

**LEUPA**

**Type B(U) Package for Fissile Materials**

**LEUPA  
SPECIFICATION FOR THE ASSEMBLY  
OF THE TYPE B(U) PACKAGE FOR  
APPROVAL TESTS**

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## **1 PURPOSE**

1. The purpose of this document is to provide the details of the preparation of the specimen for tests, identifying the various parts of thereof and the equipment/devices to be used for the assembly of the type B(U) LEUPA package.

## **2 SCOPE**

1. The parts of the package, the devices and necessary auxiliary elements for the assembly of the specimen to be tested for approval as type B(U) package to transport fissile materials for land, sea and air transport.
2. Given the classification as Type B (U) Package for all means of transport: land, sea and air, and as agreed with the ARN -Nuclear Regulatory Authority - in previous communications, the tests provided for in Standard 10.16.1 Rev. 2 "Transport of radioactive materials" apply.

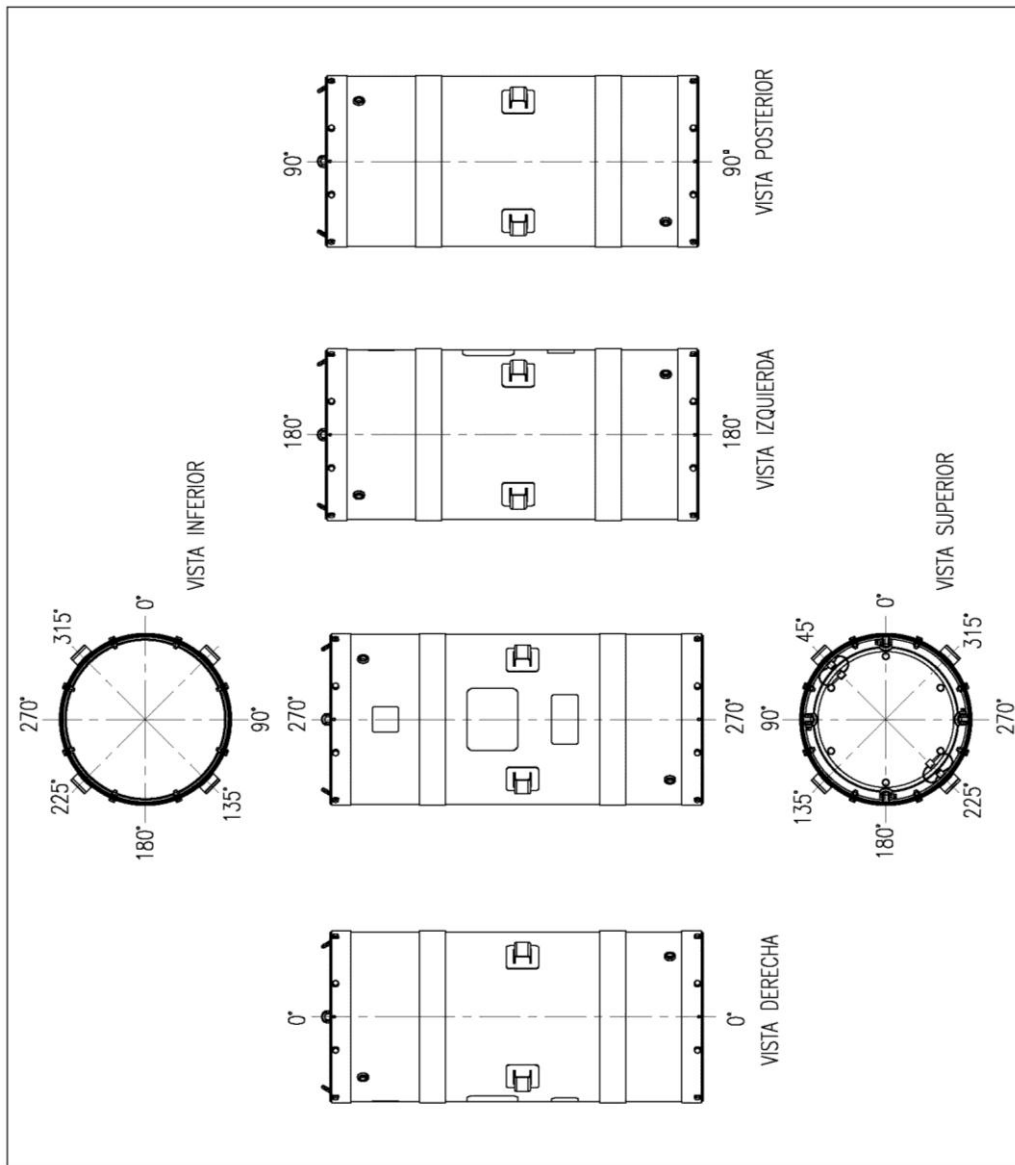
## **3 FACILITIES**

1. The specimen to be tested for approval is assembled at INVAP's workshops in the city of San Carlos de Bariloche (Río Negro province) by qualified technical staff before one of INVAP's QA officers.

## **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 specimen assembled for tests, the fissile material is simulated with lead pellets with 1.5 mm to 3 mm diameter.
3. The lead pellets are placed on polyethylene film bags approximately 100 micron thick which are then closed. The sizes of the polyethylene bags shall be slightly below the internal size of the Internal Containers.
4. Each Internal Container shall hold a 12 kg +/- 1 kg mass.
5. Generatrices 0°/45°/90°/135°/180°/225°/270°/ 315°/ and 360° shall be marked with indelible ink outside the test bulk (see drawing 0908-LE01-3AEIN-010 and Figure 1 below to see angle references), in white.
6. Each one of those nine (9) generatrices shall be marked with the related angle, with approximately 25 mm height characters. If generatrices are interrupted by warning, design and manufacturing, identification plates and sling hooks, they shall be discontinued in those areas.
7. After the free drop tests specified in Standard AR 10.16.1 Rev. 2 "Transport of Radioactive Materials" and before the thermal test, the specimen shall be transported to INVAP's workshops, where thermocouples shall be installed (see Figure 19 - Sp. N°0908-LE02-3BEIN-002).

**Figura 1: Package views**



## 5 ASSEMBLY OF THE PACKAGE FOR TESTS

### 5.1 Auxiliary elements

1. Prior to the assembly of the LEUPA package for tests, the following elements shall be available:
  - a. Lead blasting material, 2 mm diameter -mass not under 50 kg-.
  - b. 100-micron thick polyethylene bags.
  - c. Portable polyethylene bag sealer (suggested).
  - d. Digital scale, 0-30 kg capacity, +/- 10 g sensitivity, 10 g or similar resolution (suggested).
  - e. Ratchet switch and 300 mm-long extension bar, 1/2" drive.
  - f. 1.1/4" W tube for 3/4" W nut, 1/2" drive.
  - g. M 19 tube for M12 nut, 1/2" drive.

- h. Torque wrench with dial indicator, easy reading Nm/Kg scale, 1/2" drive, +/-3% precision, 10 – 100 Nm range (suggested).
- i. Packaging, Main body according to Drawing No. 0908-LE01-3AEIN-010.
- j. Stainless/Graphite spiraled connector, w/ int.-ext. support, 5" nominal diameter –ASME B16.20– 316L F.G. (as per Pos. 04 – Drawing No. 0908-LE01-3AEIN-005).
- k. Rubber joints and gaskets set as per Drawing No. 0908-LE01-3AEIN-020.
- l. DN 125 blind flange, Series 150 (as per Pos. 07 – Drawing No. 0908-LE01-3AEIN-005).
- m. Internal Containers as per Drawing No. 0908-LE01-3AEIN-007 –four (4)–.
- n. Intermediate cover as per Drawing No. 0908-LE01-3AEIN-008.
- o. External cover as per Drawing No. 0908-LE01-3AEIN-009.
- p. Safety seal – SEGUPRES HP22 (Pos. 13 – Drawing No. 0908-LE01-3AEIN-004) –two (2)–.

## 5.2 General description

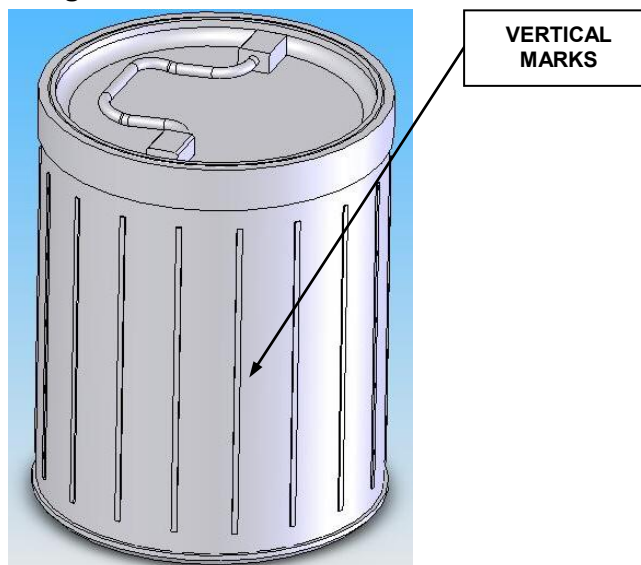
### 5.2.1 Filling of internal container

1. Open and clean Interior container (x four) – Drawing No. 0908-LE01-3AEIN-007.
2. Weight the empty container with its cover and record the information (x four).
3. Fill the bag with the lead blasting material up to maximum capacity to place inside the inner container and place its cover with no interference (x four).
4. Close polyethylene bag with portable sealer (x four).
5. Place the polyethylene bag inside the Internal container and place the cover into place (x four) (see Figure 1).
6. Weight the covered internal container, record the information and identify the internal container with a number (x four).
7. Put the temperature stickers in the container (irreversible sensor) or mark with temperature-sensitive crayons as shown in Figure 2 (x four).
8. If possible, record each operation with photographs (x four).
9. A protocol shall be prepared with all data on the technical staff present, where all data recorded during filling/assembly of internal containers shall be described.

**Figura 2: Internal container**



**Figura 3: Vertical marks**

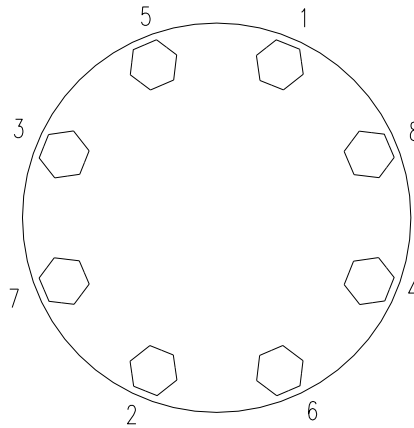


### 5.2.2 Assembly of Container of Internal Containers

1. After internal cleaning of the container of internal containers, Drawing No. 0908-LE01-3AEIN-005, they are placed inside the internal containers as shown in Figure 5.
2. Present the stainless/graphite spiraled connector into place and place the blind flange above (Pos. 2 – Drawing No. 0908-LE01-3AEIN-005) (see Figure 6).
3. Place the eight (8) UNC  $\frac{3}{4}$ " thread bolts, tighten screws evenly and in opposite 180° sequence applying a minimum 55 Nm torque.

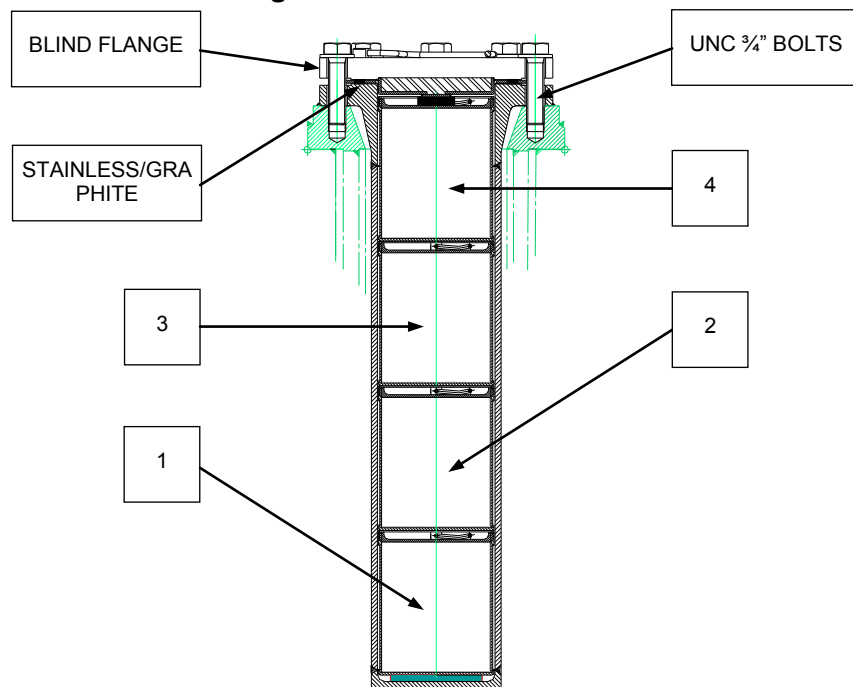
4. The torque shall be applied in at least five (5) stages.
5. The recommended sequence is that presented in Figure 4.

**Figure 4: Recommended closure sequence (container cover)**



6. If possible, record each operation with photographs.
7. A protocol shall be prepared with all data on the technical staff present, where all data recorded during assembly of internal containers shall be described.

**Figure 5: Container details**





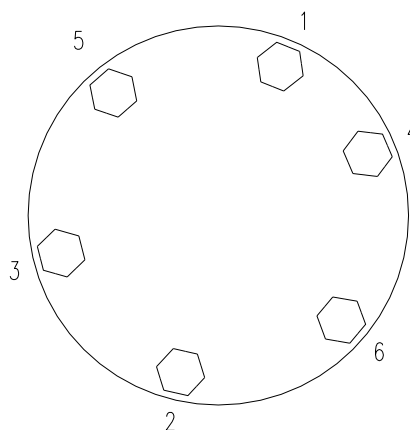
**Figura 6: Stainless/graphite connector**



### 5.2.3 Assembly of the LEUPA Package - General

1. Place the rubber joints for the intermediate cover (Pos. 04 – Drawing No. 0908-LE01-3AEIN-020) into place.
2. Mount the six (6) M12 screws for the intermediate cover, tighten screws evenly and in opposite 180° sequence applying a minimum 15 Nm torque.
3. The torque shall be applied in at least three (3) stages.
4. The recommended sequence is that presented in Figure 7.

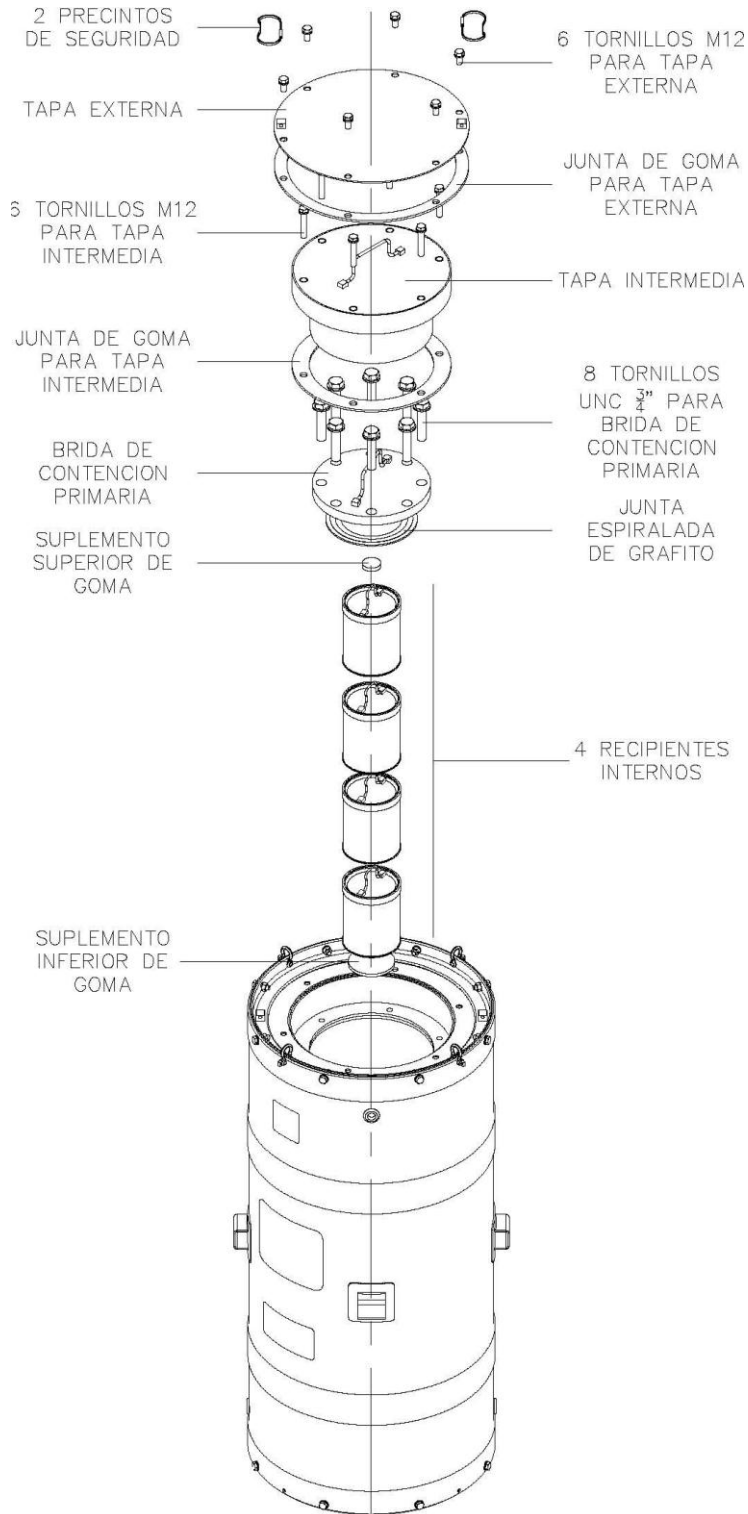
**Figura 7: Recommended closure sequence (intermediate/external cover)**



5. Place the rubber joints for the external cover (Pos. 01 – Drawing No. 0908-LE01-3AEIN-020) into place.
6. Mount the six (6) M12 screws for the external cover, tighten screws evenly and in opposite 180° sequence a minimum 15 Nm torque.
7. The torque shall be applied in at least three (3) stages.

8. The recommended sequence is that presented in Figure 7.
9. Put the two (2) safety seals into place (Pos. 13 – Drawing No. 0908-LE01-3AEIN-004).
10. If possible, record each operation with photographs.
11. A protocol shall be prepared with all data on the technical staff present, where all data recorded during assembly of the LEUPA package shall be described.

### 5.2.4 General B(U)F LEUPA Package

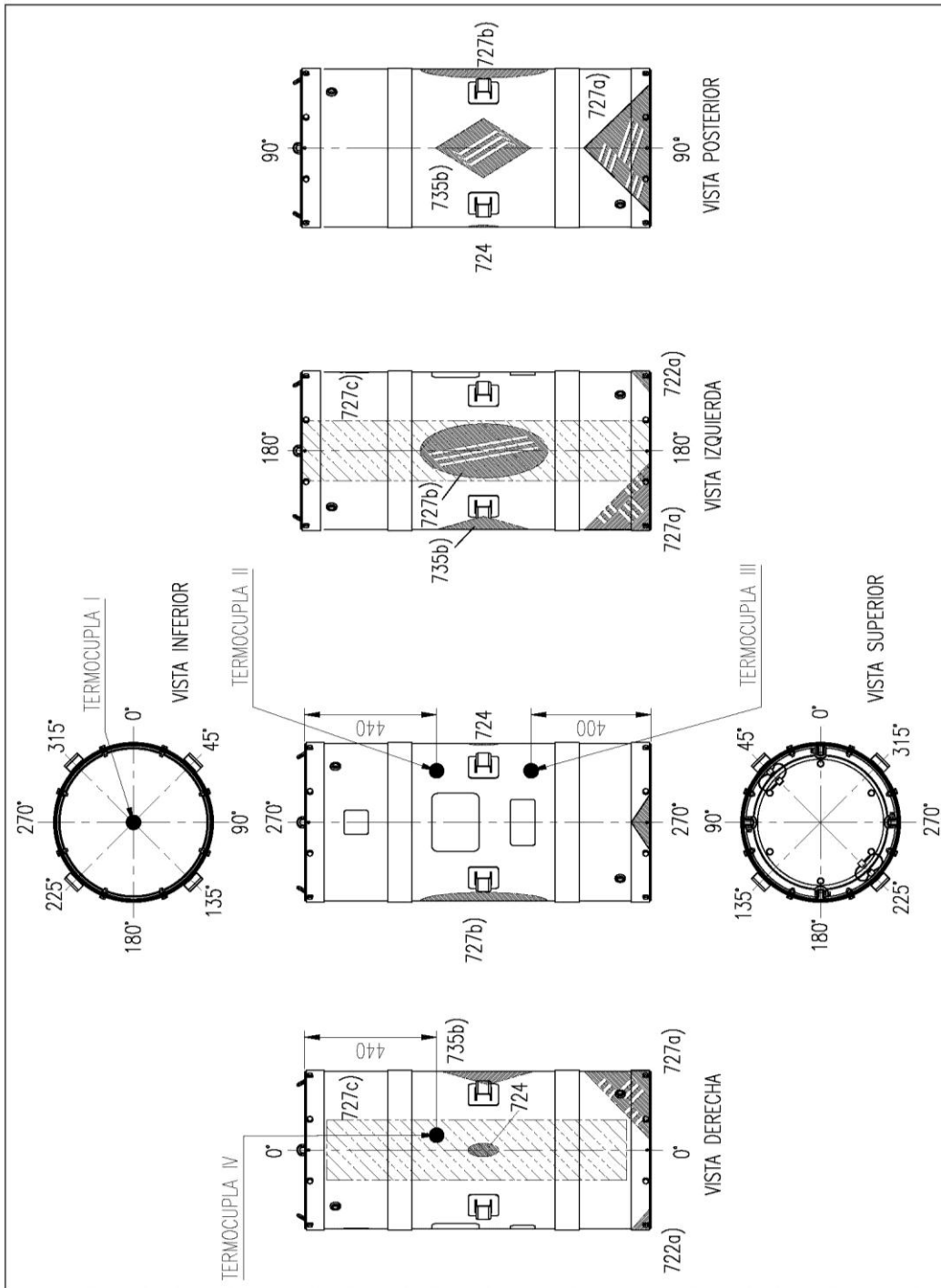


### 5.2.5 Installation of thermocouples for enhanced thermal test

1. The enhanced thermal test shall be carried out after completing all mechanical tests.
2. To carry out the enhanced thermal test, the LEUPA shall be instrumented, installing four (4) K-type thermocouples, 1/8" diameter in special points of interest.

3. The thermocouples shall be placed on strategic places to record the temperatures during the test. Thermocouples are installed after the mechanical tests in the positions shown in Figure 8 and taking into consideration potential deformation caused by prior tests.
4. 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-LE01-3AEIN-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.
5. Thermocouples are installed at INVAP's workshops in the city of San Carlos de Bariloche (Río Negro province) by qualified technical staff before one of INVAP's QA officers.

**Figura 8: Installation of thermocouples**



## 6 APPENDIX I - VALID DRAWINGS

Drawing	Title
0908-LE01-3AEIN-004	LOW ENRICHED URANIUM PACKAGE (LEUPA) – GENERAL JOINT PACKAGE.
0908-LE01-3AEIN-005	LOW ENRICHED URANIUM PACKAGE (LEUPA)-CONTAINER OF INTERNAL CONTAINERS
0908-LE01-3AEIN-006	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – CADMIUM CHAMBER
0908-LE01-3AEIN-007	LOW ENRICHED URANIUM PACKAGE (LEUPA) - INTERNAL CONTAINER
0908-LE01-3AEIN-008	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING - INTERMEDIATE COVER
0908-LE01-3AEIN-009	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING - EXTERNAL COVER
0908-LE01-3AEIN-010	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING - MAIN BODY
0908-LE01-3AEIN-015	LOW ENRICHED URANIUM PACKAGE (LEUPA)-PACKAGING - MAIN BODY - TYPE "A" AND "B" SHEETS
0908-LE01-3AEIN-016	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING - MAIN BODY - FLANGE
0908-LE01-3AEIN-017	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – WARNING PLATE
0908-LE01-3AEIN-018	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – IDENTIFICATION PLATE
0908-LE01-3AEIN-019	LOW ENRICHED URANIUM PACKAGE (LEUPA) – PACKAGING – MAIN BODY – DESIGN AND MANUFACTURING PLATE
0908-LE01-3AEIN-020	LOW ENRICHED URANIUM PACKAGE (LEUPA) – RUBBER JOINTS AND GASKETS SET