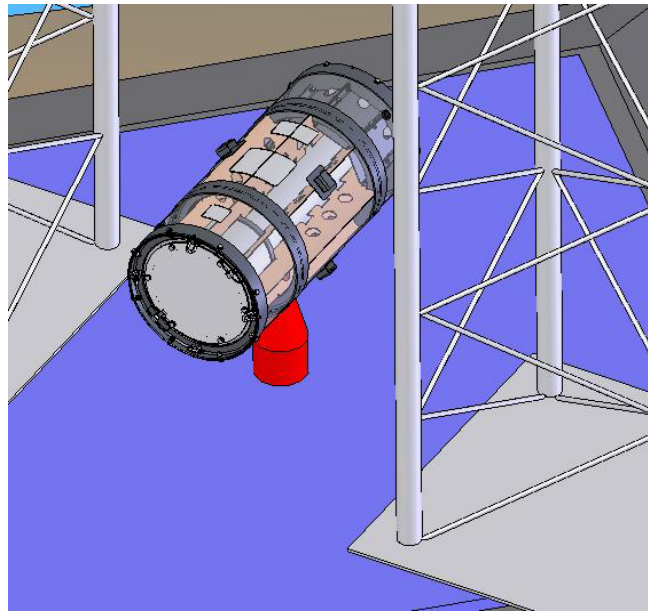


Figure 15

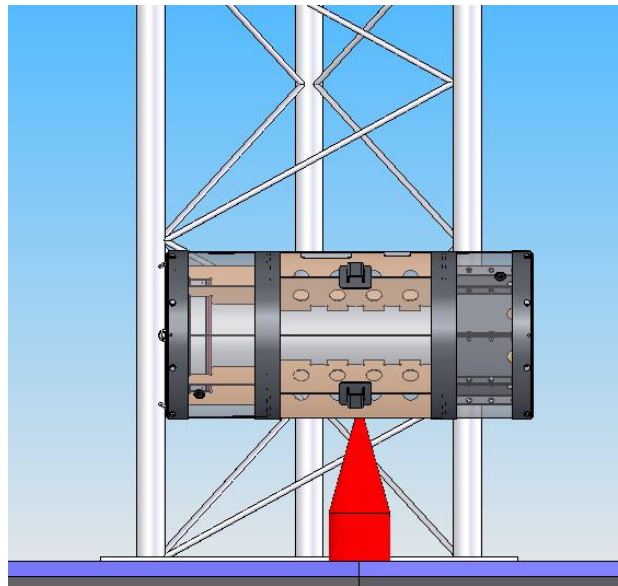


Figure 1

7.1.5 Impact test, Paragraph 737:

- 1 Transcription of paragraph 737, Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"737. Impact test: The specimen shall be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target shall be as defined in paragraph 717, except that the target surface may be at any orientation as long as the surface is normal to the specimen path.

2. For the demonstration of this test, the LEUPA specimen was modeled following the finite elements method with a dynamic simulation of the drop at an impact speed against the target above 90m/sec.

3. Refer to technical specification No. 0908-LE02-3ASIN-005.

7.1.5.1 Acceptance criterion for the test

1. The acceptance criterion is that stated in paragraph 680.
2. The modeling in the references specification is carried out to estimate the behavior of the specimen.
3. It has been proved in point 8 of specification 0908-LE01-3BEIN-024 - Criticality Analysis, that, assuming total destruction of the package, it is still subcritical.

7.2 WATER IMMERSION TEST, PURSUANT TO PARAGRAPH 729:

1. Transcription of paragraph 729, Standard AR 10.16.1 "Transport of Radioactive Materials – Rev.

"729. Water immersion test: The specimen shall be immersed under a head of water of at least 15 m for a period of not less than 8 h in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions."

2. For this specific test, specimen 2 shall be used.
3. Specimen 02 shall be placed in the tests facility (PI No. 0908-LE02-3ASIN-001), filled with water and pressurized at a gauge pressure above 150 kPa for at least 8 hours.

7.2.1 Acceptance criterion for the test according to paragraph 657 b)

1. The acceptance criterion is that stated in paragraph 657 b).
2. It is established that the test has been approved when it is verified that internal containers and the container of internal containers (PI No. 0908-LE01-3ASIN-005) preserve their initial state and no water has leaked inside.

7.3 ENHANCED THERMAL TEST, PURSUANT TO PARAGRAPH 736:

- e) Transcription of paragraph 736, Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

"736. Enhanced thermal test: The conditions for this test shall be as specified in paragraph 728, except that the exposure to the thermal environment shall be for a period of 60 minutes."

"728. Thermal test: The specimen shall be in thermal equilibrium under conditions of an ambient temperature of 38°C, subject to the solar insolation conditions specified in Table 13 and subject to the design maximum rate of internal heat generation within the *package* from the *radioactive contents*. Alternatively, any of these parameters are allowed to have different values prior to and during the test, provided due account is taken of them in the subsequent assessment of package response. The thermal test shall then consist of a) followed by b)

a) Exposure of a specimen for a period of 30 min to a thermal environment which provides a heat flux at least equivalent to that of a hydrocarbon fuel–air fire in sufficiently quiescent ambient conditions to give a minimum average flame emissivity coefficient of 0.9 and an average temperature of at least 800°C, fully engulfing the specimen, with a surface absorptivity coefficient of 0.8 or that value which the package may be demonstrated to possess if exposed to the fire specified.

b) Exposure of the specimen to an ambient temperature of 38°C, subject to the solar insolation conditions specified in Table 13 and subject to the design maximum rate of internal heat generation within the package by the radioactive contents for a sufficient period to ensure that temperatures in the specimen are everywhere decreasing and/or are approaching initial steady state conditions. Alternatively, any of these parameters are

allowed to have different values following cessation of heating, provided due account is taken of them in the subsequent assessment of *package* response. During and following the test, the specimen shall not be artificially cooled and any combustion of materials of the specimen shall be permitted to proceed naturally."

- f) To record the temperatures of internal containers during thermal tests (paragraphs 728 a) / paragraph 736), prior to installation of containers in the packaging, Labels stating the temperature (Irreversible High Temperature Labels) or marks using temperature-sensitive crayons shall be placed.
- g) In both cases the highest possible temperature range within a range of 40 °C to 320 °C shall be covered.
- h) Each label has 8/9 points which change colors once the stated temperature is reached, thereby logging a history of those temperatures.
- i) Labels are stuck on the four (4) containers.
- j) Crayons liquefy when the stated temperature is reached.
- k) Each one of the 4 internal containers shall be marked, similarly as shown in the following figure:

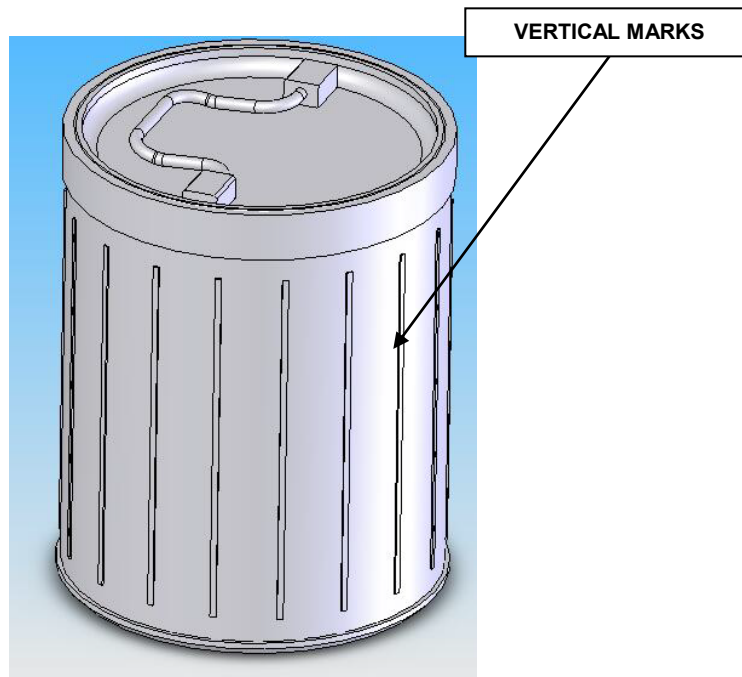


Figure 17

- l) The vertical marks of the crayons shall be approximately 60mm long and approximately 2mm wide.
- m) To carry out the enhanced thermal test, the LEUPA shall be instrumented, installing 4 K-type thermocouples, 1/8" diameter in special points of interest.
- n) The 4 thermocouples shall be placed on strategic places to record the temperatures during the test. Thermocouples shall be installed after the mechanical tests. Figure 18 details the installation sites.
- o) The positions of thermocouples with numbers I / II / III / IV can be seen in figure 18 a) below; (in the same figure, the potential schematic deformation due to previous mechanical tests has been stated as well).
- p) To install thermocouples, the external wall of the packaging and the thermal insulation shall be perforated to reach the exterior wall of the cadmium chamber (see item 21 in drawing

0908-LE01-3ASIN-010). Extreme precautions shall be taken not to perforate or affect that wall. The hole shall not be more than 6mm in diameter. Afterwards, the thermocouple shall be introduced in the hole and the free space shall be filled with fiber thermal insulation, KAOWOOL-type or similar, free from asbestos.

- q) Thermocouples shall be manufactured at INVAP's workshops in San Carlos de Bariloche.
- r) To carry out the test, an oven with the following characteristics shall be used (see figure 19):
 - a) Approximate working temperatures range: 100 to 1100 °C
 - b) Natural gas or electrical heating
 - c) On-off-type temperature control with potential ramps and plateaus
 - d) Measurement of temperatures in the chamber by means of thermocouples
 - e) Process supervision via temperature logging
 - f) Thermal insulation through ceramic blanket and refractory bricks
 - g) Curtain or hinge-type door

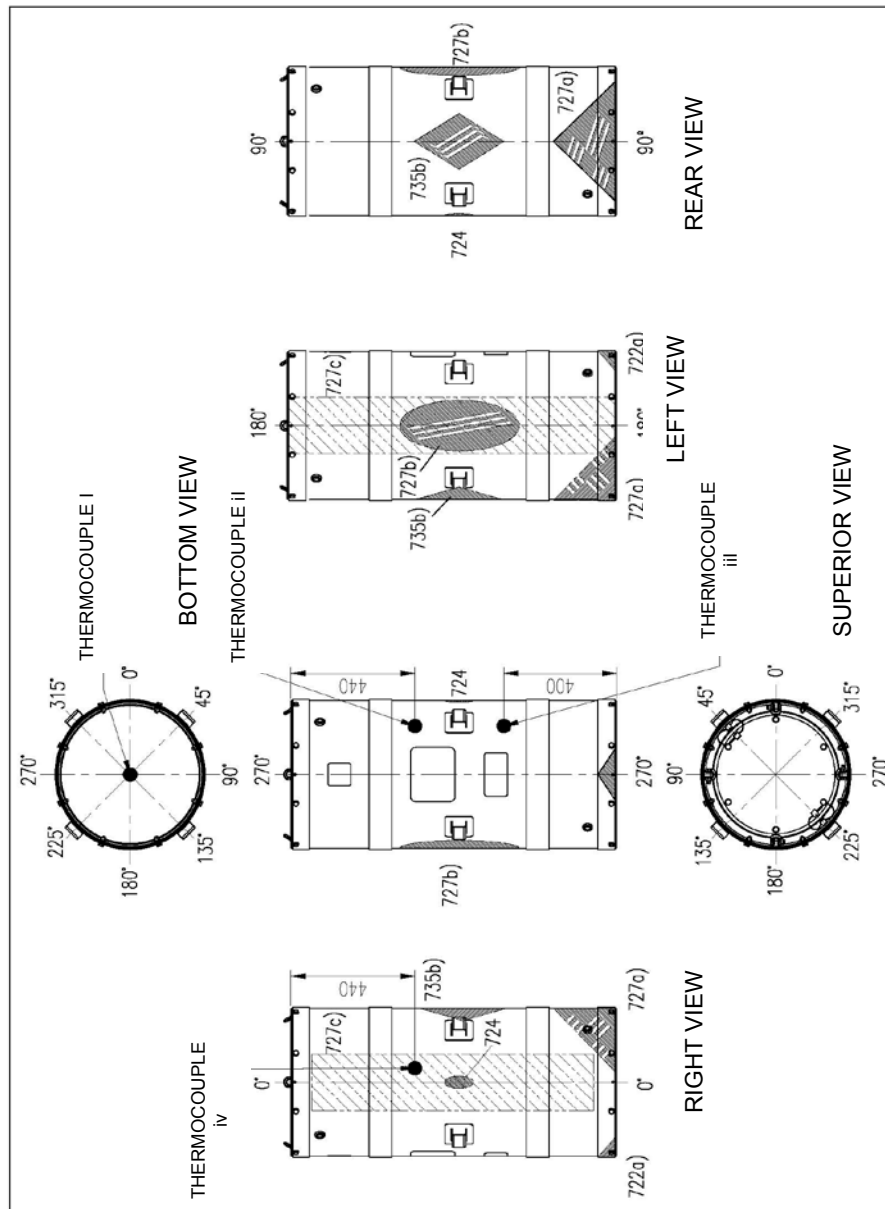


Figure 18



Figure 19

7.3.1 Progress of the test

- 1 The LEUPA shall be placed in the oven using an auto-elevator with a specific lifting device. Both elements are part of the oven's supplementary facilities.
- 2 Additionally, a support structure shall be used to maintain its structural integrity at the high temperatures involved, to place the LEUPA in a horizontal position in the oven, detached from the floor, so that the package is completely surrounded by the heat. (Refer to figure 20).
- 3 After depositing it in the abovementioned structure, the oven door is closed, and the 1-hour count of the test begins.
- 4 During the test, temperature is followed through the 4 thermocouples installed in the specimen. The test may be cancelled by the person/s in charge of the test, should any inconvenient be detected.
- 5 If the test continued and the 1-hour period was completed, the LEUPA shall be withdrawn from the oven and left to cool in a dedicated area, with good natural ventilation.
- 6 Once cooling to room temperature has been verified, the tests can continue.

**Figure 20**

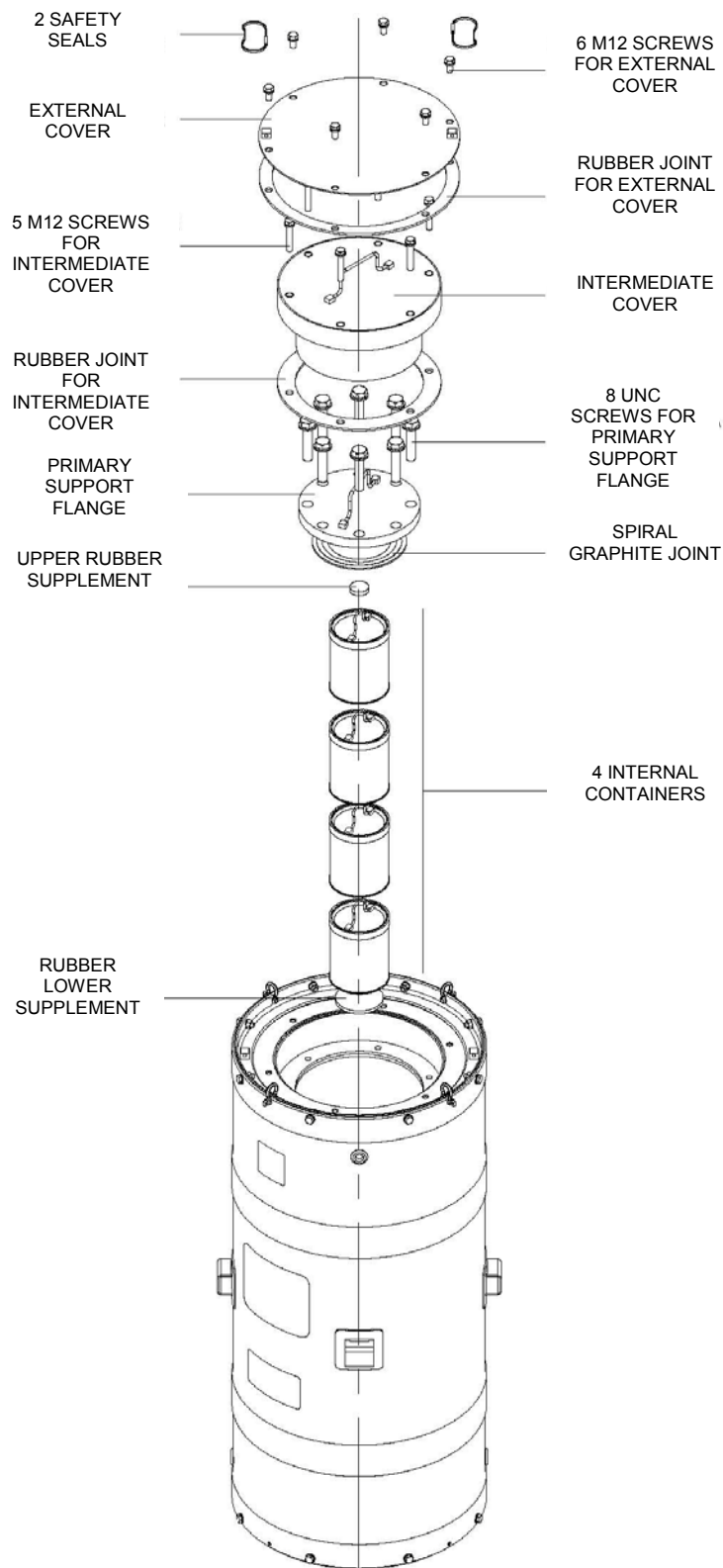


Figure 21

7.3.1.1 Acceptance criterion for the test according to paragraph 736.

It is established that the test has been approved if after cooling down the specimen is disassembled and the following is verified:

- It complies with the provisions in paragraph 680 a). Under any conditions it is subcritical.

- There are no leaks outside the interior containers, whatever the state of the content. (0908-LE01-3ASIN-007).
- Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The test shall be recorded with photographs and videos, as stated in section 8.

7.4 WATER IN-LEAKAGE TEST, PARAGRAPH 733:

1. Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

733. "Water in-leakage test applicable to packages containing fissile materials: The specimen shall be immersed under a head of water of at least 0.9 m for a period of not less than 8 h and in the attitude which will lead to maximum in-leakage."

7.4.1 Acceptance criterion for the test according to paragraph 657 b)

It is established that the test has been approved if:

- There are no leaks outside the interior containers, whatever the state of the content. (0908-LE01-3ASIN-007).
- Upon completion of the test, a report shall be prepared stating the damages suffered, including the measurements of any deformities. The test shall be recorded with photographs and videos, as stated in section 8.

7.5 ENHANCED WATER IMMERSION TEST, PURSUANT TO PARAGRAPH 730:

1. Transcription of Standard AR 10.16.1 "Transport of Radioactive Materials – Rev. 2:

730. "Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than 1 h. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions."

2. For the demonstration of this test, the LEUPA specimen was modeled following the finite elements method with a simulation whereby an external pressure of 2MPa was applied.

1. Refer to technical specification No. 0908-LE02-3ASIN-004.

7.5.1.1 Acceptance criterion for the test according to paragraph 657 a)

1. The acceptance criterion is that stated in paragraph 657 a)
2. It is established that the test has been approved when it is verified that both the Container of Internal Containers, PI No. 0908-LE01-3AEIN-004 and its connection/flange have not suffered any deformities.

7.6 SEQUENCE OF TESTS FOR ACCIDENTAL TRANSPORT CONDITIONS

- 1 The specimen used in accidental transport condition tests shall be the same previously used for normal transport conditions.
- 2 The sequence of tests and movements of the LEUPA is as follows:
 - a) Drop I, pursuant to paragraph 727 a).
 - b) Drop II, pursuant to paragraph 727 b).
 - c) Drop III, pursuant to paragraph 727 c).
 - d) Puncture/tearing, pursuant to paragraph 735 b).
 - e) Instrumentation of the LEUPA Container
 - f) Enhanced thermal test, pursuant to paragraph 736.

- g) Water In-Leakage test, paragraph 733
- h) Dismantling, extraction of Internal Containers and inspection of damages.

8 RECORDS AND DOCUMENTATION OF THE TESTS

- 1 Every test, whether for normal or accident transport conditions, shall be documented as follows.
 - a) Minutes of each test carried out shall be prepared, stating date, time, person in charge, intervening personnel and everyone present.
 - b) Refer to the test sheets in Appendix 4.
 - c) Mechanical tests shall be filmed with at least two cameras placed at orthogonal angles among them, to allow for a high degree of definition in the image.
 - d) For drop tests, the immediate state prior to the drop shall be photographed, from at least two orthogonal angles. Photographs shall include all elements involved in the test. When spreaders are used to verify the height of the test, the moment of that verification shall be photographed.
 - e) All damages to the specimen shall be photographed in detail. Photographs of the damages shall be clearly coded to link them to each test unequivocally.
 - f) Gridded black and white boards shall be placed, with squares of 15 cm on each side, in the back of the impact area, so that the cameras filming the test capture those boards in the back. The size of the boards shall be such that the shot of the LEUPA upon impact is completely within the limits of the board.
 - g) Damages to the specimen shall be detailed in writing, making reference to the positions of the LEUPA's constructive planes, a list of which is attached in appendix I and to the generatrices marked in the specimen. The report of damages shall include sizes of the parts that were deformed or torn and references to the codes of the previously stated photographs.
 - h) In the case of junctions screwed with no visible damage, the necessary torque to open them after the test shall be stated, if possible.
- i) The dismantling consists of withdrawing the external cover, the intermediate cover, the flange of the primary containment and finally the internal containers (see fig. 21). During the dismantling, photographs and videos shall be shot, and written reports prepared to record the state of the abovementioned elements. Furthermore, if the torque applied to unscrew the covers and flange mentioned above can be measured, it shall be reported.
- j) After withdrawing the Internal Containers, the temperature of external surfaces and whether content was leaked or not shall be recorded.
- k) The state of the thermal insulation shall be recorded where possible based on the container's conditions.
- l) Afterwards, a visual inspection of the interior of the container shall be made, with special emphasis on the state of the container of internal containers, 0908-LE01-3ASIN-005.

9 APPENDIX 1, VALID DRAWINGS

DRAWING	TITLE
0908-LE01-3ASIN-004	LOW ENRICHED URANIUM PACKAGE (LEUPA)- GENERAL JOINT PACKAGE
0908-LE01-3ASIN-005	LOW ENRICHED URANIUM PACKAGE (LEUPA)- CONTAINER OF INTERNAL CONTAINERS

0908-LE01-3ASIN-006	LOW ENRICHED URANIUM PACKAGE (LEUPA)- PACKAGING - MAIN BODY - CADMIUM CHAMBER
0908-LE01-3ASIN-007	LOW ENRICHED URANIUM PACKAGE (LEUPA)- INTERNAL CONTAINER
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" SHEETS
0908-LE01-3ASIN-016	LOW ENRICHED URANIUM PACKAGE (LEUPA)- PACKAGING - MAIN BODY - FLANGE
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 - IDENTIFICATION PLATE
0908-LE01-3ASIN-019	LOW ENRICHED URANIUM PACKAGE (LEUPA)- PACKAGING - MAIN BODY - DESIGN AND MANUFACTURING PLATE
0908-LE01-3ASIN-020	LOW ENRICHED URANIUM PACKAGE (LEUPA)- RUBBER SUPPLEMENTS AND GASKETS SET

10 APPENDIX 2, ENGINEERING MODIFICATIONS

MODIFICATION No.	DRAWING INVOLVED
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

11 APPENDIX 3, VALID DRAWINGS OF TEST ELEMENTS

DRAWING	TITLE
0908-LE02-3ASIN-003	LOW ENRICHED URANIUM PACKAGE (LEUPA)- VALIDATION TESTS - PENETRATION PURSUANT TO SECTION 724
0908-LE01-3ASIN-004	LOW ENRICHED URANIUM PACKAGE (LEUPA)- VALIDATION TESTS - PENETRATION PURSUANT TO SECTIONS 727 b) AND 735 b)
0908-LE02-3ASIN-005	LOW ENRICHED URANIUM PACKAGE (LEUPA)- VALIDATION TESTS - TEST PLATE PURSUANT TO SECTION 727 c)
0908-LE02-3ASIN-006	LOW ENRICHED URANIUM PACKAGE (LEUPA)- VALIDATION TESTS - ARRANGEMENT OF PENETRATORS ON THE TARGET

0908-LE02-3ASIN-009	LOW ENRICHED URANIUM PACKAGE (LEUPA)- VALIDATION TESTS - PIPING FOR SPRAY TEST PURSUANT TO SECTION 722
0908-LE02-3ASIN-001	LOW ENRICHED URANIUM PACKAGE (LEUPA)- CONTAINER FOR IMMERSION TEST SIMMULATION
0908-LE02-3ASIN-012	LOW ENRICHED URANIUM PACKAGE (LEUPA)- FAST RELEASE HOOK FOR DROP TESTS

12 APPENDIX 4, TESTS SHEETS

12.1 RECORD 01

TESTS FOR THE APPROVAL OF B(U) PACKAGE							
INVAP	ARN						
ARN - STANDARD AR 10.16.1 - REV 2							
CONTAINER MODEL: LEUPA	RECORD No. 01						
TEST: Assembly	PARAGRAPH:						
1 - INITIAL STATE:	PHOTOGRAPHS:						
VISUAL CONTROL:	VIDEO SHOOT:						
<table><thead><tr><th>Amounts</th><th>Magnitudes</th><th>Meets specifications</th></tr></thead><tbody><tr><td colspan="3"></td></tr></tbody></table>		Amounts	Magnitudes	Meets specifications			
Amounts	Magnitudes	Meets specifications					
2 - FINAL STATE:	PHOTOGRAPHS:						
VISUAL CONTROL:	VIDEO SHOOT:						
ASSESSMENT OF DAMAGES							

ELEMENTS INVOLVED:

Specification N° 0908-LE02-3BSIN-006

PERSONNEL PRESENT

PERSON IN CHARGE	INVAP	ARN

DATE:

TIME:

12.2 RECORD 02

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 02	
TEST: Water Spray		PARAGRAPH: 721	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Number of sprinklers:	4	Un	
Sprinklers' height:	1.6	mts	
Duration	1	Time	
Water Calculation	50	mm	
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN : PIPING PARA ENSAYO ASPERSIO - PL N° 0908-LE02-3ASIN-009		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.3 RECORD 03

TESTS FOR THE APPROVAL OF B(U) PACKAGE		
INVAP	ARN	
ARN - STANDARD AR 10.16.1 - REV 2		
CONTAINER MODEL: LEUPA	RECORD No. 03	
TEST: Free Drop	PARAGRAPH: 722 a)	
1 - INITIAL STATE:	PHOTOGRAPHS:	
VISUAL CONTROL:	VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes Meets specifications
Fall angle	20+/-5	degrees
Free Height target-hook	11.4	mts
Height lower part Package-target	1.2	mts
Package Weight	480	kgs
2 - FINAL STATE:	PHOTOGRAPHS:	
VISUAL CONTROL:	VIDEO SHOOT:	
ASSESSMENT OF DAMAGES		

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		
HORA:		

12.4 RECORD 04

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 04	
TEST: Penetration		PARAGRAPH: 724	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Bar weight	6000	grams	
Bar diameter	3.2	cm	
Drop height lower end-point of impact	1	mts	
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN : PENETRADOR PARA ENSAYO PL. N° 0908-LE02-3ASIN-003		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.5 RECORD 05

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 05	
TEST: Stacking		PARAGRAPH: 723	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Time	24	hours	
Load weight	2,400	kgs	
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.6 RECORD 06

TESTS FOR THE APPROVAL OF B(U) PACKAGE																	
INVAP	ARN																
ARN - STANDARD AR 10.16.1 - REV 2																	
CONTAINER MODEL: LEUPA	RECORD No. 06																
TEST: Drop I	PARAGRAPH: 727 a)																
1 - INITIAL STATE:	PHOTOGRAPHS:																
VISUAL CONTROL:	VIDEO SHOOT:																
<table border="1"> <thead> <tr> <th>Previous Conditions</th> <th>Amounts</th> <th>Magnitudes</th> <th>Meets specifications</th> </tr> </thead> <tbody> <tr> <td>Height lower part package-target</td> <td>900+/-20</td> <td>cms</td> <td></td> </tr> <tr> <td>Wind</td> <td>None/mild</td> <td></td> <td></td> </tr> <tr> <td>Fall angle</td> <td>20 +/-5</td> <td>degrees</td> <td></td> </tr> </tbody> </table>		Previous Conditions	Amounts	Magnitudes	Meets specifications	Height lower part package-target	900+/-20	cms		Wind	None/mild			Fall angle	20 +/-5	degrees	
Previous Conditions	Amounts	Magnitudes	Meets specifications														
Height lower part package-target	900+/-20	cms															
Wind	None/mild																
Fall angle	20 +/-5	degrees															
2 - FINAL STATE:	PHOTOGRAPHS:																
VISUAL CONTROL:	VIDEO SHOOT:																
ASSESSMENT OF DAMAGES																	

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.7 RECORD 07

TESTS FOR THE APPROVAL OF B(U) PACKAGE		
INVAP	ARN	
ARN - STANDARD AR 10.16.1 - REV 2		
CONTAINER MODEL: LEUPA	RECORD No. 07	
TEST: Drop II	PARAGRAPH: 727 b)	
1 - INITIAL STATE:	PHOTOGRAPHS:	
VISUAL CONTROL:	VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes Meets specifications
Height lower part package-target	1	mt
Impact position	180	degrees
Cylinder bar diameter	150	mm
2 - FINAL STATE:	PHOTOGRAPHS:	
VISUAL CONTROL:	VIDEO SHOOT:	
ASSESSMENT OF DAMAGES		

ELEMENTOS QUE INTERVIENEN : PENETRADORES PARA ENSAYOS - PL. N°0908-LE02-3ASIN-004		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.8 RECORD 08

TESTS FOR THE APPROVAL OF B(U) PACKAGE																			
INVAP		ARN																	
ARN - STANDARD AR 10.16.1 - REV 2																			
CONTAINER MODEL: LEUPA		RECORD No. 08																	
TEST: Drop III		PARAGRAPH: 727 c)																	
1 - INITIAL STATE:		PHOTOGRAPHS:																	
VISUAL CONTROL:		VIDEO SHOOT:																	
<table border="1"> <thead> <tr> <th>Previous Conditions</th> <th>Amounts</th> <th>Magnitudes</th> <th>Meets specifications</th> </tr> </thead> <tbody> <tr> <td>Plate weight</td> <td>500</td> <td>kgs</td> <td></td> </tr> <tr> <td>Height lower part package-target</td> <td>900+/-20</td> <td>cms</td> <td></td> </tr> <tr> <td>Wind</td> <td>None/mild</td> <td>mm</td> <td></td> </tr> </tbody> </table>				Previous Conditions	Amounts	Magnitudes	Meets specifications	Plate weight	500	kgs		Height lower part package-target	900+/-20	cms		Wind	None/mild	mm	
Previous Conditions	Amounts	Magnitudes	Meets specifications																
Plate weight	500	kgs																	
Height lower part package-target	900+/-20	cms																	
Wind	None/mild	mm																	
2 - FINAL STATE:		PHOTOGRAPHS:																	
VISUAL CONTROL:		VIDEO SHOOT:																	
ASSESSMENT OF DAMAGES																			

ELEMENTOS QUE INTERVIENEN : PLACA PARA ENSAYO - PL N°0908-LE02-3ASIN-005		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.9 RECORD 09

TESTS FOR THE APPROVAL OF B(U) PACKAGE																							
INVAP		ARN																					
ARN - STANDARD AR 10.16.1 - REV 2																							
CONTAINER MODEL: LEUPA		RECORD No. 09																					
TEST: Penetration - Tearing		PARAGRAPH: 735 b)																					
1 - INITIAL STATE:		PHOTOGRAPHS:																					
VISUAL CONTROL:		VIDEO SHOOT:																					
<table border="1"> <thead> <tr> <th>Previous Conditions</th> <th>Amounts</th> <th>Magnitudes</th> <th>Meets specifications</th> </tr> </thead> <tbody> <tr> <td>Launch position</td> <td>horizontal</td> <td></td> <td></td> </tr> <tr> <td>Height lower part package-target</td> <td>300+/- 10</td> <td>cms</td> <td></td> </tr> <tr> <td>Cone-shaped bar diameter</td> <td>20</td> <td>cms</td> <td></td> </tr> <tr> <td>Wind</td> <td>None/mild</td> <td>mm</td> <td></td> </tr> </tbody> </table>				Previous Conditions	Amounts	Magnitudes	Meets specifications	Launch position	horizontal			Height lower part package-target	300+/- 10	cms		Cone-shaped bar diameter	20	cms		Wind	None/mild	mm	
Previous Conditions	Amounts	Magnitudes	Meets specifications																				
Launch position	horizontal																						
Height lower part package-target	300+/- 10	cms																					
Cone-shaped bar diameter	20	cms																					
Wind	None/mild	mm																					
2 - FINAL STATE:		PHOTOGRAPHS:																					
VISUAL CONTROL:		VIDEO SHOOT:																					
ASSESSMENT OF DAMAGES																							

ELEMENTOS QUE INTERVIENEN : PENETRADORES PARA ENSAYOS - PL. N°0908-LE02-3ASIN-004		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.10 RECORD 10

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 10	
TEST: Enhanced Thermal Test		PARAGRAPH: 736	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Test Temp	850	°C	
Duration	1	Time	
Wind	None/mild	mm	
Initial Temperature			
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.11 RECORD 11

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 11	
TEST: Water in-leakage		PARAGRAPH: 733	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Test Temp			
Minimum Duration	8	Time	
Minimum Depth	0.9	m	
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.12 RECORD 12

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 12	
TEST: Water Immersion - Specimen 2		PARAGRAPH: 729	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
Test Temp			
Minimum Duration	8	Time	
Minimum Depth	15	m	
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA:

12.13 RECORD 13

TESTS FOR THE APPROVAL OF B(U) PACKAGE			
INVAP		ARN	
ARN - STANDARD AR 10.16.1 - REV 2			
CONTAINER MODEL: LEUPA		RECORD No. 13	
TEST: Dismantling - Inspection		PARAGRAPH:	
1 - INITIAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
Previous Conditions	Amounts	Magnitudes	Meets specifications
2 - FINAL STATE:		PHOTOGRAPHS:	
VISUAL CONTROL:		VIDEO SHOOT:	
ASSESSMENT OF DAMAGES			

ELEMENTOS QUE INTERVIENEN :		
PERSONAL PRESENTE		
RESPONSABLE	INVAP	ARN
FECHA:		HORA: