

LEUPA

Type B(U) Package to Contain Fissile Substances

OPERATION MANUAL

Made by

IN/AP

June 01, 2015

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1 PURPOSE

1. This manual provides instructions to safely handle RA/0103/B(U)F-96 – LEUPA package for the transport of type LEU radioactive material.

2 SCOPE

1. It includes operation procedures for activities such as: handling, loading, unloading, preparation for storage and transport of packages in transit, in a way suitable to the characteristics of design and in compliance with the applicable requisites of regulations in force.

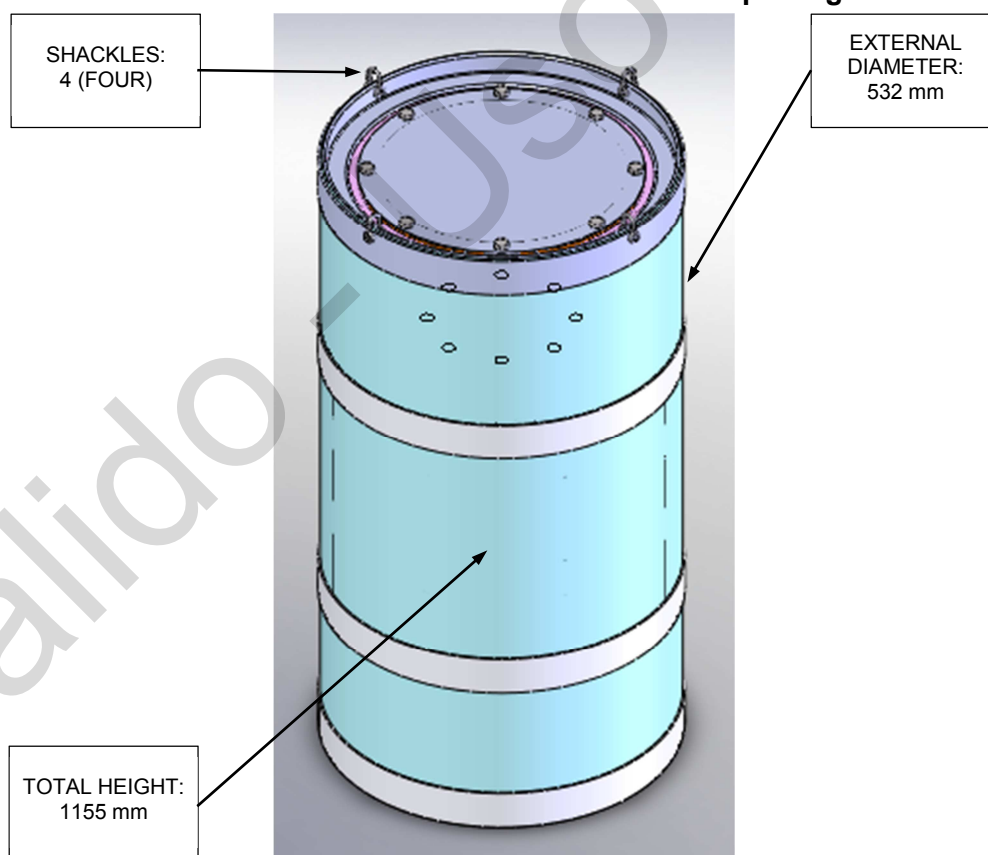
3 ABBREVIATIONS

Abbreviation	Description
LEUPA	Low Enriched Uranium Package for Transport

4 DESCRIPTION OF PACKAGE

1. The LEUPA package has a net mass (empty) of 377.50 kg and a mass (loaded) of approx. 430 kg.

Picture 1: General dimension of package

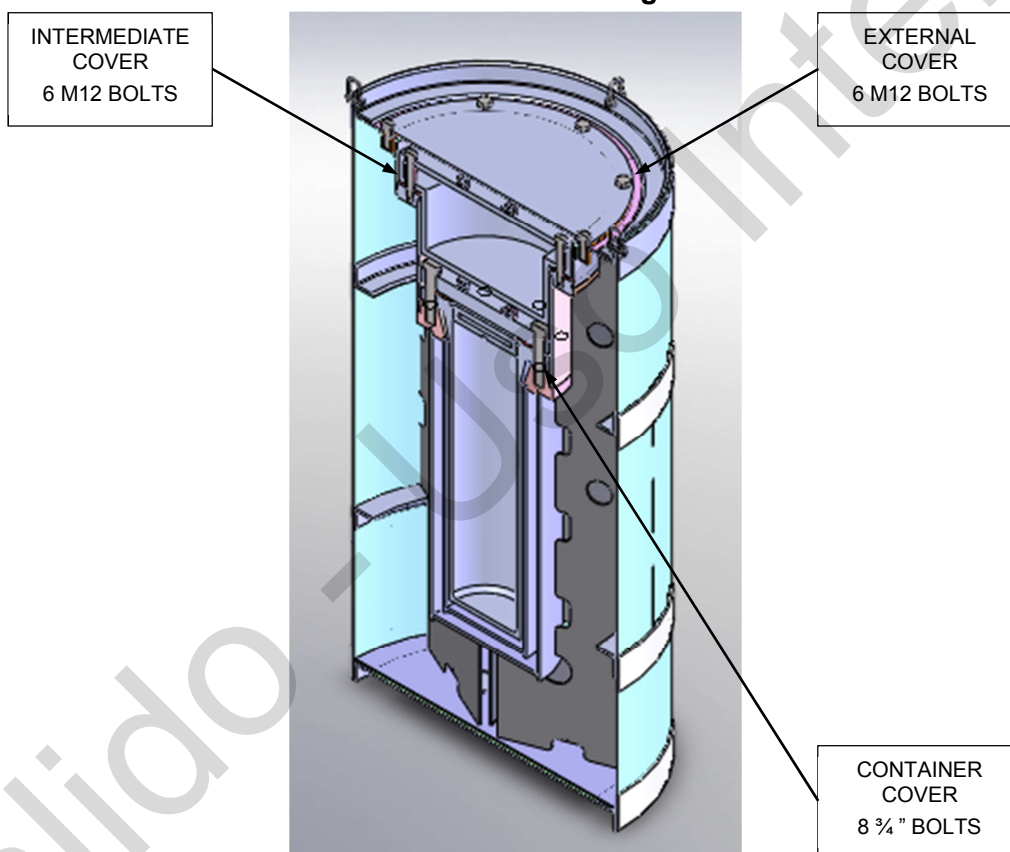


2. The general dimensions of LEUPA package are:

Table 1: General dimensions of package

Detail	Dimensions
External Diameter	532 mm
Total Height	1155 mm

3. The package has in its upper part four (4) shackles to be used for lifting/movement of 500 kg weight each one (see Picture 1:).
4. The package has an external cover secured by six (6) M12 bolts to the main body, an intermediate cover what is also fixed with six (6) M12 bolts to the main body and an inner container cover with spiral gasket, secured by means of eight (8) $\frac{3}{4}$ " UNC bolts to the inner container (see Picture 2:).

Picture 2: Package detail


5 PACKAGE INVENTORY

Table 2: Inventory

Components	Quantity
Main Body (0908-LE01-3ASIN-004)	1
Hex Head Screw M12x30 stainless ISO 4017	6
Washer for M12	6
Nitrile Rubber Gasket 5 mm thick OD420	1
External Cover (0908-LE01-3ASIN-009)	1
Hex Head Screw M12x70 stainless ISO 4017	6
Split Lock Washer for M12	6
Intermediate Cover (0908-LE01-3ASIN-008)	1
Bolt UNC 3/4" x 3 1/2" ANSI B 18.2.1 carbon steel	8
Flat Washer 3/4"	8
Container Cover Blind Flange # 150 ANSI B 16.5	1
Spiral Gasket stainless / graphite DN 125 ASM B16.20	1
Inner Can with Screw Cap (0908-LE01-3ASIN-007)	4

6 EQUIPMENT NEEDED FOR HANDLING

Table 3: Handling elements

Elements	Quantity	Specifications	Use
Slings	4	Resistance similar or higher than 7x19+0 (5670 kg) rope. Minimum length 135 cm.	Handling
Sling Hooks	4	DIN 5691 or similar. Working load limit 3250 kg.	Handling
Shackles	4	DIN 82101 or similar. Working load limit 3250 kg.	Handling
Turnbuckles	4	Standardized. Working load limit 3250 kg.	
Bolts with Nuts and Washers	52 (each)	Bolts M10 – Grade 8.8 – DIN 933. Length 75 mm. Nuts M10 – Grade 10 – DIN 934. Washers for M10 – DIN 125.	Transport
Wrench	1	Tube 19 mm. Socket 3/8".	External Cover

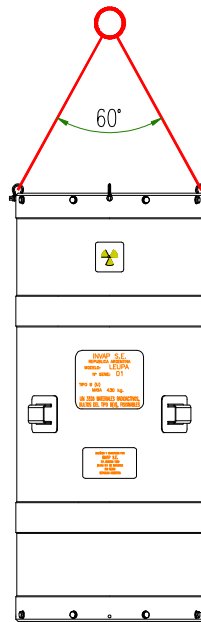
Elements	Quantity	Specifications	Use
Tube Wrench Extension	1		Intermediate Cover
Ratchet Wrench		Length approx. 300 mm. Socket 3/8".	Inner Cover
Wrench	1	Socket 3/8".	General Use
Torque Wrench	1	Tube 1".1/4".	Inner Cover

7 PROCEDURE

7.1 Handling

1. The lifting and moving must be made by means of a sling of four sections joined by a master link and a hook at the end, in accordance with DIN 5691.
2. The hooks must have a minimum 1000 kg working capacity each.
3. The slings can be of a 10 mm (7x19+0) nominal diameter rope, otherwise the rope diameter cannot be less than 6 mm.
4. The α angle can be 60°, otherwise, said angle must be less than 90° (see Picture 3:).
5. The shackles must be DIN 82101 or resistant.
6. The slings must be manufactured with standardized components (thimbles, cord grips, hooks, shackles, turnbuckles, etc.).
7. The loading system (crane, lifting gear, etc.) must have a minimum 1000 kg capacity.
8. While handling, the package must be moved at the least possible distance from ground.

Picture 3: Schematic of package handling



7.2 Loading and Unloading

7.2.1 General Guidelines

1. The team work must have at least one professional or technician with the experience in this operation.
2. Operation must be supervised by a professional or technician with the knowledge and experience in criticality and radiological safety.
3. The cleanliness of inner cans must be verified by means of a sweep test.
4. The loading and unloading form (see Picture 13:) must be filled in and attached to the dispatch documentation.
5. Packages must be loaded or unloaded one at a time, avoiding the accumulation of packages in non-planned zones.
6. Before each loading, verify that the radioactive content does not exceed the authorized maximum.
7. Radioactive content must be the one stated in the approval certificate, it must not exceed the authorized maximum.

7.2.2 Loading of Fissile Substances in Inner Cans

1. The loading of each inner can, four (4) at the most for each package, must be carried out inside the glove box.
2. The substances to be loaded in the inner cans must have been previously contained in thermosealed polyethylene bags.

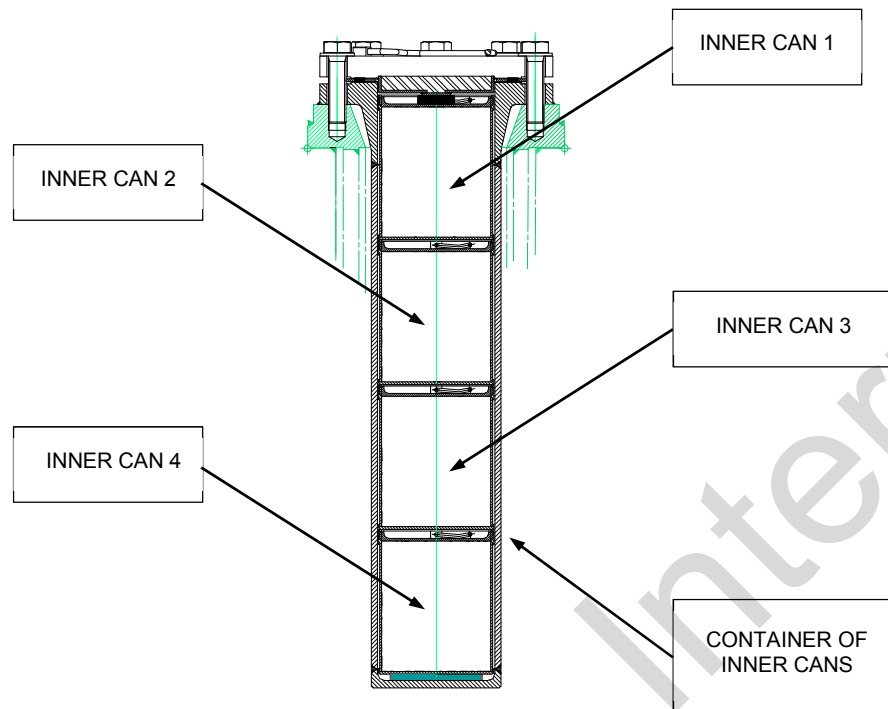
Picture 4: Inner can



3. The cans must leave the glove box fully closed and clean.
4. The external cleansing of inner cans must be verified by means of sweep test, and must not exceed 0.4 Bq/cm^2 .

7.2.3 Loading of Inner Cans into the Container

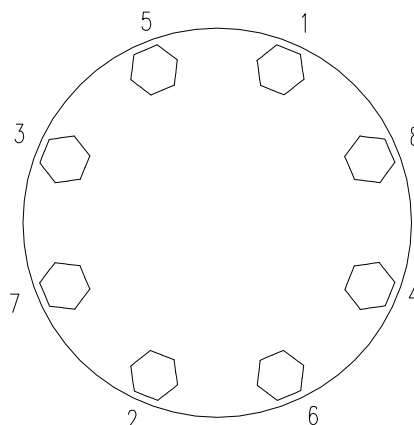
1. Once outside the glove box, the loaded and sealed inner cans must be placed inside the container.
2. The inner cans loaded with fissile substances must be vertically placed inside the package, the cover upwards, and must be piled one on top of the other (see Picture 5:).

Picture 5: Container details


3. In case there is volume left within the inner can, it must be filled with expandable resin.

7.2.4 Sealing of Container of Inner Cans

1. Once the inner cans have been placed inside the container, the following steps must be carried out:
 - a. Mount the spiral gasket stainless/graphite onto its place and on its top put the blind flange.
 - b. Place bolts UNC $\frac{3}{4}$ " –quantity: eight (8) – with their corresponding washers.
 - c. Tighten bolts up to an airtight closure of the container –torque not less than 55 Nm– (see Picture 6:).

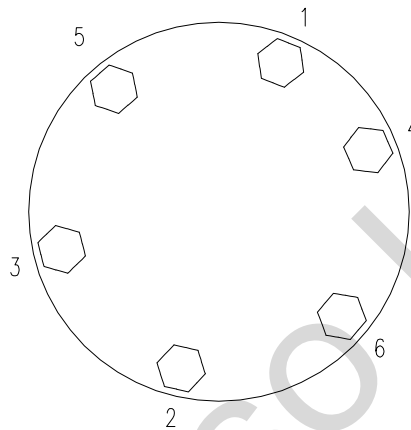
Picture 6: Recommended sealing sequence (container cover)


7.2.5 Sealing of LEUPA Package

1. Once the container of inner cans is closed, proceed in the following way:
 - a. Place the gasket (nitrile) of the intermediate cover.

- b. The intermediate cover is placed in its position.
 - c. Bolts M12 –quantity: six (6)– are mounted with their corresponding washers.
 - d. Bolts are tightened until the intermediate cover is fixed (torque not less than 15 Nm).
2. Once the intermediate cover is fixed in its position, the following must be done:
 - a. Place the gasket (nitrile) of the external cover.
 - b. Place bolts M12 –quantity: six (6)– with their corresponding washers.
 - c. Bolts are tightened until the external cover is fixed –torque not less than 15 Nm– (see Picture 7:).

Picture 7: Recommended closure sequence (intermediate/external cover)



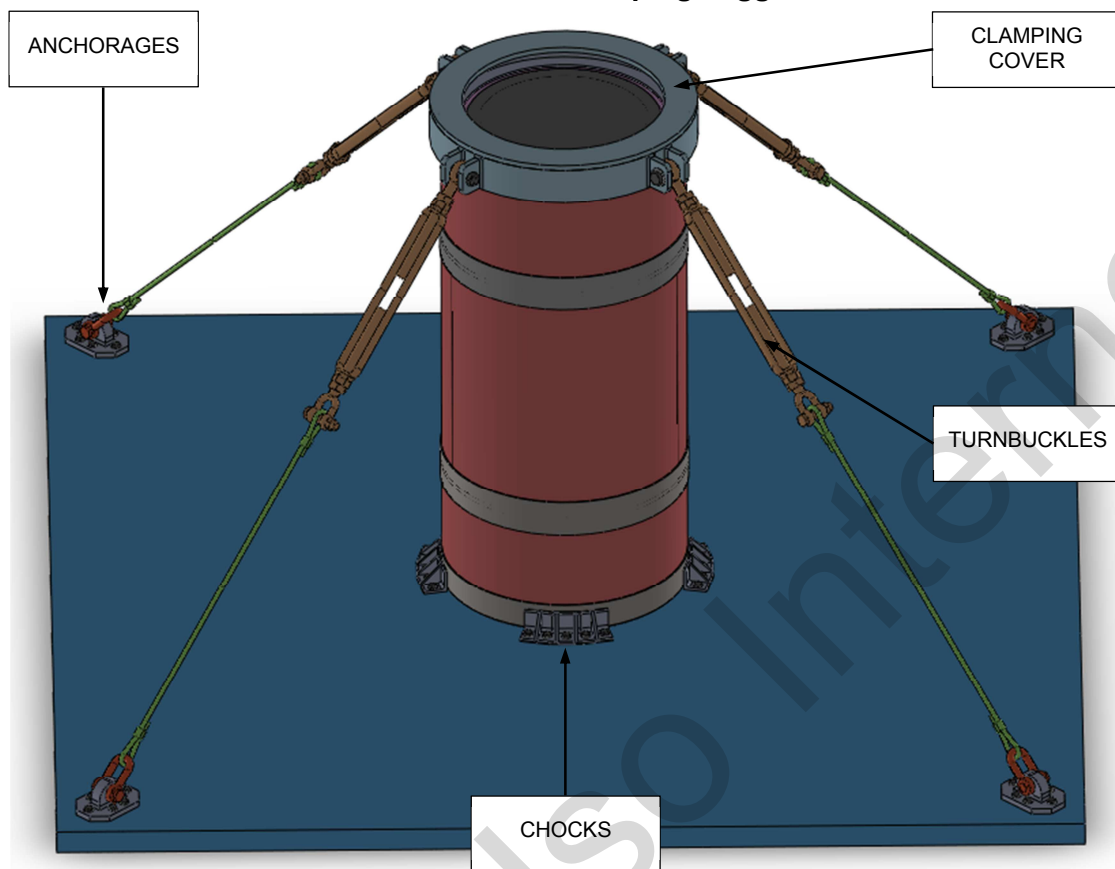
7.2.6 Transport

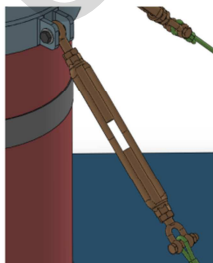
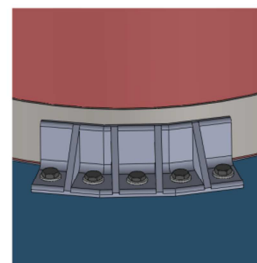
1. Before each dispatch the following must be done:
 - a. Verify the external cleansing of the package by sweep test.
 - b. Complete dispatch form of each package.
 - c. Visually inspect the external look of each package.
 - d. Verify that the temporary radioactive contamination of the external surfaces does not exceed:
 - i. 4 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters.
 - ii. 0.4 Bq/cm² for all other alpha emitters.
 - e. Verify the Transport Index (TI). This shall be determined as the maximum radiation level in millisievert units per hour (mSv/h) at a distance of one (1) meter from the external surfaces of the package. The determined value is multiplied a hundred times and the obtained figure is the Transport Index. This figure shall be rounded up (for example 1.13 shall be 1.2), except in cases of 0.05 values or less, which can be considered as zero.
 - f. Verify that the ISC value is the one stated in the Approval Certificate of the LEUPA – RA/103/B(U)F-96.
 - g. Verify that the package is duly marked and labelled:
 - i. UN abbreviation.
 - ii. Clover symbol printed (Picture 1 Paragraph 534 – AR 10.16.1 Rev. 2).
 - iii. Labels on package, placed on two opposite sides (Picture 2 Paragraph 536, Picture 5 Paragraph 539 and N° of the United Nations AR10.16.1 Rev. 2).
 - iv. Name of dispatch.

- v. Net mass.
- vi. Type of package.
- vii. Identification mark.
- viii. Series No.
- ix. Sender and Addressee address.
- h. Verify the package has been sealed.
- i. Verify all required documentation for dispatch.
 - i. Approval Certificate – ARN.
 - ii. Loading Form.
 - iii. Dispatch Form.
 - iv. Sender's certificate/statement (Paragraph 545 – AR 10.16.1 Rev. 2).
 - v. Consignment details (Paragraph 544 – AR 10.16.1 Rev. 2).
- j. Verify that the approved and in force inspection form is with dispatch documentation.
- k. Verify that the loading and unloading form is with dispatch documentation (see Picture 8:).
- 2. Once the above mentioned issues are verified, the LEUPA package is free for transport.

7.2.7 Clamping Method during Transport

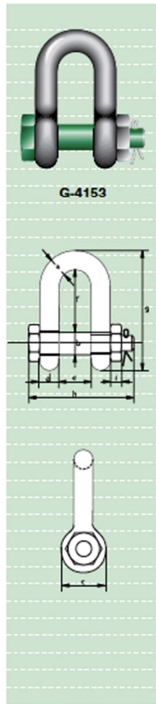
- 1. The transportation of the LEUPA must be with the package in a vertical position with covers upwards on the means of transportation chosen, and it must be fixed with the four (4) turnbuckles by chocks to the floor.
- 2. For the transportation of the LEUPA package, it is recommended to fix it as explained in Picture 8: and Picture 9:.
- 3. The angle of turnbuckles can be around 45° (see Picture 8:).
- 4. The shackles must be standardized, working load limit 3250 kg, or others of higher resistance.
- 5. Turnbuckles must be standardized, working load limit 3270 kg.
- 6. The stainless steel rope must be standardized 7x19+0, working load limit 3270 kg.
- 7. The slings must be manufactured with standardized components (thimbles, cord grips, hooks, shackles, etc.).
- 8. All bolts used are M10 –grade 8.8 and nuts M10– grade 10.
- 9. Any other clamping method to be used must be revised and approved by the dispatch manager prior to transport.

Picture 8: Clamping suggestion

Picture 9: Clamping Elements

Anchorage

Turnbuckle

Chock

10. Verification of clamping mode, the components used and the details thereof are in the Technical Specification No. 0908-LE01-3BSIN-025.
11. Anchorage 0908-LE02-3ASIN-013 / Chock 0908-LE02-3ASIN-014 / Clamping Cover 0908-LE02-3ASIN-015.
12. To select shackles, turnbuckles and ropes, see the following tables in accordance with DIN 5691 standards.

Picture 10: Shackles



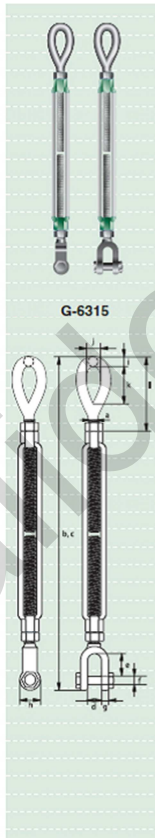
Green Pin® Standard Shackles

dee shackles with safety bolt

- **Material** : bow and pin high tensile steel, Grade 6, quenched and tempered
- **Safety Factor** : MBL equals 6 x WLL
- **Standard** : EN 13889 and
meets performance requirements of US Fed. Spec. RR-C-271 Type IVB Class 3, Grade A
- **Finish** : hot dipped galvanized
- **Temperature Range** : -20 °C up to +200 °C
- **Certification** : at no extra charges this product can be supplied with a works certificate, 3.1 material certificate, manufacturer test certificate, EC Declaration of Conformity and all shackles starting from 2 t can be supplied with DNV 2.7-1 certificate.

working load limit	diameter bow	diameter pin	diameter eye	width eye	width inside	length inside	length	length bolt	thickness nut	weight each
t	a	b	c	d	e	f	g	h	i	kg
2	13.5	16	34	13	22	43	81	82	13	0.39
3.25	16	19	40	16	27	51	97	98	17	0.67
4.75	19	22	46	19	31	59	112	114	19	1.08
6.5	22	25	52	22	36	73	134	130	22	1.66
8.5	25	28	59	25	43	85	154	150	25	2.46
9.5	28	32	66	28	47	90	167	166	27	3.4
12	32	35	72	32	51	94	180	178	30	4.51
13.5	35	38	80	35	57	115	209	197	33	6.1
17	38	42	88	38	60	127	230	202	39	7.63
25	45	50	103	45	74	149	271	249	43	12.88
35	50	57	111	50	83	171	305	269	51	17.35
42.5	57	65	130	57	95	190	345	301	59	25.94
55	65	70	145	65	105	203	376	330	67	35.33
85	75	83	162	73	127	229	427	380	79	52.97

Picture 11: Turnbuckles







Green Pin® turnbuckles Eye - Jaw

generally to ASTM F1145-92

- **Material** : drop forged high tensile steel SAE 1035 or 1045
- **Safety factor** : MBL equals 5 x WLL
- **Standard** : generally to ASTM F1145-92
formerly U.S. Federal Specification FF-T-791b
- **Finish** : hot dipped galvanized
- **Certification** : a works certificate, proof load test certificate
can be supplied upon request

diameter thread	take up	length closed position	length open position	length opening jaw	length inside jaw	diameter pin	thickness eye	diameter eye	diameter eye	width inside eye	length inside eye	length closed position	working load limit	weight each
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Inch	Inch	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	tons	kg
3/16	6	302	416	13	22	8	8	21	9	13	28	65	0.54	0.34
1/8	6	338	452	16	26	9.5	10	25	12	18	36	80	1	0.69
1/4	9	414	585	16	26	9.5	10	25	12	18	36	80	1	0.78
1/2	12	490	719	16	26	9.5	10	25	12	18	36	80	1	0.93
5/8	6	394	508	18	33	13	13	33	14	21	43	98	1.59	1.07
3/4	9	470	641	18	33	13	13	33	14	21	43	98	1.59	1.39
1	12	546	775	18	33	13	13	33	14	21	43	98	1.59	1.71
1 1/4	6	432	546	23	38	15.5	16	41	17	25	53	113	2.36	1.76
1 1/2	9	508	679	23	38	15.5	16	41	17	25	53	113	2.36	1.95
1 3/4	12	584	813	23	38	15.5	16	41	17	25	53	113	2.36	2.43
2	18	737	1080	23	38	15.5	16	41	17	25	53	113	2.36	2.98
2 1/4	12	625	854	27	44	19	18	48	20	31	59	118	3.27	3.53
2 1/2	18	778	1121	27	44	19	18	48	20	31	59	118	3.27	4.19
3	6	524	638	30	52	22	20	54	22	36	74	155	4.54	4.05
1	12	676	905	30	52	22	20	54	22	36	74	155	4.54	5.08
1 1/4	18	829	1172	30	52	22	20	54	22	36	74	155	4.54	6.03
1 1/2	24	980	1437	30	52	22	20	54	22	36	74	155	4.54	7.39
1 3/4	12	760	989	44	73	29	25	67	29	45	88	197	6.9	8.80
2	18	912	1255	44	73	29	25	67	29	45	88	197	6.9	11
2 1/4	24	1064	1521	44	73	29	25	67	29	45	88	197	6.9	12.9
2 1/2	12	823	1052	52	70	35	27	80	32	54	105	215	9.71	13.1
3	18	975	1318	52	70	35	27	80	32	54	105	215	9.71	14.7
3 1/4	24	1128	1585	52	70	35	27	80	32	54	105	215	9.71	17.8
3 1/2	18	1060	1403	59	85	41	33	90	38	60	119	254	12.7	22.3
4	24	1213	1670	59	85	41	33	90	38	60	119	254	12.7	27.5
4 1/4	24	1315	1772	64	93	51	39	108	45	69	146	308	16.78	42.9
4 1/2	24	1486	1943	75	114	57	38	143	51	79	165	344	27.22	68
5	24	1562	2019	89	110	70	42	156	57	83	178	381	34.02	91

Picture 12: Ropes
**AISI 316 STAINLESS STEEL ROPES
LOAD BREAKING LIMIT**

NOMINAL DIAMETER	1x19+0 standard	7x19+0 standard	7x7+0 standard	Dyform 1x19+0
				
mm	kgf	kgf	kgf	kgf
2	320	226	242	---
2,5	500	355	---	690 (1)
3	720	510	545	1.000 (1)
4	1.280	907	968	1.780 (1)
5	2.000	1.420	1.510	2.440
6	2.880	2.040	2.180	3.550
7	3.550	2.780	2.970	4.910
8	4.640	3.630	3.870	6.150
10	7.250	5.670	6.050	9.770
11	8.770	---	---	12.100
12	10.400	8.160	8.710	14.400
14	14.180	11.100	11.900	19.300 (2)
16	18.560	13.600	---	25.600 (2)
19	21.620	---	---	32.000 (3)
22	29.070	---	---	---
26	40.600	---	---	---

7.2.7.1 Alternative Clamping Method

1. For those cases in which the means of transportation does not allow for the clamping method described above in 6.2.7, the following shall be done:
 - a. The container must be placed vertically.
 - b. It must be fixed on the upper part by means of the clamping cover.
 - c. Its base shall have movement restrictions so that it may not slide.
 - d. It must have at least four (4) anchorages. All of them clamped on its bottom to the transportation floor.
 - e. Vertical and horizontal movements must be restricted.
 - f. In case this clamping method is used the dispatch manager must approve it for its transport.

7.2.8 Storage

1. No special environment conditions are needed for storage.
2. No more than six (6) of this type of packages can be stored in the same site.
3. They must not be piled up.

7.2.9 Empty Packages

1. To be dispatched as exempted package, the plates with radioactive symbol must be covered, in such a way that they may not fall off until arrival. The following steps shall be checked:
 - a. The package must be kept in good conditions and tightly closed.
 - b. The inner contamination level cannot exceed 400 Bq/cm².
 - c. The radiation level at any external part of the exempted package shall not exceed 5 µSv/h.
 - d. Labels that may have been on its surface while loaded with radioactive material will be discarded.
 - e. Place the UN No. on exempted packages.

8 FORMS SAMPLE

Picture 13: Loading and unloading form

LOADING AND UNLOADING FORM			
LEUPA PACKAGE			
SERIES NUMBER: _____		DATE: ____ / ____ / ____	
LOADING / UNLOADING FISSILE MATERIAL (Weight and type of Fissile Material)			
Number of Inner Cans: _____			
No.	Description	Observations	Done/Supervised
1	Technical Manager		
2	Safety and Radioprotection Manager		
3	Verify Radioactive Content		
4	Tightening of Container Flange	Torque:	
5	Tightening of Intermediate Cover	Torque:	
6	Tightening of External Cover	Torque:	

Picture 14: Dispatch form

DISPATCH FORM			
LEUPA PACKAGE			
SERIES NUMBER: _____		DATE: ____ / ____ / ____	
No.	Description	Observations	Done/Supervised
1	Visual Inspection		
2	Verify Surface Radioactive Contamination ($< 4 \text{ Bq/cm}^2$) / ($< 0.4 \text{ Bq/cm}^2$)		
3	Transport Index (in one meter)		
4	Safety Index as regards Cricality (ISC)		
5	Verify Labels and Marks		
6	Verify Seals		
7	Verify Documentation		
8	Verify Clamping Method		

Picture 15: Consignment Details

CONSIGNMENT DETAILS		
Correct name of Dispatch:	(AR 10.16.1 Rev. 2 – Table 1)	
“7”		
Sender: (Name and Address)		
Addressee: (Name and Address)		
UN _ _ _ _	UN assigned Number to the Material (AR 10.16.1 Rev. 2 – Table 1)	
Name or Symbol of the Transported Radionuclides:	URANIUM 235 (_ _ _ _ _ %)	
Physical and Chemical Description:		
Total Mass in grams (Fissile Substance)	_____ grams	Fuel Elements/Plates (Quantity of Plate Carriers)
Category of Package		I – WHITE
		II – YELLOW
		III – YELLOW
Transport Index (ΣIT):		
Safety Index as regards Criticality (ΣISC):		
Applicable Identification Mark from Competent Authority: B(U)F – RA/0103/B(U)F-96 Package Others:		
Dispatch on exclusive use mode		
	YES	NO
<p>“I hereby state that the content of this consignment is wholly and fully described above under the correct name dispatch; and that it has been classified, packed, marked and labelled, and it is by all means in appropriate conditions for its transport, in accordance with international and national regulations in force”.</p>		
Signature	Print Full Name	Date

Resumen del circuito de firmas del documento: 0908-LE00-3BEIN-017-A

Descripción	Nombre	Fecha
Autor	Lodi, Eduardo	03-06-2015
Revisor	Ausas, José	03-06-2015
Aprobador	Orticelli Juan Carlos	03-06-2015

Válido - Uso Interno

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