U.S. Department
of Transportation
**Pipeline and
Hazardous Materials
Safety Administration**

East Building, PHH-23
1200 New Jersey Ave., SE
Washington, D.C. 20590

**COMPETENT AUTHORITY CERTIFICATION
FOR A TYPE B(U)F FISSILE
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0492/B(U)F-96, REVISION 10**

REVALIDATION OF FRENCH COMPETENT AUTHORITY CERTIFICATE F/313/B(U)F-96

This certifies that the radioactive materials package design described is hereby approved for use within the United Sates for import and export shipments only. Shipments must be made in accordance with the applicable regulations of the International Atomic Energy Agency[1] and the United States of America[2].

1. Package Identification - TN-BGC1.

2. Packaging Description and Authorized Contents - as described in France Certificate of Competent Authority F/313/B(U)F-96, Revision Hag (attached). Contents are restricted to:

    a. Solid non-irradiated uranium bearing materials contained within a TN-90 secondary conditioning container as described in French Certificate of Approval No. F/313/B(U)F-96(Hag), Appendix 11, Content No. 11 (attached).

    b. Non-irradiated TRIGA fuel elements as described in French Certificate of Approval No. F/313/B(U)F-96(Hag), Appendix 26, Content No. 26 (attached).

3. Criticality -

    a. The minimum criticality safety index for non-irradiated uranium bearing materials contained within a TN-90 secondary conditioning container, listed as Content No. 11 on the French Certificate of Approval, is 1.0.

    b. The minimum criticality safety index for non-irradiated TRIGA fuel elements, listed as Content No. 26 on the French Certificate of Approval, is 0.0.

    c. The maximum number of packages per conveyance is determined in accordance with Table X of the IAEA regulations cited in this certificate.

---

[1] "Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), No. TS-R-1 (ST-1, Revised)," published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

[2] Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

4. General Conditions -

a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation. The user shall prepare the package for shipment in accordance with the documentation and applicable regulations.

b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Technology, (PHH-23), Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, Washington D.C. 20590-0001.

c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

d. This certificate provides no relief from the limitations for transportation of plutonium by air in the United States as cited in the regulations of the U.S. Nuclear Regulatory Commission 10 CFR 71.88.

e. Records of Quality Assurance activities required by Paragraph 310 of the IAEA regulations[1] shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors in the United States exporting shipments under this certificate shall satisfy the applicable requirements of Subpart H of 10 CFR 71.

5. Special Conditions -

a. For air transport of Content No. 11, the maximum fissile mass must not exceed 5 kilograms U-235 per package. The mass of water must not exceed 2000 grams per package in the form of moisture content of wood. No hydrogenous packaging materials are permitted within the package containment vessel.

b. For air transport of Content No. 26, the maximum number of TRIGA fuel elements per package must not exceed 5 standard elements or 23 thin elements, where standard and thin elements are defined in F/313/B(U)F-96 26ag, Appendix 26, Content No. 26. The total mass of cardboard must not exceed 1200 grams, the moisture content of the wood components must not exceed 10 percent, and the total water content (including moisture content of the wood and water equivalent in the form of cardboard) must not exceed 2900 grams per package. No other hydrogenous packaging materials are permitted within the package containment vessel.

CERTIFICATE USA/0492/B(U)F-96, REVISION 10

6. Marking and Labeling - The package shall bear the marking USA/0492/B(U)F-96 in addition to other required markings and labeling.

7. Expiration Date - This certificate expires on June 30, 2008.

This certificate is issued in accordance with paragraph 814 of the IAEA Regulations and Section 173.472 and 173.473 of Title 49 of the Code of Federal Regulations, in response to the May 25, 2007 petition by Edlow International Company, Washington, DC, and in consideration of other information on file in this Office.

Certified by:

JAN 15 2008

Bob Richard (DATE)
Deputy Associate Administrator for Hazardous Materials Safety

Revision 10 - Issued to authorize, subject to special conditions, air transport of Content No. 11 and Content No. 26.

NUCLEAR SAFETY AUTHORITY

GENERAL MANAGEMENT
OF NUCLEAR SAFETY
AND RADIOPROTECTION

Fuel cycle and
radioactive materials transportation section

F/313/B(U)F-96 (Hag)

CERTIFICATE OF APPROVAL OF A PACKAGE DESIGN

The French Competent Authority,

further to the request made by the Commissariat à l'Energie Atomique in the letter CEA/DEN/CAD/DTAP/SPI/GET DO 536 of August 20, 2003, DPSN/SSR/2004/109/GB of May 6, 2004 and DPSN/SSR/2005/041/GB of February 18, 2005;

further to the Safety Analysis Report EMB TNBGC PBC DS-CA000001B of August 20, 2003 completed by the documents listed in the telecopy CEA/DEN/CAD/DTAP/SET DO 117 of April 7, 2004, in the technical note EMB TNBGC PBC NIT CA000536 A of May 4, 2004, in the telecopy CEA/DEN/CAD/DTAP/SET DO 247 of May 14, 2004 and in the technical note 160 EMBAL PFM NOT 05000527 Ind. A of February 9, 2005,

hereby certifies that the package design comprising the **TN-BGC1** packaging, described hereinafter in appendix 0 index ag and loaded with one of the following contents :

- content n°2: non-irradiated uranium oxide powder (described in appendix 2 index ag),
- content n°4: ingots of non-irradiated metallic uranium (described in appendix 4 index ag),
- content n°7: pellets, section of rods or non irradiated uranium oxide rods (described in appendix 7 index ag),
- content n°11: non irradiated uranium-bearing materials in any solid form (described in appendix 11 index ag),
- content n°26: non irradiated TRIGA fuel (described in appendix 26 index ag),
- content n°27: 3 non irradiated CAMIX-COCHIX pins (described in appendix 27 index ag),
- content n°28: FUTURIX/Concept pins (described in appendix 28 index ag),
- content n°29: FUTURIX/FTA DOE pins (described in appendix 29 index ag),
- content n°30: FUTURIX/FTA ITU-CEA pins (described in appendix 30 index ag),

as a B(U) type package design loaded with fissile material, is in accordance with the requirements of the regulations, agreements and recommendations listed below :

- Regulations for the Safe Transport of Radioactive Materials, from the International Atomic Energy Agency, Safety Norms n°TS-R-1, edition 1996 revised ;
- European Agreement concerning the international carriage of dangerous goods by road (ADR),
- Regulations concerning the international carriage of dangerous goods by rail (RID),
- International Maritime Dangerous Goods Code, International Maritime Organization (IMDG Code from OMI),
- Technical instructions for the safe transport of dangerous goods by air, International Civil Aviation Organization,
- Decree of June 1st, 2001 modified concerning the carriage of dangerous goods by road (ADR decree),
- Decree of June 5, 2001 concerning the carriage of dangerous goods by rail (RID decree),
- Regulations concerning the Safety of Ships (RSN), section 411 enclosed to the Decree of November 23, 1987 modified,
- Decree of May 12, 1997 modified concerning technical conditions of plane operations by a public air carrier company (OPS1 decree).

However, only contents n°11, 26 and 27 are allowed to be transported by air.

The present certificate does not exempt the consignor from conforming to the prescriptions established by the authorities of the countries through which the package will be carried.

The validity of this certificate expires on **June 30, 2008.**

Registration No. **DGSNR/SD1/0794/2006.**

PARIS, November 10, 2006.

For the Minister of the Economy,
Finances and Industry,
and, by delegation,
the General Head of Nuclear
Safety and Radioprotection

On behalf of the General Head of Nuclear
Safety and Radioprotection
The Assistant General Manager

M. BOURGUIGNON

For the Minister of Land Management
and Environment,
and by delegation,
the General Head of Nuclear
Safety and Radioprotection

On behalf of the General Head of Nuclear
Safety and Radioprotection
The Assistant General Manager

M. BOURGUIGNON

SUMMARY OF THE CERTIFICATE ISSUES

Issued	Expires	Emission type and modifications	Type of certificate	Revision index							
				Body	t	0	1	2	3	4	5
08.06.04	30.06.08	Prorogation	B(U)F-96	Haa	--	aa	--	aa-	--	aa	--
15.07.04	30.06.08	Prorogation	B(M)F-96 T	Hab	ab	ab	ab	---	ab	--	ab
		Reserved		Hac							
		Reserved		Had							
29.09.04	30.06.08	Extension	B(U)F-96	Hae	--	ae	--	---	--	--	--
27.10.05	30.06.08	Extension	B(U)F-96	Haf	--	af	--	---	--	--	--
10.11.06	30.06.08	Extension	B(U)F-96	Hag	--	ag	--	ag-	--	ag	--

Body	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Haa	--	aa	--	--	--	aa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	aa				
Hab	ab	--	ab	--	--	--	--	--	--	ab	--	--	--	--	ab	--	--	ab	--	--	--				
Hac																									
Had																									
Hae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Ae			
Haf	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	af	af	Af
Hag	--	ag	--	--	--	ag	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ag	ag	ag	ag	Ag

APPENDIX 0

1. DESCRIPTION OF THE PACKAGING

The packaging is designed, fabricated, inspected, tested, maintained and used in accordance with the safety analysis report EMB TNBGC PBC DS-CA000001B of August 20, 2003.

The packaging, composed of a parallelepipedic cage inside which is fastened a body of general cylindrical shape, fitted with a closure system and a cover, is presented in the diagram page 5.

The design drawings of the packaging are the following:

- Design and overall drawing: TN 9990-65 (C)
- Cage : TN 9990-118 (B)
- Plug assembly: TN 9990-117 (B)

The principal dimensions of the packaging are the following:

- cross-section of cage: 600 x 600 mm²,
- overall height of cage: 1 821 mm,
- diameter of regular section of body: 295 mm,
- diameter of cover : 466 mm,
- overall height of body and cover; 1 808 mm.

The maximum masses of the packaging are:

- unloaded: 280 kg,
- loaded: 396 kg.

When considering the margins on the dimensions and densities of balsa and poplar contained in the packaging (shock absorbing cover and bottom of the body), the total mass of water in these elements is less than 1 670 g.

The packaging is composed of the main subsets described below:

1.1 Cage

The cage is built of aluminum tubes of size 30 x 30 mm and 2 mm thick,

Passage points reinforced by angle bars are provided at two levels to allow passage of the forks of a fork lift truck when needed to lift the package.

Frames designed to connect the body to the cage are provided within the cage, welded to the uprights of the cage and drilled to allow passage of the screws that fasten the body holding struts.

1.2 Body

The cavity, of internal useful diameter 178 mm and of useful length 1475 mm, consists of a 6 mm thick shell in stainless steel (providing the main radial shielding of gamma rays) and of a 8 mm thick bottom plate in stainless steel too.

A second shell in stainless steel 1.5 mm thick and of internal diameter 292 mm delimits with the first shell a space that is filled with resin containing a filler (minimal thickness: 48 mm) that acts as a neutron absorber and as an active thermal insulation.

The bottom plate protection is completed, from inside the packaging to outside, by a 25 mm thick distribution plate in steel of high yield strength, a 24 mm layer of resin. an intermediate plate, a shock absorbing disk in wood and a sheet in stainless steel.

At the top, a machined flange in stainless steel is welded to the two shells to hold the closure system described below.

1.3 Closure system

The cavity in the body is closed by a system consisting of three principal parts: a plug, a clamping ring and a bayonet ring.

The plug is held against the body by the clamping ring which is screwed into the bayonet ring that, in its turn, boars on the body flange.

A port fitted with a quick connection in the center of the plug allows depressurization in the packaging before shipment and return to atmospheric pressure on arrival before unloading. This port is closed by at cap.

Two pairs of O-rings gaskets provide leak-tightness between the plug and the body, and leak-tightness of the quick connection cap. The spaces between the O-rings gaskets both communicate with a common test port designed to test the leak-tightness of the closure system.

The two O-rings gaskets that define the containment envelope are made of THT silicone, of shore hardness 65; they are marked 11 and 13 is the drawing TN 9990-65 (C), the two other O-rings gaskets, marked 12 and 14, are made of Viton.

1.4 Shock absorbing system

A shock absorbing cover encloses the body head and the closure system.

It consists of two compartments made of stainless steel sheets. The nearest to the body is filled with resin, the other is filled with wood (balsa and poplar).

The cover is fastened to the body by two toggle fasteners and by two bent rods connected to struts that are solid with the body.

1.5 Elements of handling and stowage

It is the cage of the packaging which enables its handling and its stowage.
The packaging can be handled and transported vertically or horizontally.
The packaging can be transported in a container, but only vertically.

In a vertical position, the packaging can be handled in two ways:

- by fork-lift truck which forks penetrate in the passages provided in the cage (2 possible levels)
- by straps or slings which are hanged on the middle of the tubes. This reinforces the corners of the cage in its upper part.

In an horizontal position, the packaging can be handled by putting two straps around the cage.

When the transport of the package is made vertically, the stowage can be done in two manners:

- by wedging at the feet level and straps in the middle
- by wedging with crosspieces at two different levels.

When the transport is made horizontally, the stowage is made by wedging on the ground around the cage and by strapping over the cage.

1.6 Safety functions

The main safety functions are:

- the confinement ensured by the protective shield of the packaging constituted by an internal shell and the bottom of the body, the plug and the quick connection cap, which are equipped of silicone gaskets;

- the radiological protection is essentially ensured by:
  - lateral shielding constituted by the stainless steel of the internal (6 mm) and external (1,5 mm) shells for the main part of the shielding against the gamma radiation and by resin for the shielding against neutron radiation;
  - bottom shielding constituted by the stainless steel of the bottom cavity (8 mm) and 2 closing sheet metals (2 x 1,5 mm) as well as by carbon steel of the repartition plate (25 mm) for the main part of the shielding against gamma radiation and by resin (25 mm, 24 mm min.) and wood (65 mm) for the shielding against neutron radiation;
  - top shielding constituted by the stainless steel of the plug and the sheet metals of the cover (gamma protection) and by resin and wood contained in the cover (neutron protection);

- the safety criticality ensured by the system of isolation composed of the elements described in the appendixes of the contents and of:
  - the packaging: geometry (maximum diameter of the packaging to favor interactions, cage), materials used, composition and thickness of neutron-absorbing resin (content of hydrogen and boron, thickness of burnt resin);
  - internal arrangements: geometry of spacers, material constituting the spacers (aluminum), geometry (diameter, thickness) of the container, material used for the container;

- dissipation of the internal thermic power ensured by radiation between radioactive materials and the body, by conduction in the body and exchange between the body and ambient air;
- the protection against impacts ensured by the shock absorbing cover and the cage;
- the protection against fire ensured by the radiological protection. The body is equipped with fusible plugs which avoid risks of suppression due to steam.

2. MEASURES TO BE TAKEN BY THE SHIPPER BEFORE SHIPPING

The packaging must be used in compliance with procedures based on the specifications contained in chapter 10 of the Safety Analysis Report.

Before each shipment, the shipper must check that all the following controls have been correctly made in accordance with a list pre-established from the conditions of use described in the chapter 10 of the Safety Analysis Report, that the results of these controls comply with the specified requirements and that the list has been properly signed:

- checking that the packaging has been handled in compliance with paragraph 3 of this present certificate,
- checking that the content is in compliance with this certificate of approval,
- control that the rate of maximal global leak is less than $6{,}66.10^{-4}$ $Pa.m^3.s^{-1}$ (5 lusec) in the SLR conditions;
- checking the couples torque of tightening according to table 1;
- checking that the application effort of the plug is 30 kN;
- control the contamination of the external surfaces of the package (in accordance with the acceptable regulatory limits)
- control the intensity of the maximal radiation around the package (in accordance with the acceptable regulatory limits), in particular on the following points: in contact and at one meter laterally and in the axis.
- Checking that the temperature of the accessible surfaces of the packaging in the shade, after having reached the thermal balance, does not exceed 50°C for an air transport or under non exclusive use, and 85°C for a non air transport under exclusive use.
- control of the regular labels and markings ; the identification marking of the packaging is : F/313/B(U)F-96;
- control that seals have been placed to prevent disassembly of the cover.
- control that, in case of air transport, the packaging(s) is(are) placed in a reinforced cargo space;

Table n° 1: summary of the nominal torque of tightening

Screw or bolt	**Tightening cork**
Quick connection cap	50 N.m
Test plug	10 N.m

3. MAINTENANCE PROGRAMME

The packaging must be subjected to periodic maintenance in compliance with the provisions of chapter 11 of the Safety Analysis Report.

In particular:

- Before every transport:
  - Inspect gasket seats surfaces of the body and of the plug, inspect O-rings gaskets and replace if necessary,
  - Check that there is no damage of the quick connection and of the test ports for leak-tightness of the shell seals.

- Every fifteen transports (or every three years):

  - replace the O-rings gaskets,
  - carry out detailed inspection of threads,
  - inspect closure system,
  - leak-tightness tests of the closure system (criterion: 0.5 lusec SLR)

- Every forty transports (or every six years):

  - neutron check to ensure that the neutron shielding is still effective,
  - overload test on handling points (angled bars on top of the cage),
  - leak-tightness check of the containment shell (closure system and body (criterion: 0.5 lusec SLR)).

4. NOTIFICATION and REGISTRATION OF SERIAL NUMBERS

Should a packaging be disposed of a change ownership, this must be notified to the competent authorities. Accordingly, the party relinquishing ownership of a packaging shall forward the name of the new owner.

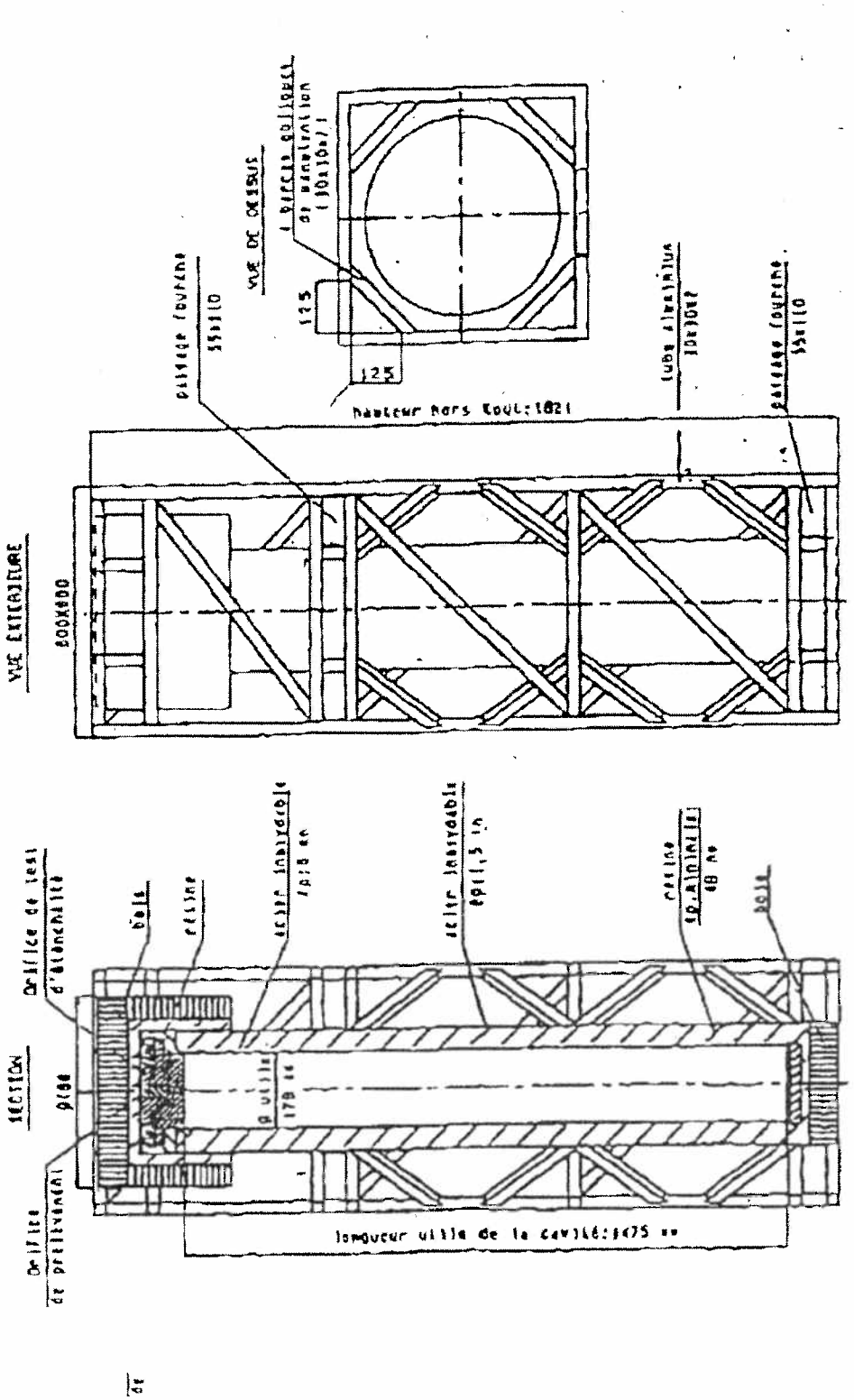
5. QUALITY INSURANCE

The principles of the quality assurance to apply during the design, the fabrication, the inspection, the tests, the handling and the use of the package must be in compliance with those described in Chapter 12 of the Safety Analysis Report.

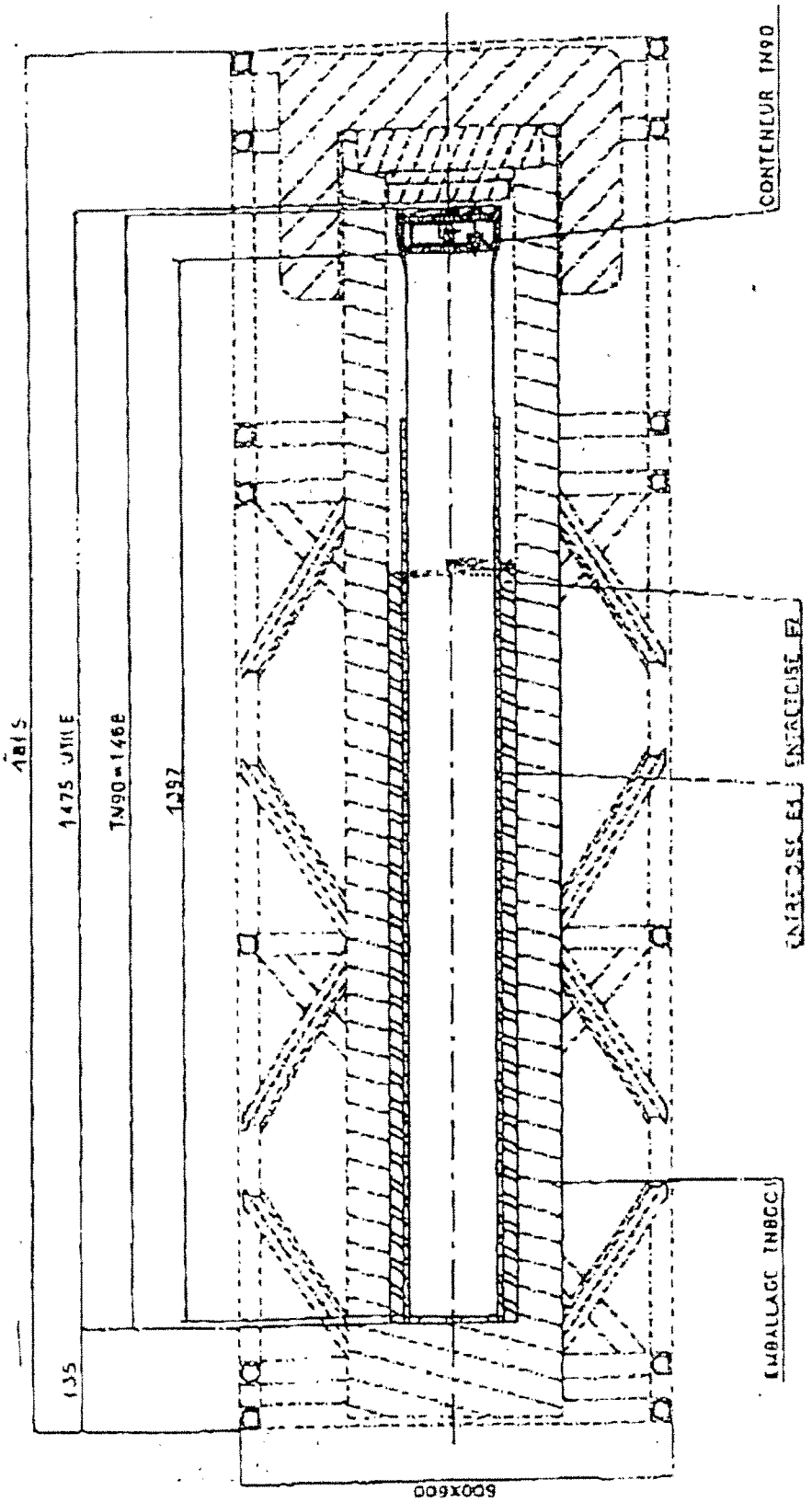
6. COMPLEMENTARY PRESCRIPTION IN CASE OF CONFINED TRANSPORT

The transport in confinement is authorized.

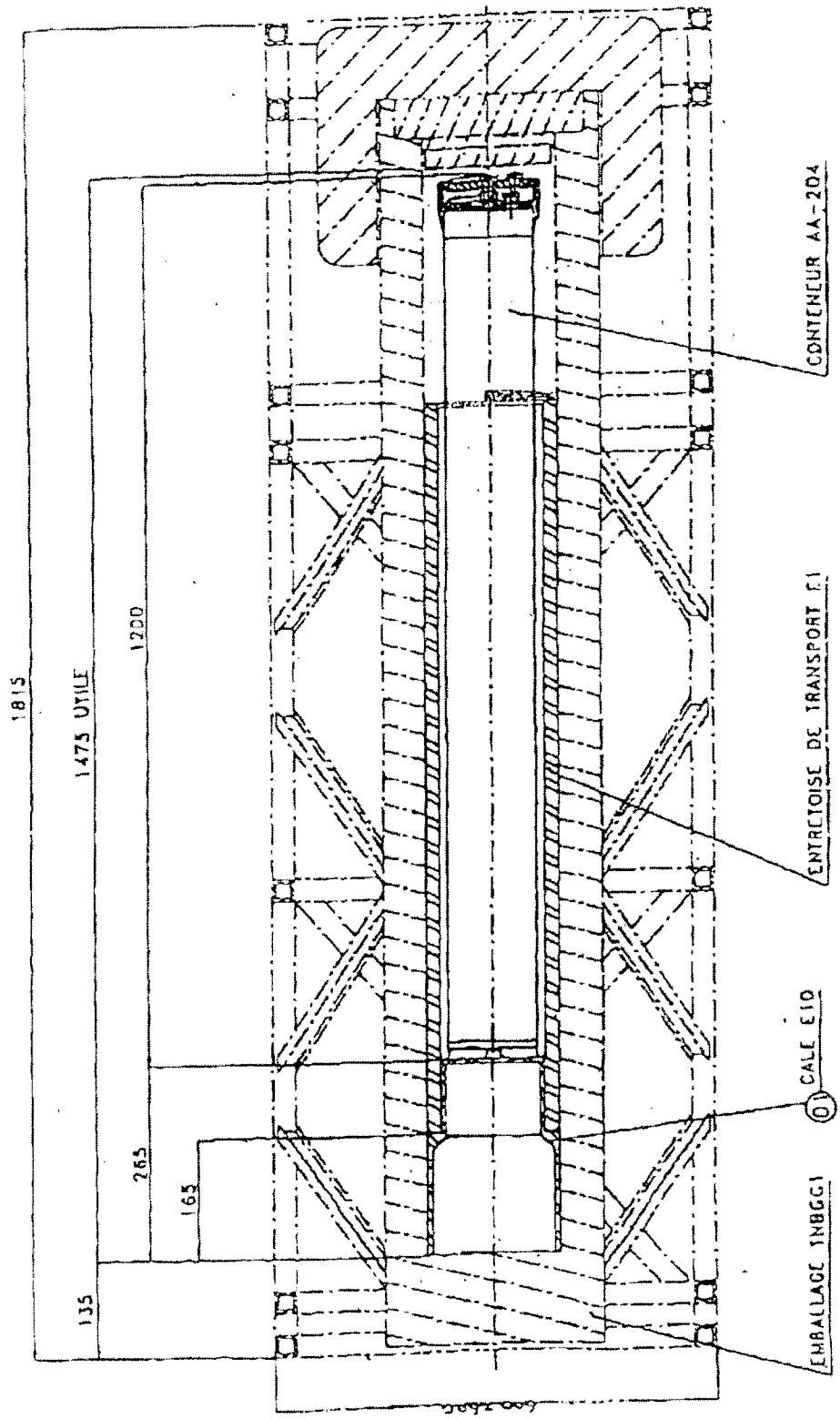
DRAWING OF THE TN-BGC1 PACKAGING



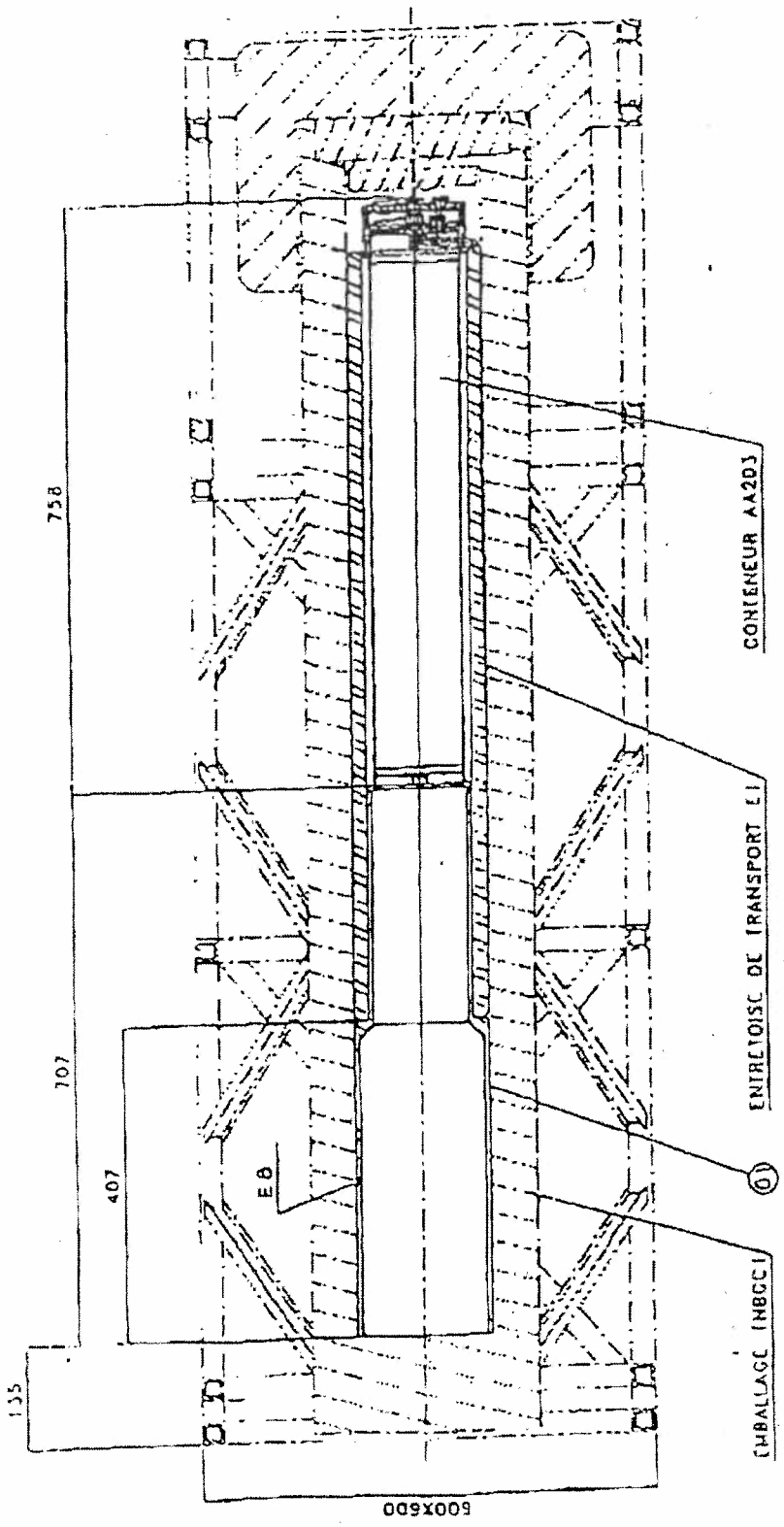
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH INTERNAL ARRANGEMENT TN 90



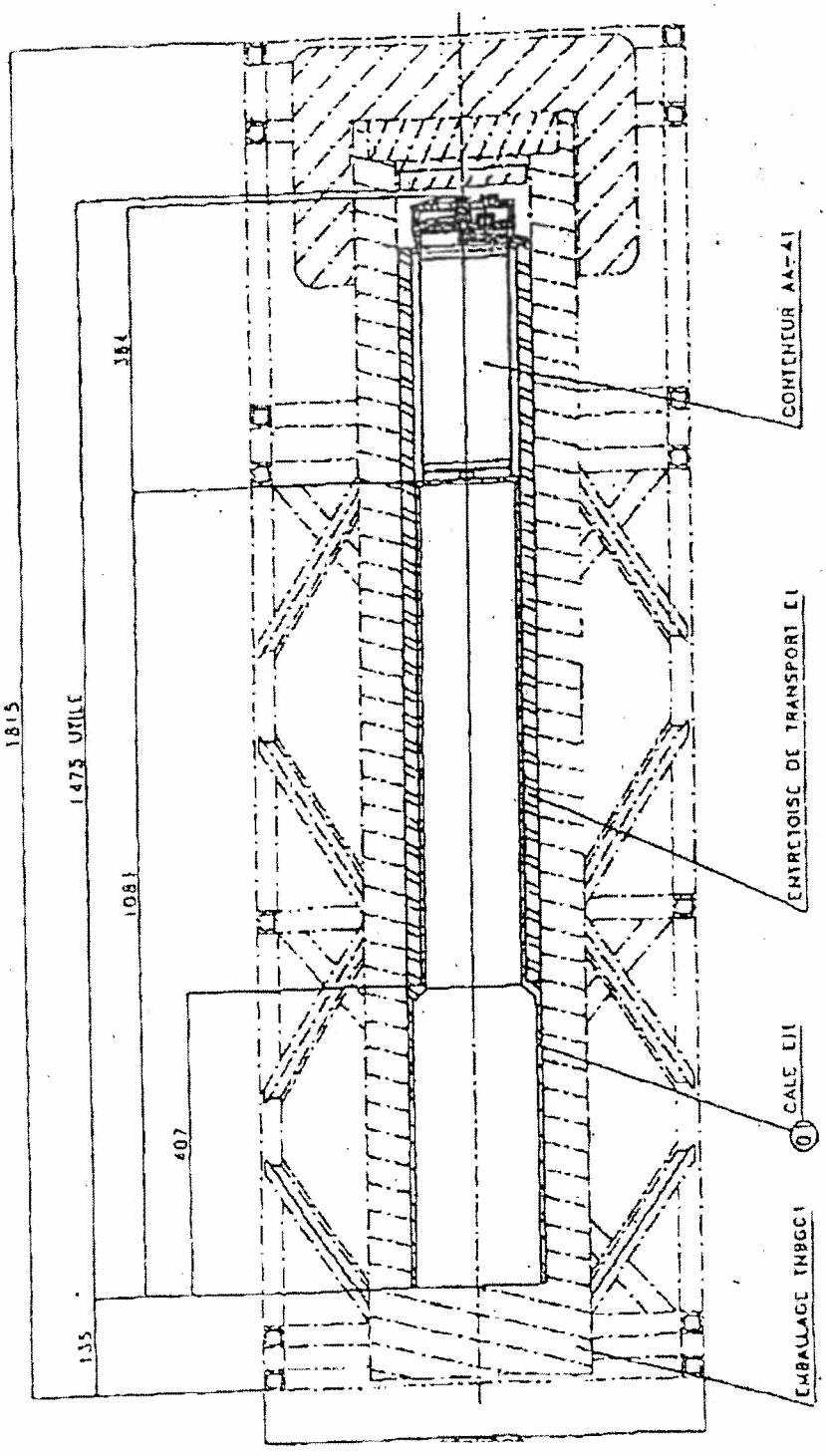
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH INTERNAL ARRANGEMENT AA204



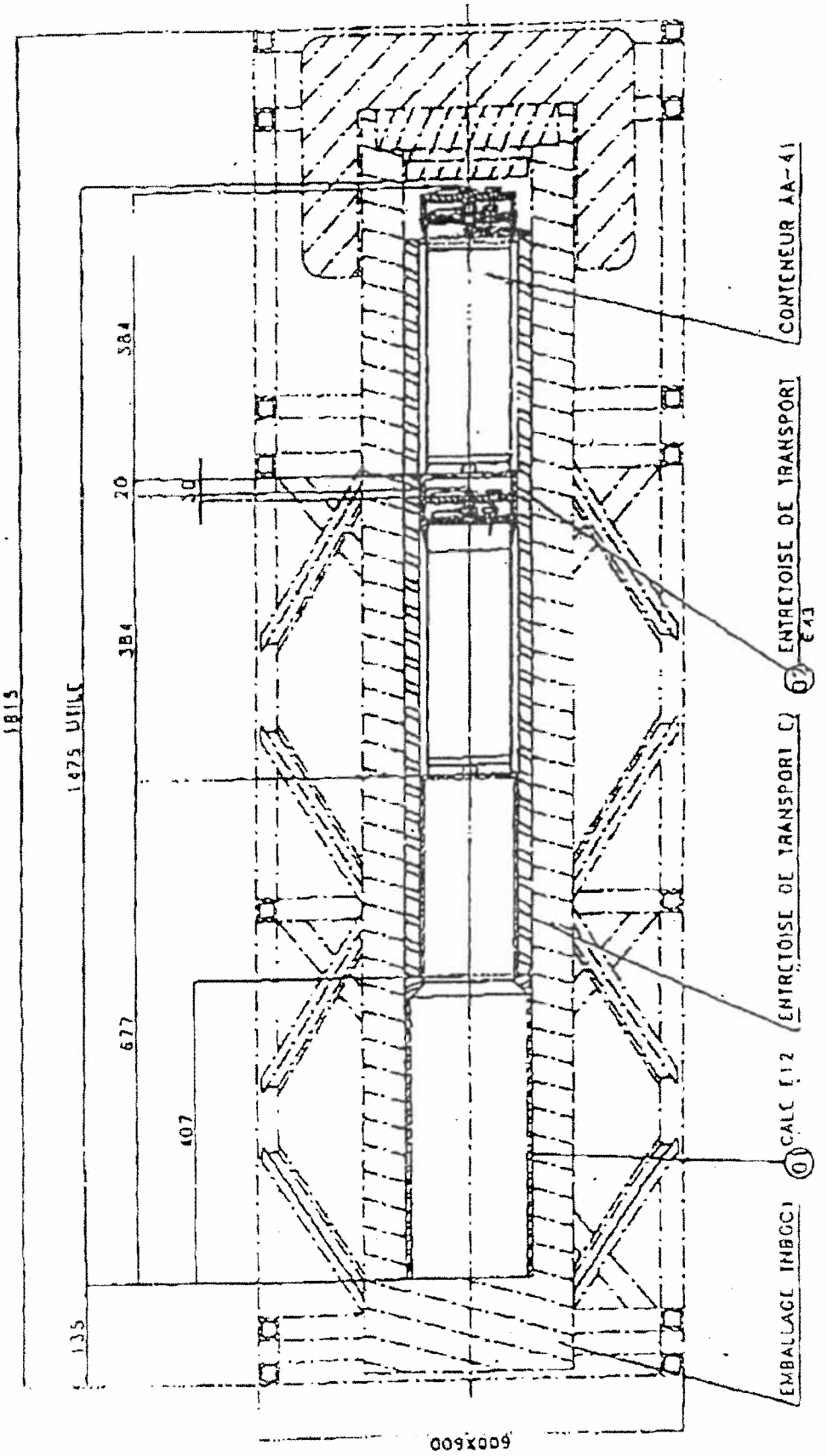
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH INTERNAL ARRANGEMENT AA203



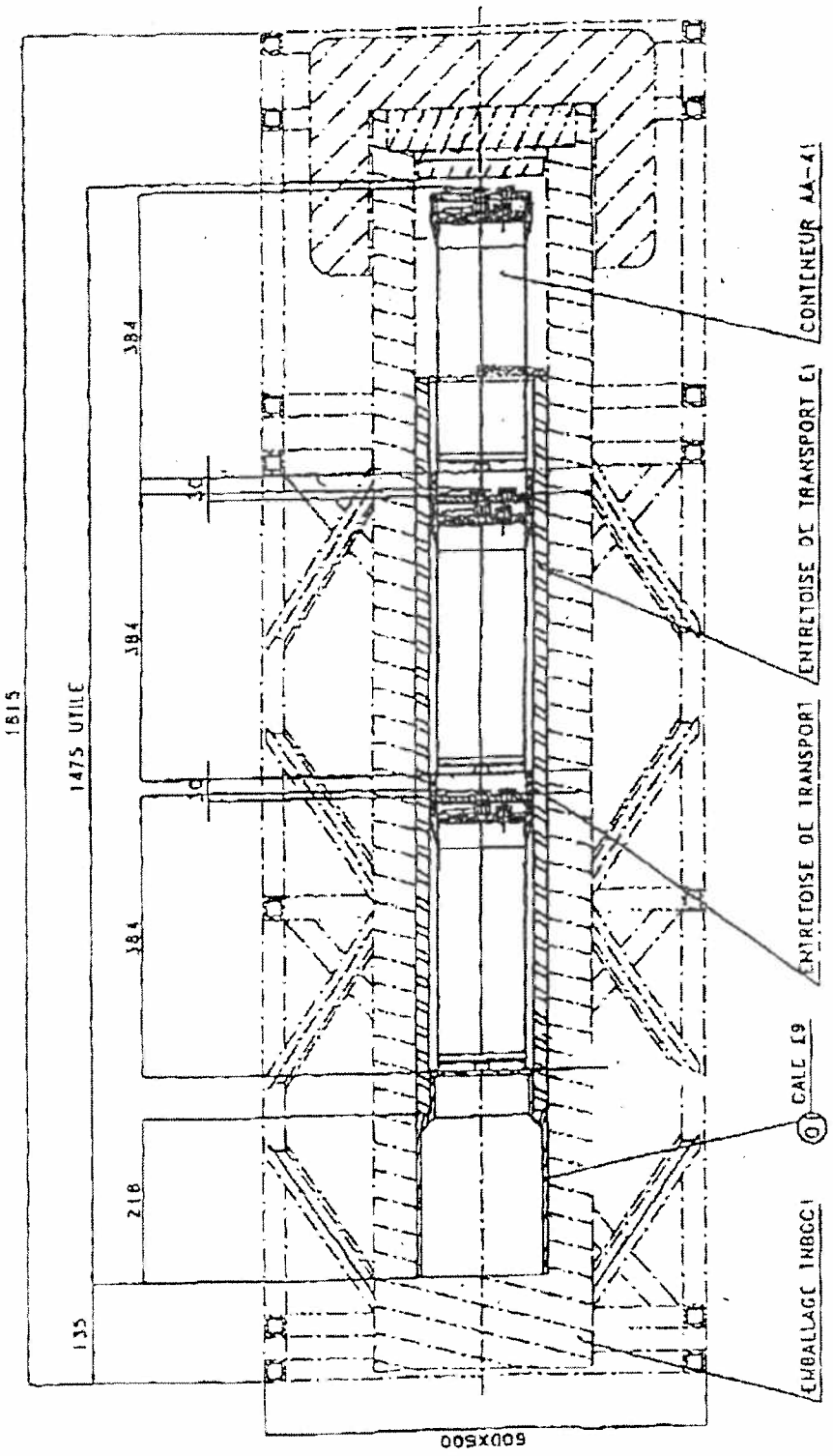
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH INTERNAL ARRANGEMENT AA41



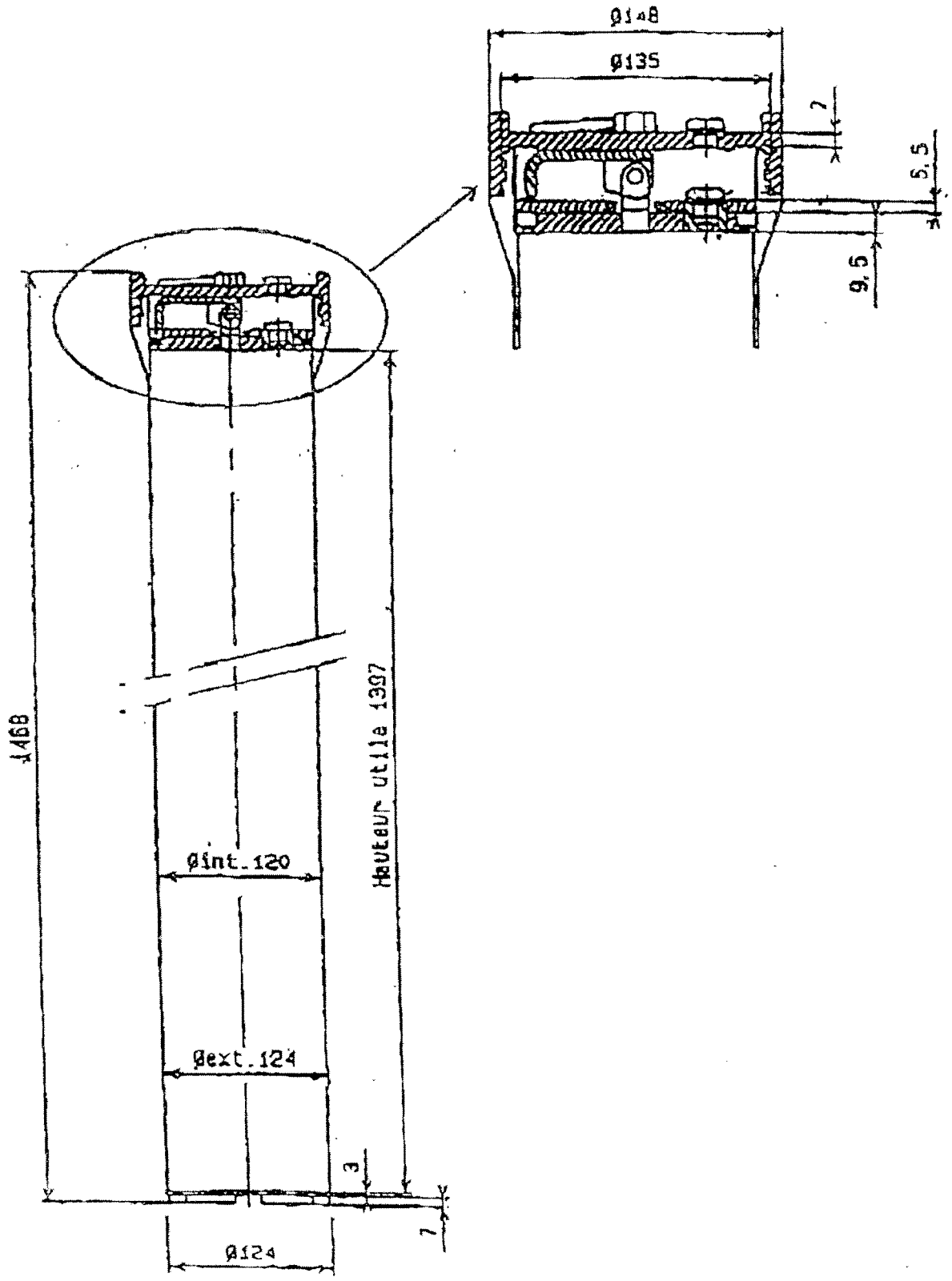
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH TWO INTERNAL ARRANGEMENTS AA41



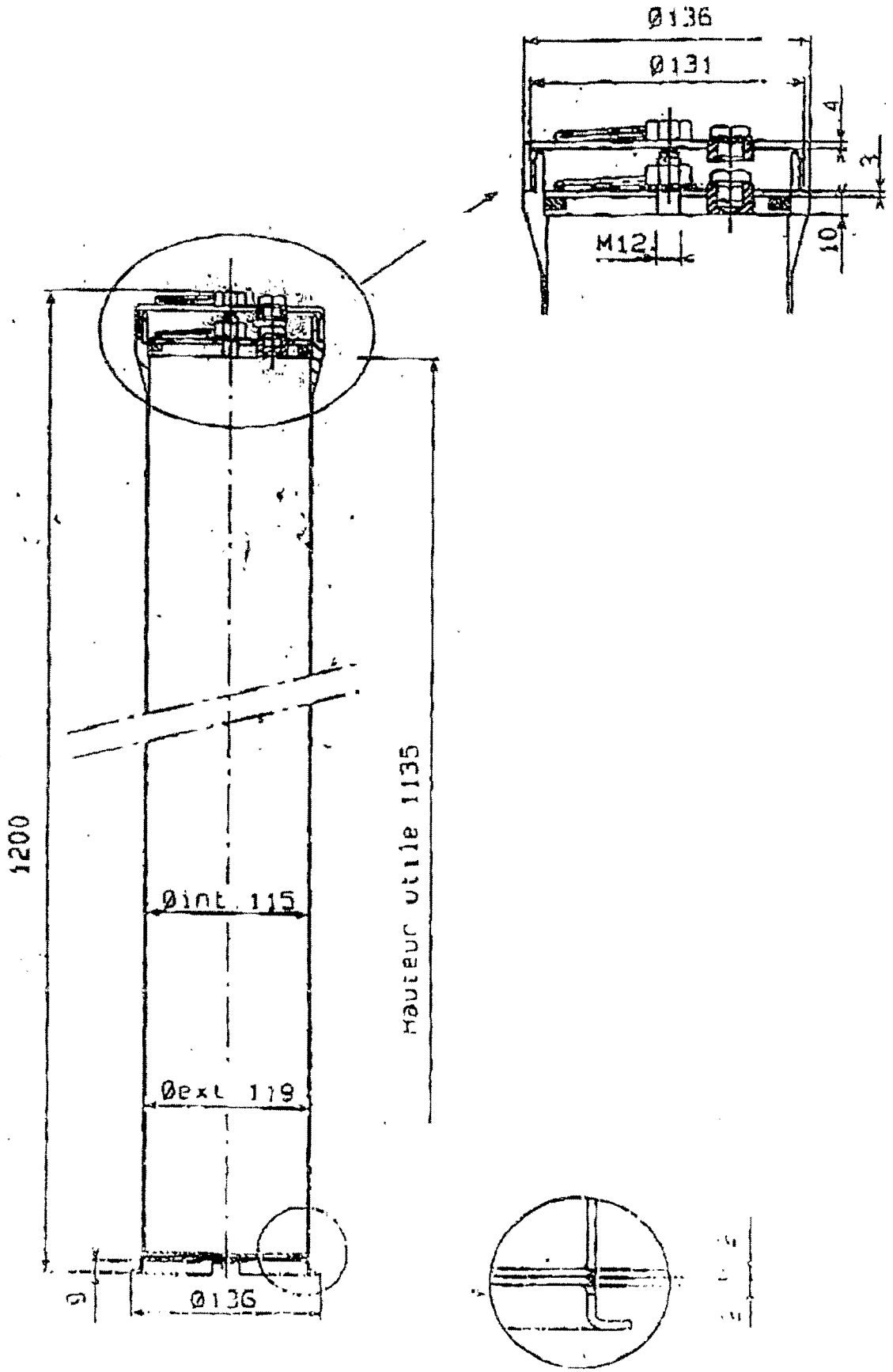
DRAWING OF THE TN-BGC1 PACKAGING LOADED WITH THREE INTERNAL ARRANGEMENTS AA41



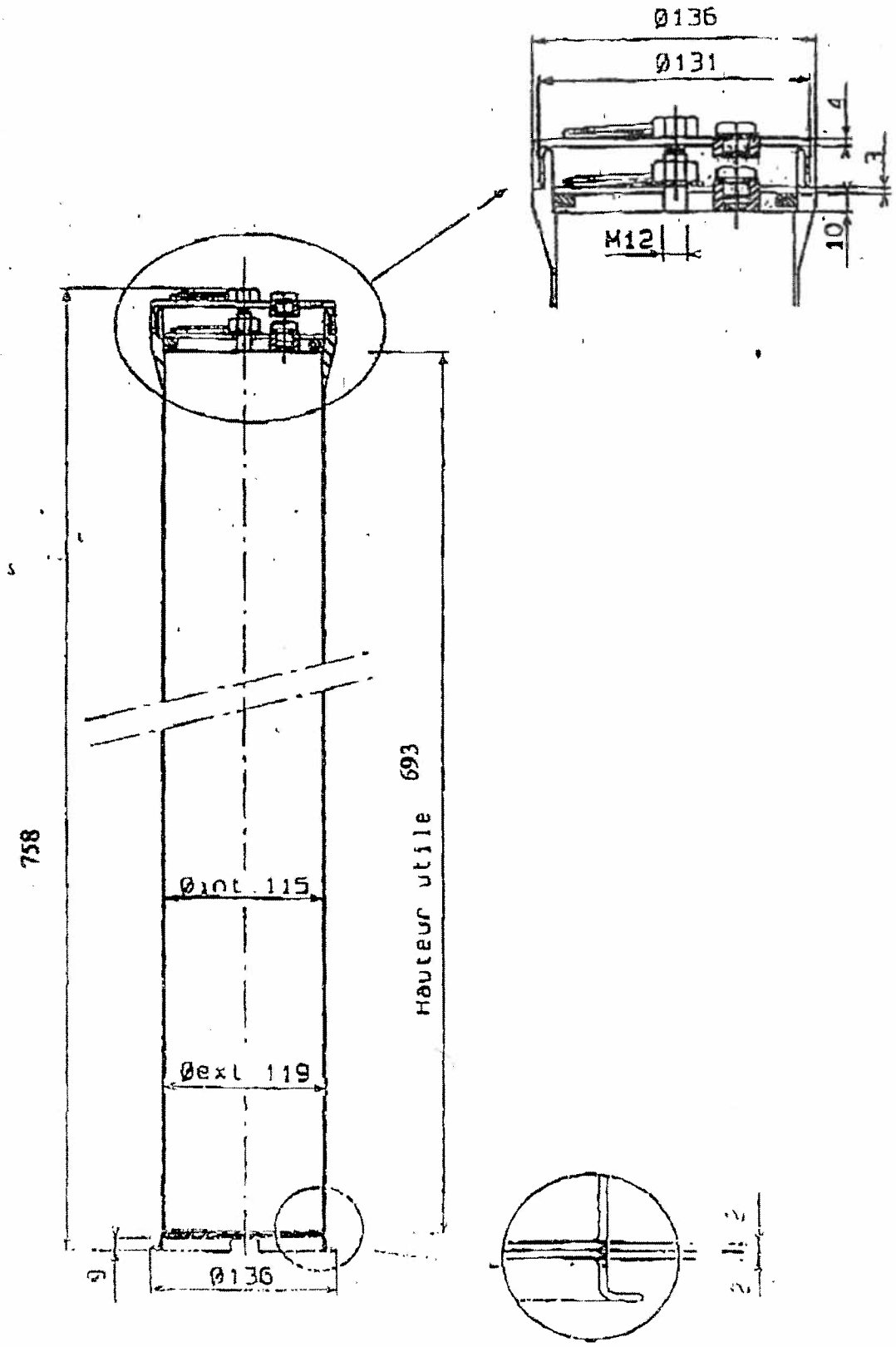
DRAWING OF THE INTERNAL ARRANGEMENT TN-90



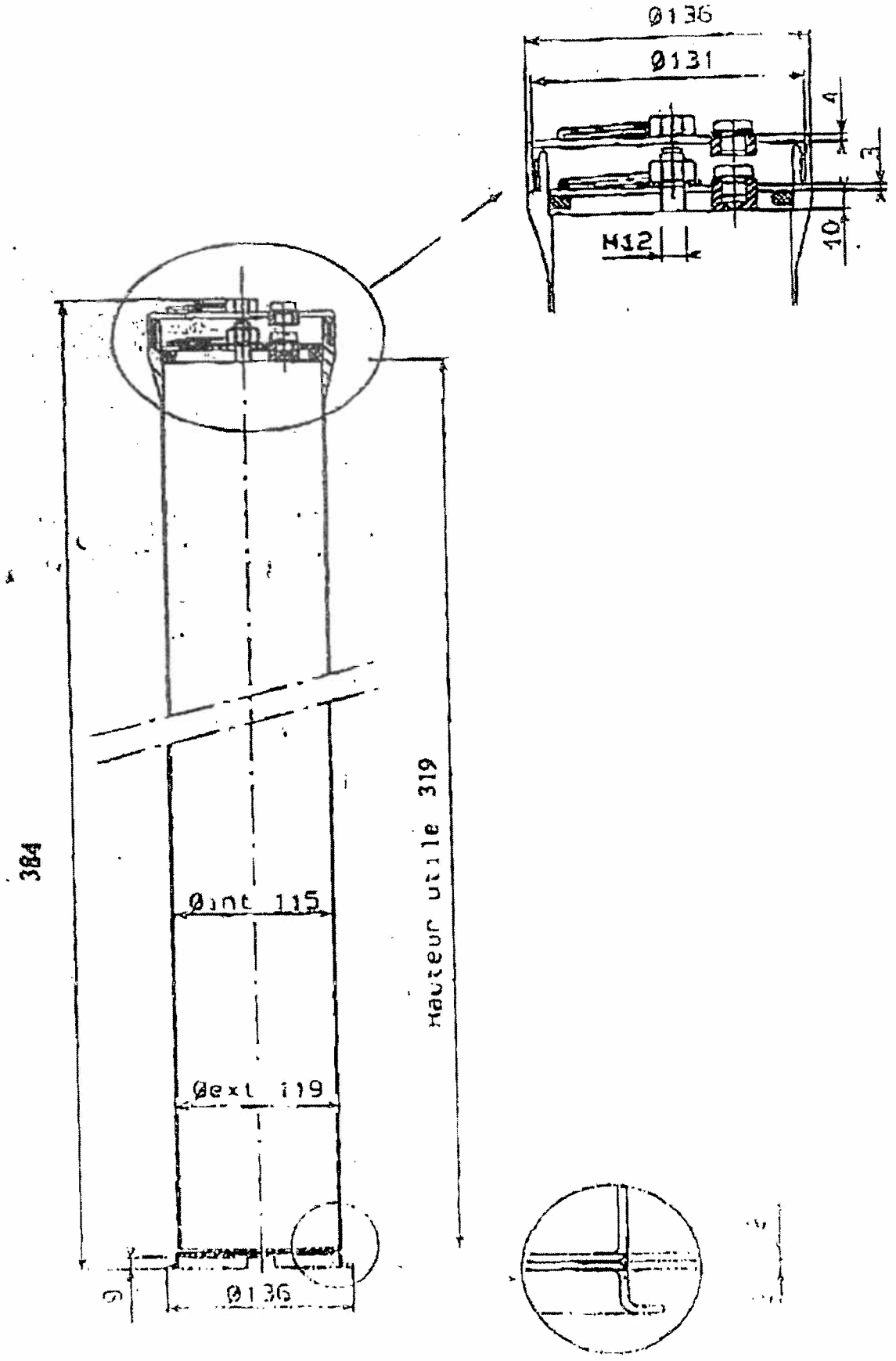
DRAWING OF THE INTERNAL ARRANGEMENT AA204



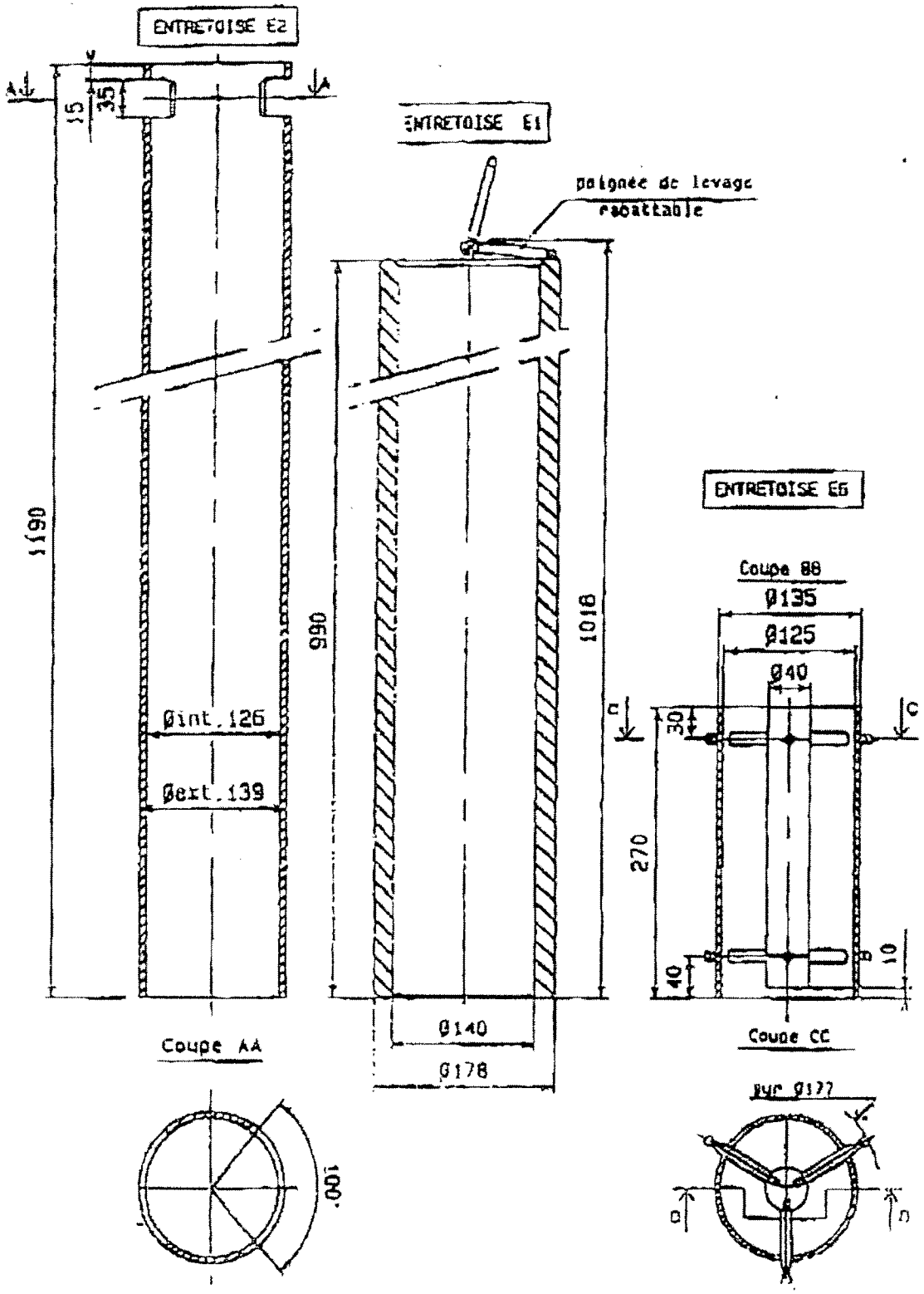
DRAWING OF THE INTERNAL ARRANGEMENT AA203



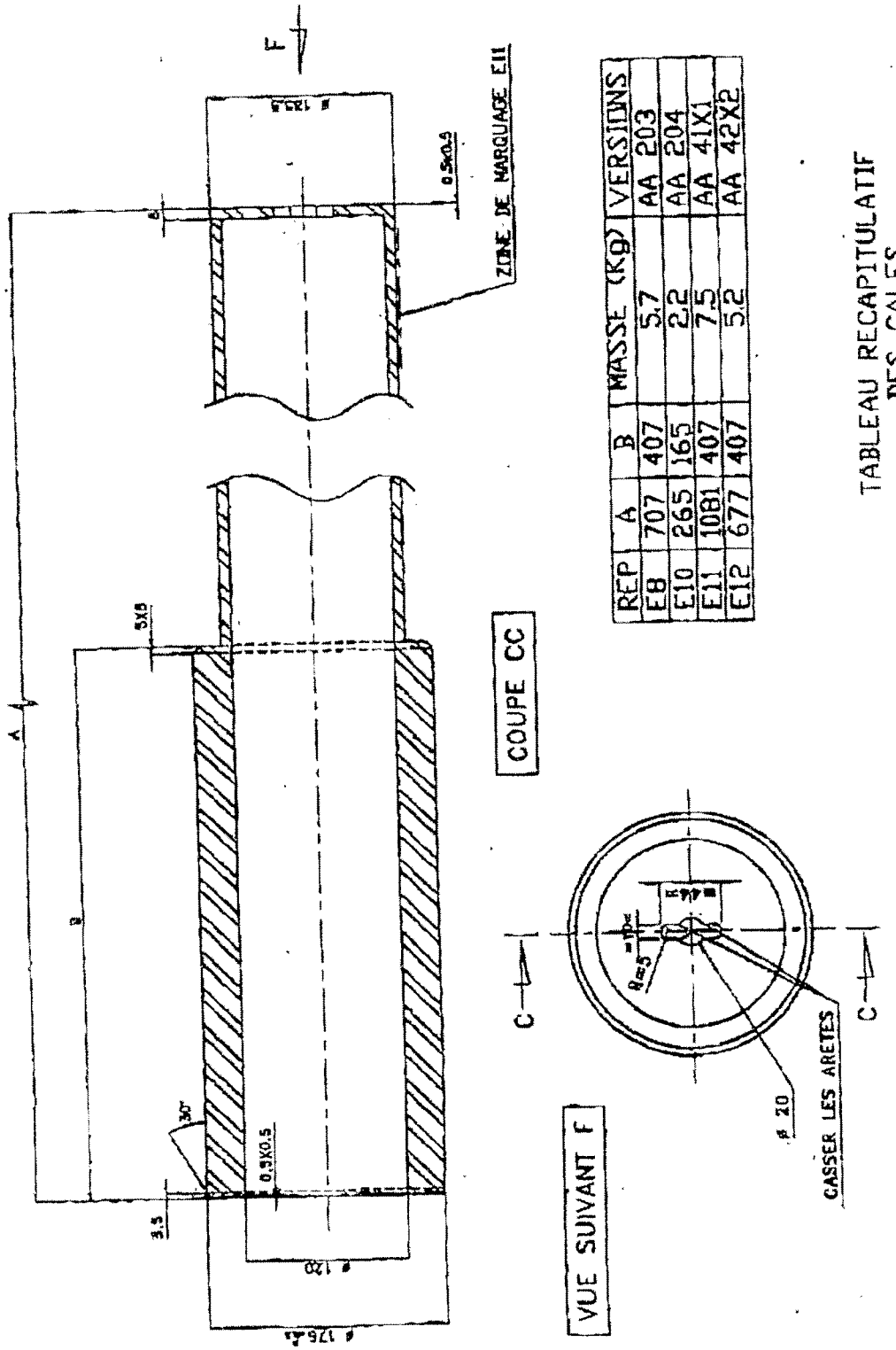
DRAWING OF THE INTERNAL ARRANGEMENT AA41



DRAWING OF THE SPACERS E1, E2, E6

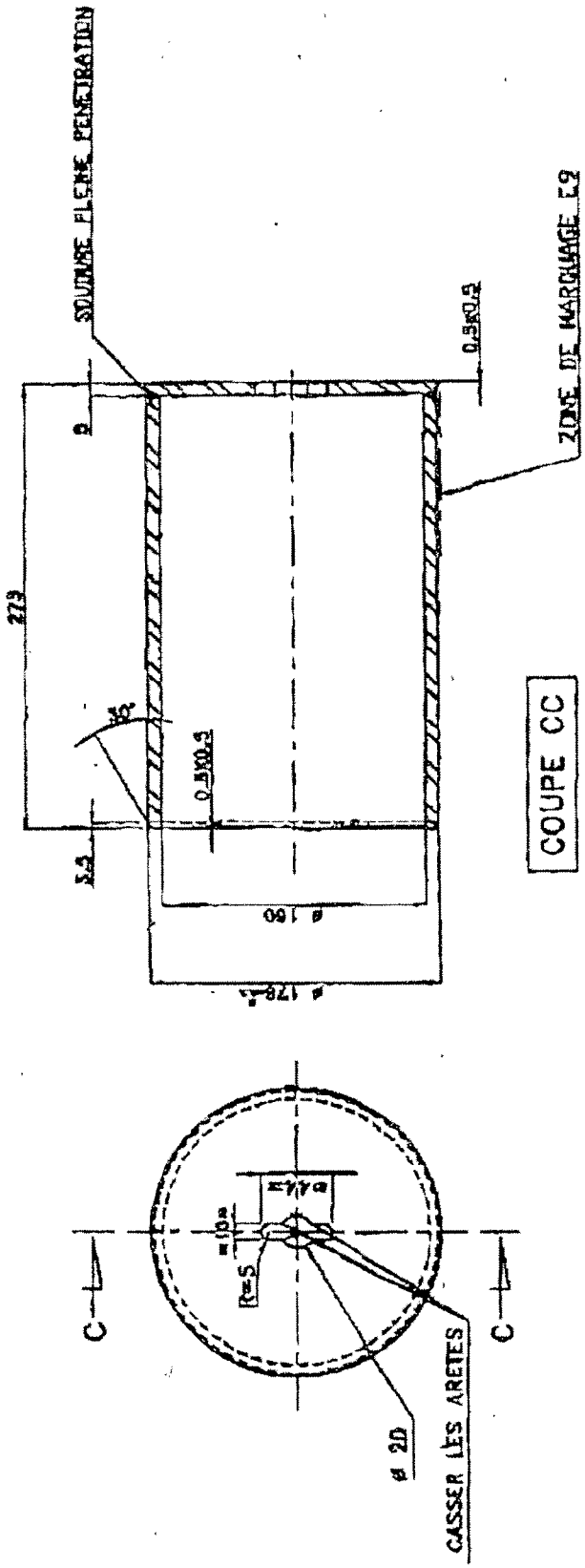


DRAWING OF THE SPACERS E8, E10, E11, E12

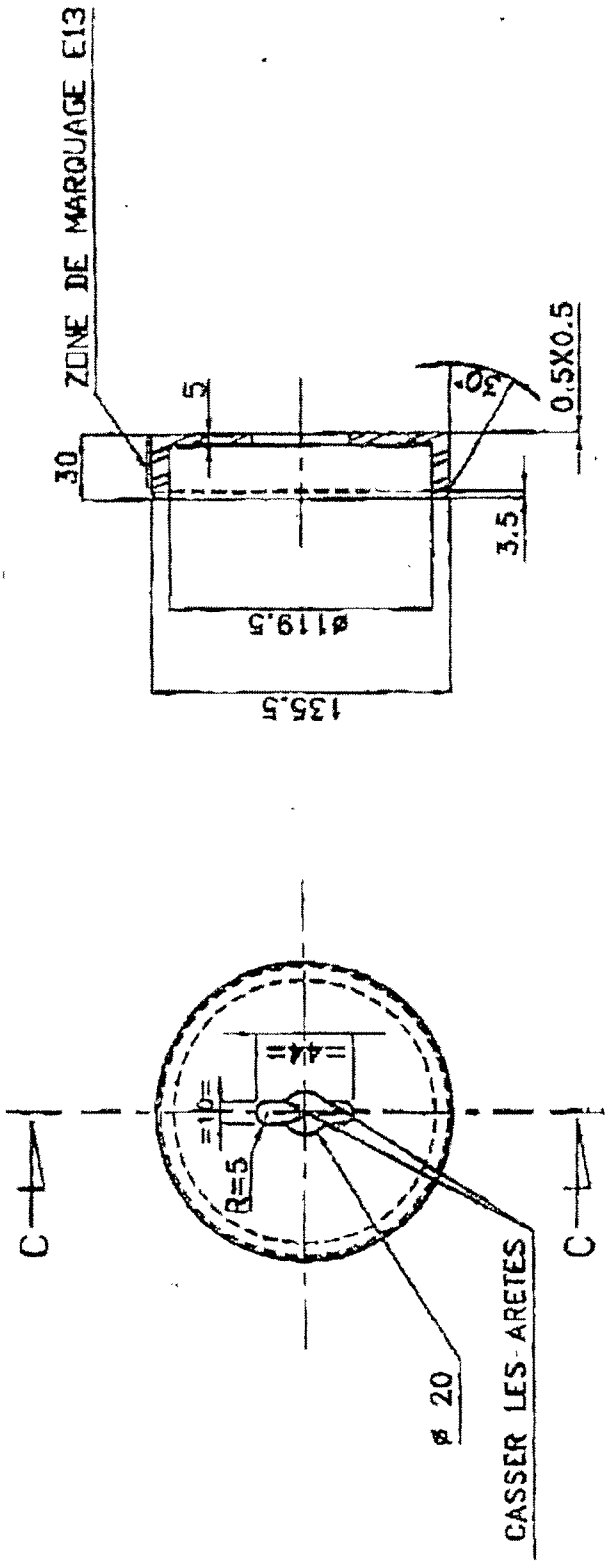


REP	A	B	MASSE (Kg)	VERSIONS
E8	707	407	5,7	AA 203
E10	265	165	2,2	AA 204
E11	1081	407	7,5	AA 41X1
E12	677	407	5,2	AA 42X2

DRAWING OF THE SPACER E9



DRAWING OF THE SEPARATION SPACER E13 FOR AA41



APPENDIX 11

CONTENT N°11

SOLID URANIUM-BEARING MATERIALS

1. DESCRIPTION

Maximum quantity and composition

The enrichment of U^{235} is indifferent, but the presence of only one kind of uranium-bearing per package is authorized (only one isotopic composition).

- For Air transportation :

  The maximum allowable mass of ^{235}U by TN-BGC1 packaging is 7 kg.

- For any transport, other than by air:

  The maximum quantity transported by TN-BGC1 packaging is function of the guaranteed confinement diameter, summed up in the table below:

TYPE OF MATERIALS	GUARANTEED CONFINEMENT DIAMETER (mm)	MAXIMUM TRANSPORTED QUANTITY (kg)
Uranium (any physical/chemical form)	$100 < \phi \leq 120$ $60 < \phi \leq 100$ $\phi \leq 60$	Mass of $^{235}U \leq 7$ Mass of $^{235}U \leq 15$ Any mass of ^{235}U(1)

In case, the presence of an only one isotopic composition can not be guaranteed by package, mass limitations are as follows:

- If the enrichment of Uranium is more than 20 %, the Uranium maximum mass transportable is 7 kg.
- If the enrichment of Uranium of each type of Uranium-bearing is less or equal to 20 %, the Uranium maximum mass transportable is 40 kg.

Physical form
Material can be of any solid form.

Chemical form
Material shall be exclusively of one of the following chemical forms :
- metallic uranium,
- uranium oxide : UO_2, UO_3, U_3O_8,
- alloys of uranium containing one or several of the following metals : aluminium (Al), molybdenum (Mo), silicon (Si),
- uranium nitride : UN, U_2N_3, UN_2,
- uranium carbide : UC, UC_2 and U_2C_3.

Special form
The material is not under special form.

Activity
The activity of the content must be such that, given the nature and energy of the emitted radiation, the regulatory dose rate limits around the package are not exceeded.

Besides, for a transportation by air, this activity should be such that the number of A_2 of the content is less than 3 000, given the isotopic composition of the content.

2. INTERNAL ARRANGEMENTS

The conditioning of the fissile material and the internal arrangements must not contain plastic materials (polyethylene, ...) which concentration in hydrogen is higher than the water one.

The secondary conditioning containers which can be used must be of type TN 90, AA 204, AA 203 or AA 41. They are shown on appendix 0 (drawings pages 12 to 15).

In case, the required diameter is strictly less than 120 mm, the positioning and the radial wedging inside the conditioning container TN 90 will be provided by an E7-type (primary conditioning) brace-spacer represented in the hereafter drawing.

The uranium metallic powders are placed in boxes (primary conditioning) ; these boxes are placed in a container of secondary conditioning.

The following spacers (shown on diagrams pages 16 to 19 in appendix 0) must be used to block the container in the packaging cavity.

- with TN 90	:	spacer E1 + spacer E2,
- with AA 203	:	spacer E1 + spacer E8,
- with AA 204	:	spacer E1 + spacer E10,
- with 1 AA 41	:	spacer E1 + spacer E11,
- with 2 AA 41	:	spacer E1 + spacer E12 + spacer E13,
- with 3 AA 41	:	spacer E1 + spacer E9 + 2 spacers E13,

The total mass of the loading of the TN 90 internal container shall not exceed 60 kg.

The total maximum mass of the loading inside the packaging cavity of the TN-BGC1 (spacers + containers + loaded material) is equal to 116 kg.

3. SAFETY ANALYSIS REPORT

The Safety Analysis Report justifying this content is the Report EMB TNBGC PBC DS-CA000001B of August 20, 2003, completed with the note EMB TNBGC PBC NTT CA000481A of January 5, 2004.

The ambient conditions admitted for the purpose of the study of the model design are those precised by the regulation.

4. CRITICALITY STUDY

This is described in Chapter 9 of the Safety Analysis Report and its Appendix 2 and 7 and the note EMB TNBGC PBC NTT CA000481A of January 5, 2004.

It accepts the presence of hydrogenated materials and/or penetration of water into all free spaces within the packaging, including inside the containment vessel.

Criticality Safety Index : CSI = 1 (number "N": 50)

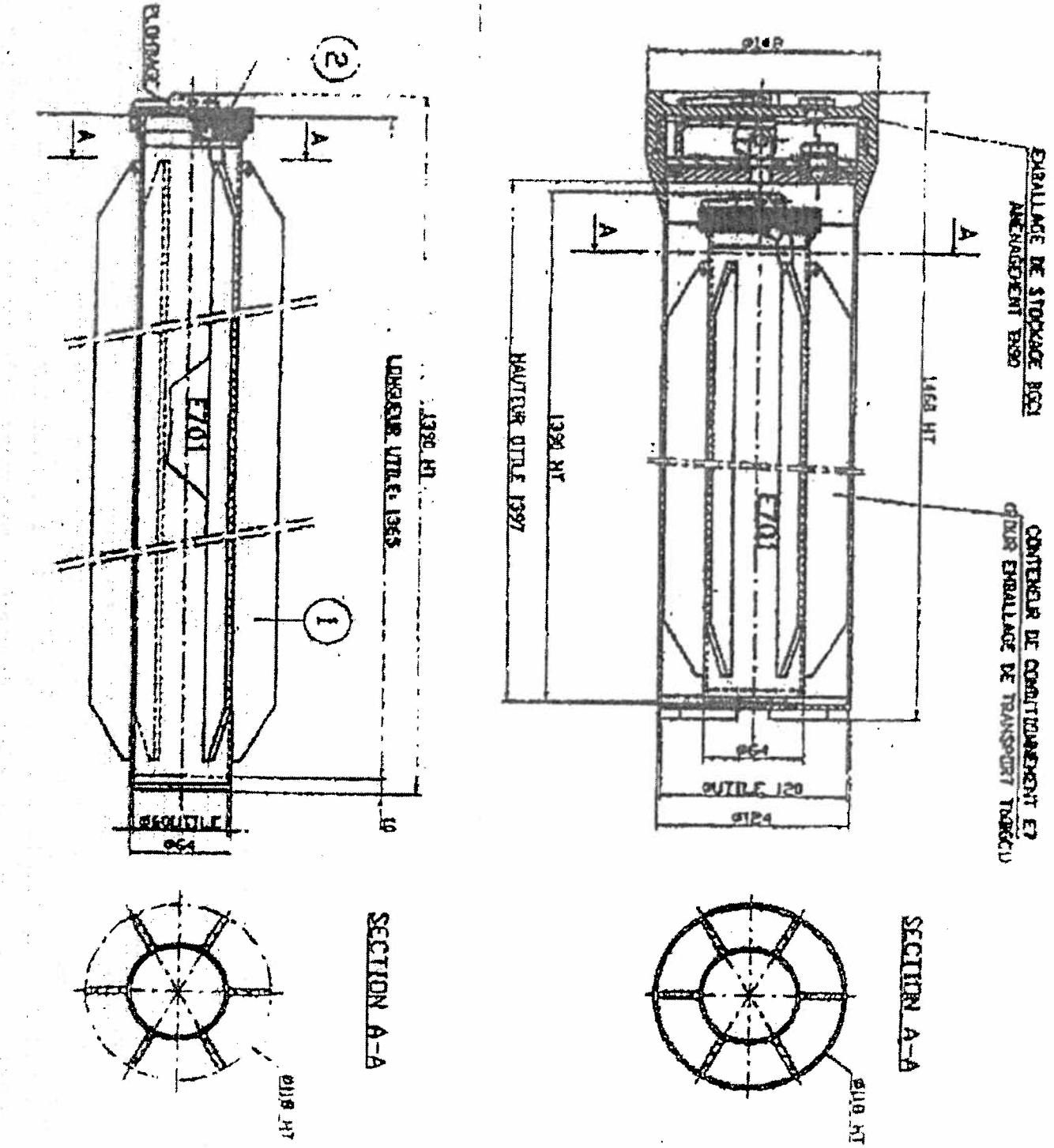
5. SPECIAL INSTRUCTIONS TO BE FOLLOWED FOR USE OF THE PACKAGING

When material is of metallic form, special attention should be paid to the surface finish of the material at the time of its loading into the packaging. This surface must present neither scratches nor hydride traces.

In case metallic powders are transported, it is necessary to do an 1 bar absolute inertage of the conditioning boxes of the powder, of the secondary conditioning container used and of the TN-BGC1 cavity, as well as a leak-test of the secondary conditioning container (leak rate less than 0,1 lusec).

DRAWING OF THE INTERNAL ARRANGEMENT OF E7 TYPE

AND CONDITIONING OF URANIUM-BEARING MATERIALS



APPENDIX 26

CONTENT N°26

NON IRRADIATED TRIGA FUEL

1. DESCRIPTION

The authorized content is composed of bars of non irradiated TRIGA fuel elements.

These bars are made of U-ZrH_x (with x comprised between 0 and 2) ; they are of cylindrical form and of two types, standard or thin, with the following geometrical characteristics:

- standard: diameter = 3,63 cm ; length = 12,7 cm ;
- thin: diameter = 1,29 cm ; length = 18,6 cm.

Standard bars are pierced in their centre before hydruration, the diameter of the hole is: 6,35 mm.

The mass content in U total varies between 8 and 47 % according to the element type:

TYPE	U (% mass)	ZrHx (% mass)	U-Zr (g/cm^3)	U-ZrH_2 (g/cm^3)
Composition of standard TRIGA fuels				
103	8	92	6,9	6,04
105	12	88	7,1	6,22
107	12	88	7,1	6,22
117	21	79	7,4	6,64
119	31	69	8,1	7,24
Composition of thin TRIGA fuels				
424	47	53	9,3	8,40

The Uranium does not come from reprocessing,

The maximum enrichment in Uranium 235 is: 20 %.

The drawing of TRIGA fuel elements, standard or thin, figures in page 4.

Maximum transportable quantities:

- For a transportation by Air: the maximum mass of transported Uranium by TN-BGC1 package depends on the element type, according to the table below:

TYPE	Maximum mass of U (kg)
103	1,1
105	1,7
107	1,7
117	3,3
119	5,3
424	6,6

- For any transport, other than by air: the maximum mass of transported Uranium by TN-BGC1 package depends on the element type, according to the table below, in the limit, however, of the respect of the maximum mass, indicated in paragraph 2, of the loading of internal arranging and of the package:

TYPE	Maximum mass of U (kg)
103	9
105	14
107	14
117	27
119	43
424	76

Special form
The material is not under special form.

Activity
The activity of the content must be such that, given the nature and energy of the emitted radiation, the regulatory dose rate limits around the package are not exceeded.

2. INTERNAL ARRANGEMENTS

The conditioning of the fissile material and the internal arrangements must not contain plastic materials (polyethylene, ...) which concentration in hydrogen is higher than the water one.

TRIGA bars are placed in cases of cardboard protection; these cases are placed in a secondary conditioning container.

The secondary conditioning containers which can be used, are necessarily of type TN 90, AA 204, AA 203 or AA 41. They are shown on appendix 0 (drawings pages 12 to 15).

A primary conditioning container of E7 type (represented on the drawing hereafter) can be used with the TN 90 for a conditioning of a uranium-bearing.

The following spacers (shown on diagrams pages 16 to 19 in appendix 0) must be used to block the container in the packaging cavity.

- with TN 90	:	spacer E1 + spacer E2,
- with AA 203	:	spacer E1 + spacer E8,
- with AA 204	:	spacer E1 + spacer E10,
- with 1 AA 41	:	spacer E1 + spacer E11,
- with 2 AA 41	:	spacer E1 + spacer E12 + spacer E13,
- with 3 AA 41	:	spacer E1 + spacer E9 + 2 spacers E13,

The total mass of the loading of the TN 90 internal container shall not exceed 60 kg.

The total maximum mass of the loading inside the packaging cavity of the TN-BGC1 (spacers + containers + loaded material) is equal to 116 kg.

3. SAFETY ANALYSIS REPORT

The Safety Analysis Report justifying this content is the Report EMB TNBGC PBC DS-CA000001B of August 20, 2003.

The ambient conditions admitted for the purpose of the study of the model design are those precised by the regulation.

4. CRITICALITY STUDY

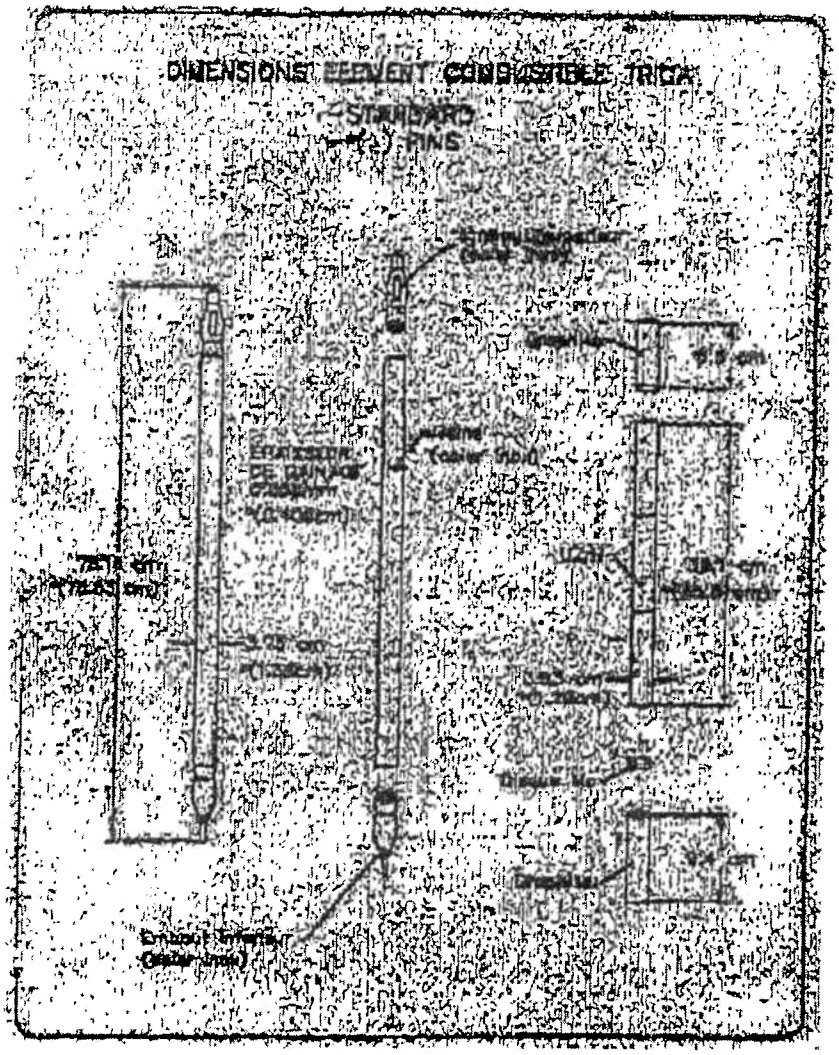
It is the subject of Chapter 9 of the Safety Analysis Report and its Appendix 6.

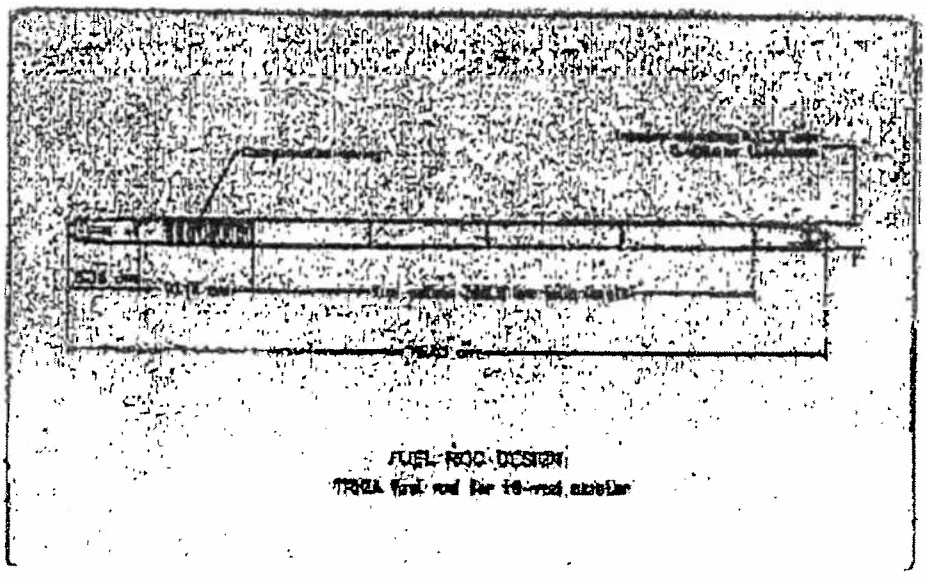
It accepts the presence of hydrogenated materials and/or penetration of water into all free spaces within the packaging, including inside the containment vessel.

However, the study, in the above-mentioned Appendix 6 related to the transportation by air (paragraph 680 of the TS-R-1) which takes into account the isolated package and considerates it in a state at least as penalizing as the one which would be noticed at the issue of the tests applicable for packages of type C, is only acceptable if, in normal and accidental conditions of transport, the mass of water present in the fissile material, regardless of the mass contained in hydrogenated materials of the package, is less than 1 200 g or 1 950 g depending on whether it concerns standard or thin elements.

Criticality Safety Index: CSI = 0 (number "N": infinite)

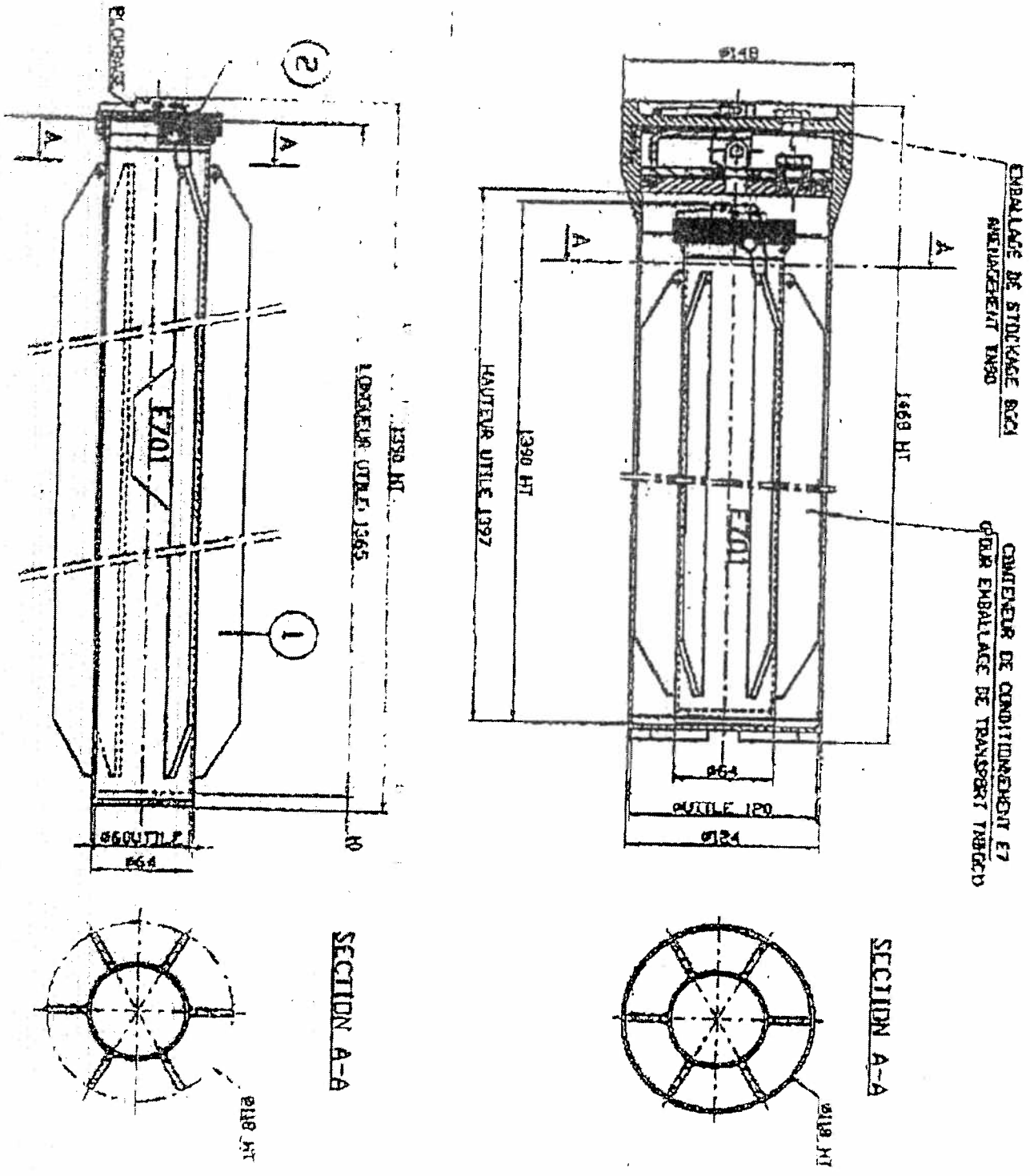
DRAWING OF TRIGA ELEMENTS





DRAWING OF THE INTERNAL ARRANGEMENT OF E7 TYPE

AND CONDITIONING OF URANIUM-BEARING MATERIALS



U.S. Department
of Transportation

**Pipeline and
Hazardous Materials
Safety Administration**

**East Building, PHH-23
1200 New Jersey Avenue SE
Washington, D.C. 20590**

CERTIFICATE NUMBER: USA/0492/B(U)F-96, Revision 10

ORIGINAL REGISTRANT(S):

Mr. Blake Williams
Director, Spent Fuel Services
Edlow International Company
460 Silverberry Lane
Sugar Hill, 32518
USA

Mr. Kinion Proctor
Transportation Manager
Edlow International Company
1666 Connecticut Ave, N.W.
Suite 201
Washington, 20009
USA

Mr. Mark Campbell
Edlow International Company
3901 Castle Hayne Rd.
M/C K01
Wilmington, 28402
USA

Ms. Marilena Conde
Vice President, Marketing and Administration
Edlow International Company
1666 Connecticut Ave, N.W
Suite 201
Washington, 20009
USA

REGISTERED USER(S):

Mr. Rick Migliore
Packaging Technology, Inc.
1102 Broadway Plaza
Suite 300
Tacoma, 98402
USA

Mr. Mark A. Gilbertson
Department of Energy
Washington, 20585
USA

Mr. Darren Condrey
Transport Logistics International
Transport Logistics International
4000 Blackburn Lane
Suite 250
Burtonsville, 20866
USA

Mr. Mark Lambert
Transport Logistics International
Transport Logistics International
4000 Blackburn Lane
Suite 250
Burtonsville, 20866
USA

Richard Montgomery
Nuclear Criticality Safety & Shipping Containers
Areva
1724 Mount Athos Road
P.O. Box 11646
Lynchburg, VA 24506-1646

Mr. Julio Raffo
Director of Transport Operations
Areva
7135 Minstrel Way
Suite 300
Columbia, 21045
USA

Mr. Fred Yapuncich
Packaging Technology, Inc.
1102 Broadway Plaza
Suite 300
Tacoma, 98402-3526
USA

Dr. James M. Shuler
Manager, Packaging Certification Program
Department of Energy
U.S. Department of Energy
1000 Independence Ave, SW
EM-60
Washington, DC 20585

B. Marie Moore
Vice President of Safety and Regulatory
Nuclear Fuel Services
P.O. Box 337, MS 123
Erwin, TN 37650

Mr. Rik Droke
Licensign and Compliance Director
Nuclear Fuel Services
P.O. Box 337, MS 123
Erwin, TN 37650

Ms. Betty Miller
Regulatory & Records Management
Nuclear Fuel Services
P.O. Box 337, MS 123
Erwin, TN 37650

Mr. Jim Davis
Areva
2101 Horn Rapids Road
Richland, WA 99352

Mr. Charlie Holman
Areva
P.O. Box 11646
Lynchburg, VA 24506-1646

Dae Chung
Department of Energy
1000 Independence Ave
Washington, DC 20585