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

East Building, PHH-23
1200 New Jersey Avenue Southeast
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 14

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

This certifies that the radioactive material package design described is hereby approved for use within the United States 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. Package Description and Authorized Radioactive Contents - as described in France Certificate of Competent Authority F/313/B(U)F-96, Iat (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(Iat), 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(Iat), Appendix 26, Content No. 26 (attached).

3. Criticality - The minimum criticality safety index is is 1.0 for Content No. 11 and 0 for Content No. 26. The maximum number of packages per conveyance is determined in accordance with Table X of the IAEA regulations cited in this certificate.

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.

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[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.

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 Content No. 11, the maximum fissile mass is not to exceed 5 kilograms U-235 per package. The mass of water and the equivalent mass of other hydrogenous materials must not exceed 2000 grams per package.

b. For 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 26at, 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.

c. Uranium metallic powder and uranium tetrafluoride (UF4) are prohibited under Content no. 11.

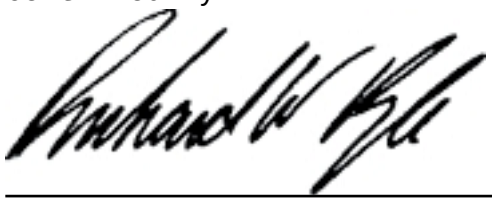
6. Marking and Labeling - The package shall bear the marking USA/0492/B(U)F-96 in addition to other required markings and labeling.

CERTIFICATE USA/0492/B(U)F-96, REVISION 14

7. Expiration Date - This certificate expires on August 31, 2013. On November 15, 2010, this certificate supersedes all previous revisions of USA/0492/B(U)F-96.

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 August 04, 2010 petition by Areva - TN International, Montigny Le Bretonneux, Saint-Quentin-en-Yvelines, France, and in consideration of other information on file in this Office.

Certified By:



Dr. Magdy El-Sibaie
Associate Administrator for Hazardous Materials Safety

Aug 10 2010
(DATE)

Revision 14 - Issued to correct typographical errors in Revision 13, to revalidate French Certificate of Competent Authority F/313/B(U)F-96, Revision Iat, restricted to contents 11 and 26 and subject to special conditions listed in paragraph 5 of this certificate.

General management for
Industrial and transportation activities

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

CERTIFICATE OF APPROVAL OF A PACKAGE DESIGN

The French Competent Authority,

further to the request made by the Commissariat à l'Energie Atomique (CEA) in the letterDPSN/SSR/2008/043/GB of March 10, 2008;

further to the Safety Analysis Report 160 EMBAL PFM DET 0800157 A of February 26, 2008,

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

- content n°2: non-irradiated uranium oxide powder (described in appendix 2 index at),
- content n°4: ingots of non-irradiated metallic uranium (described in appendix 4 index at),
- content n°7: pellets, section of rods or non irradiated uranium oxide rods (described in appendix 7 index at),
- content n°11: non irradiated uranium-bearing materials in any solid form (described in appendix 11 index at),
- content n°26: TRIGA fuel (described in appendix 26 index at),

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 in 2005) ;
- 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,
- Regulations concerning technical rules and common administrative procedures applicable to the commercial transportation by air (CE number 859/2008 called "EU-OPS-1").

However, only contents n°11 and n° 26 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.

This certificate cancel the certificate F/313/B(U)F-96 (Iak) from November 15th 2010.

The validity of this certificate expires on **August 31, 2013.**

Registration No. **CODEP-DIT-025360.**

PARIS, June 4TH 2010,

For the President of the ASN and by delegation,
The Assistant General Manager

Jean-Luc LACHAUME

SUMMARY OF THE CERTIFICATE ISSUES

Issued	Expires	Emission type and modifications	Type of certificate	Revision index d							
				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		Hae							
		Reserved		Had							
29/09/04	30/06/08	Extension	B(U)-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	--
10/11/06	30/06/08	Extension	B(M)F-96T	Hah	ah	ah	ah	--	ah	--	ah
24/07/07	30/06/08	Extension	B(U)F-96	Hai	--	--	--	--	--	--	--
		Reserved		Haj							
25/08/08	31/08/13	Prorogation	B(U)F-96	Iak	--	ak	--	ak	--	ak	--
25/08/03	31/08/13	Prorogation	B(M)F-96 T	Ial	al	al	--	--	--	--	al
		Reserved		Iam							
		Reserved		Ian							
12/02/09	31/08/13	Extension	B(M)F-96 T	Iao	ao	ao	ao	--	ao	--	--
10/04/09	31/08/13	Extension	B(M)F-96 T	Iap	ao	ao	ap	--	ap	--	--
04/11/09	31/08/13	Extension	B(M)F-96 T	Iaq	aq	aq	aq	--	aq	--	Aq
		Reserved		Iar							
28/04/10	31/08/13	Extension	B(M)F-96 T	Ias	as	--	--	--	--	--	--
04/06/10	31/08/13	Extension	B(M)F-96 T	Iat	--	at	--	at	--	at	--

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	32	39
Haa	--	aa	--	--	--	aa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	aa	--	--	--	--	--	
Hab	ab	--	ab	--	--	--	--	--	--	ab	--	--	--	--	ab	--	--	ab	--	--	--						
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Hae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ae	--	--	--	--	
Haf	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	af	af	af	--	
Hag	--	ag	--	--	--	ag	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ag	ag	ag	ag	ag	--	
Hah	ah	--	ah	--	--	--	--	--	ah	--	--	--	--	--	ah	--	--	ah	--	--	--	--	--	--	--	ah	
Hai	--	--	--	--	--	ai	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
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Iap	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Iaq	aq	--	aq	aq	aq	--	--	--	--	aq	--	--	aq	aq	aq	--	--	aq	--	--	--	--	--	--	--	--	
Iar																											
Ias	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	as
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APPENDIX 0

1. DESCRIPTION OF THE PACKAGING

The packaging has been designed, made, inspected, tested, maintained, and used conformed to the Safety Analysis Report 160 EMBAL PFM DET 0800157 A from the 26/02/08.

The packaging consists of a rectangular cage inside which is fastened a body of general cylindrical shape, fitted with a closure system and a cover, presented in drawing 0.1.

The following design drawings:

- 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 followings:

- 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 permissible weight of the packaging loaded for transportation is 396 kg; it weighs 280 kg when empty.

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 Cover

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.

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

-by a fork-lift truck which forks penetrate in the passages provided in the cage (2 position 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 by strapping over the cage.

1.6 Safety functions

The mains 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 silicon gaskets;
- the radiological protection is essentially ensured by:
  - lateral shielding constituted by the stainless steel of the internal (6mm) and external (1,5mm) shells for the main part of the shielding against neutron radiation;
  - bottom shielding constituted by the stainless steel of the bottom cavity (8mm) and 2 closing sheet metals (2x1,5mm) as well as by carbon steel of the repartition plate (25mm) for the main part of the shielding against gamma radiation and by resin (25mm, 24mm min.) and wood (65mm) 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 bidy 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 MADE BY THE CONSIGNOR BEFORE SHIPMENT

The packaging must be used in compliance with the using instructions of chapter 4 of the Safety Analysis Report.

3. MAINTENANCE PROGRAMME

The packaging maintenance is described in chapter 4 of the Safety Analysis Report.

4. NOTIFICATION AND RECORDING OF THE SERIAL NUMBERS

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

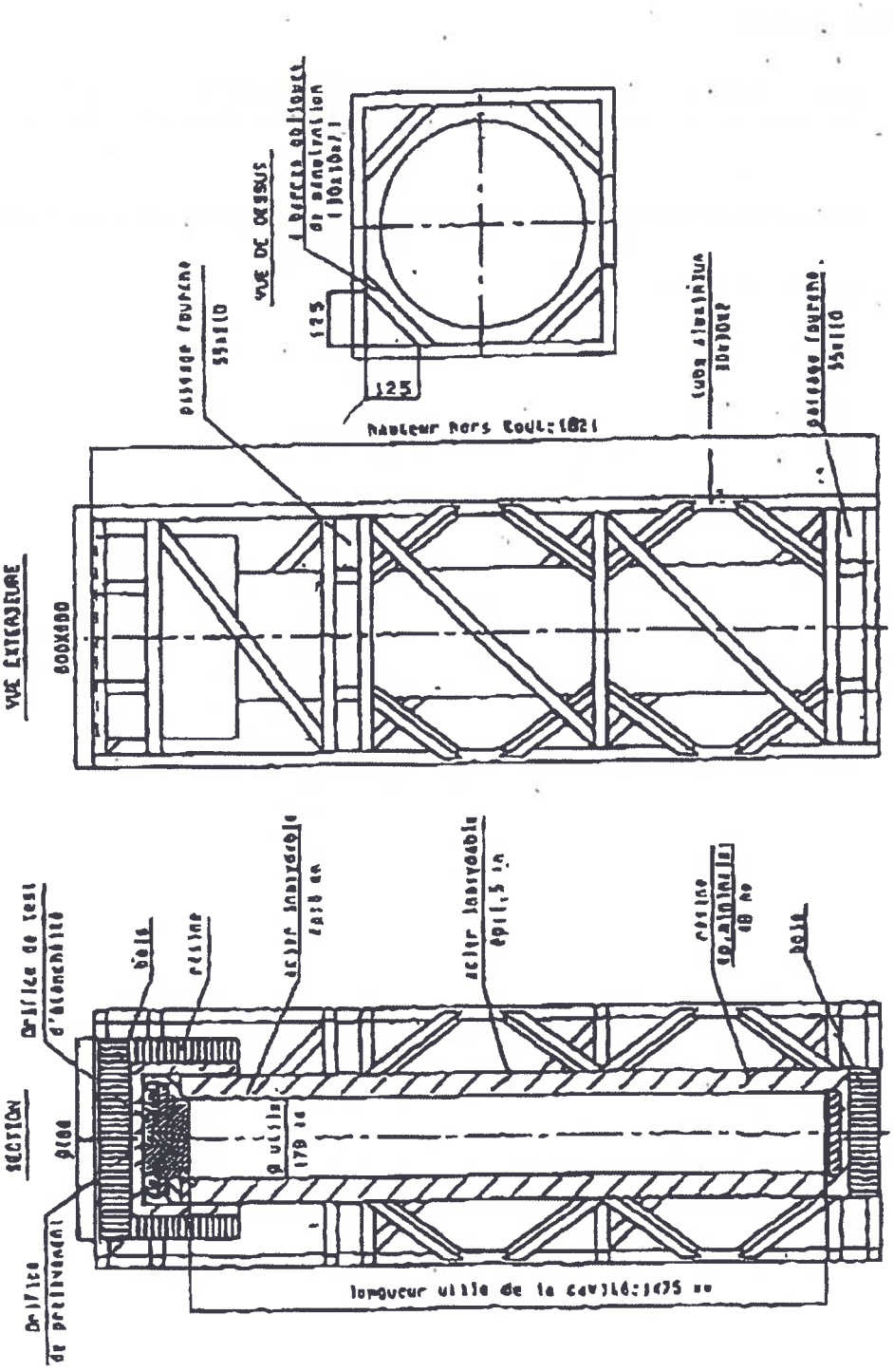
5. QUALITY ASSURANCE

The principles of quality assurance to be applied during the design, the fabrication, inspection, tests, maintenance and use, should be in accordance with the ones described in chapter 5 of the Safety Analysis report.

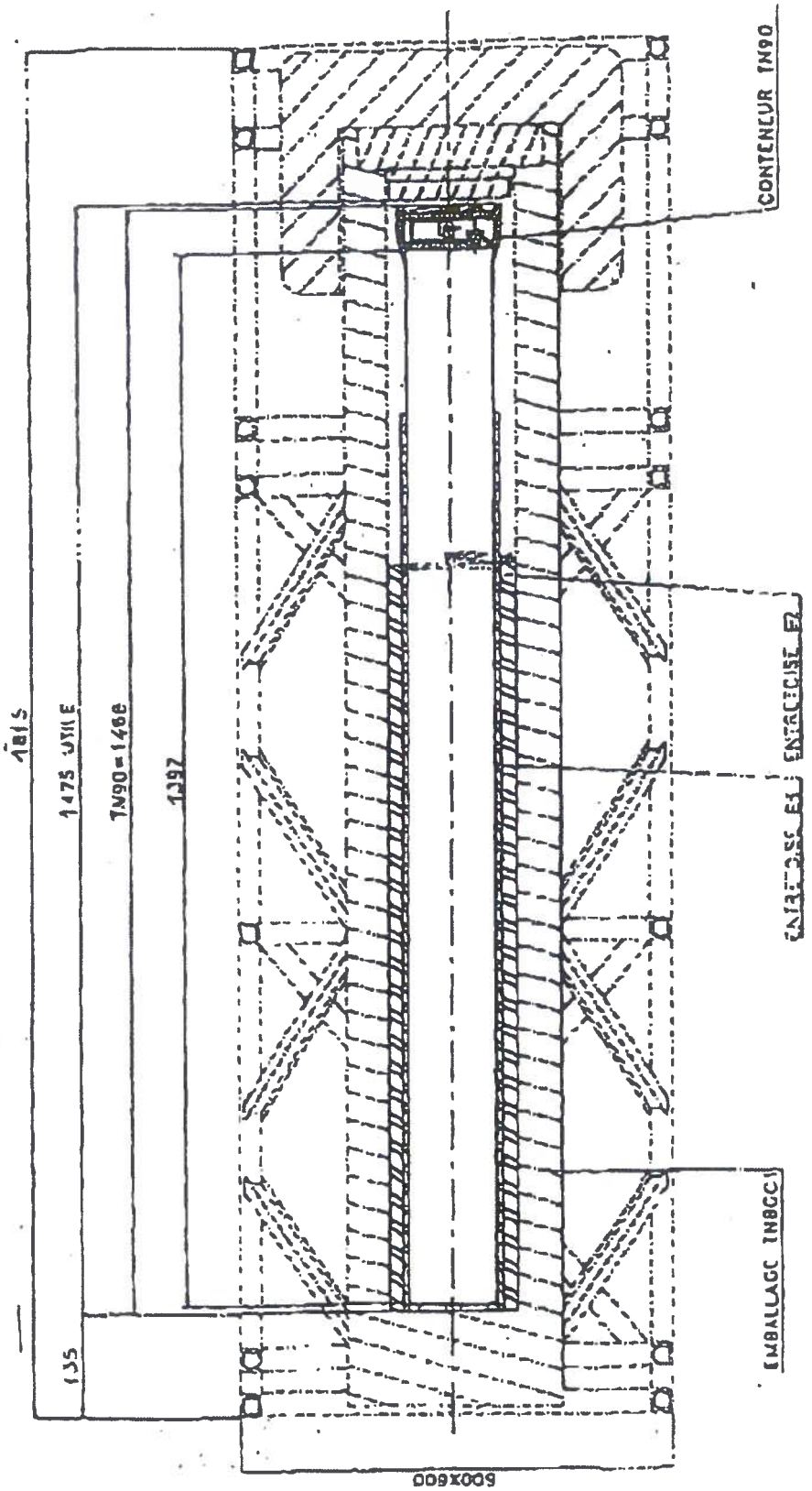
6. COMPLEMNTARY PRESCRIPTION IN CASE OF A CONFINED TRANSPORTATION

The confined transport is authorized.

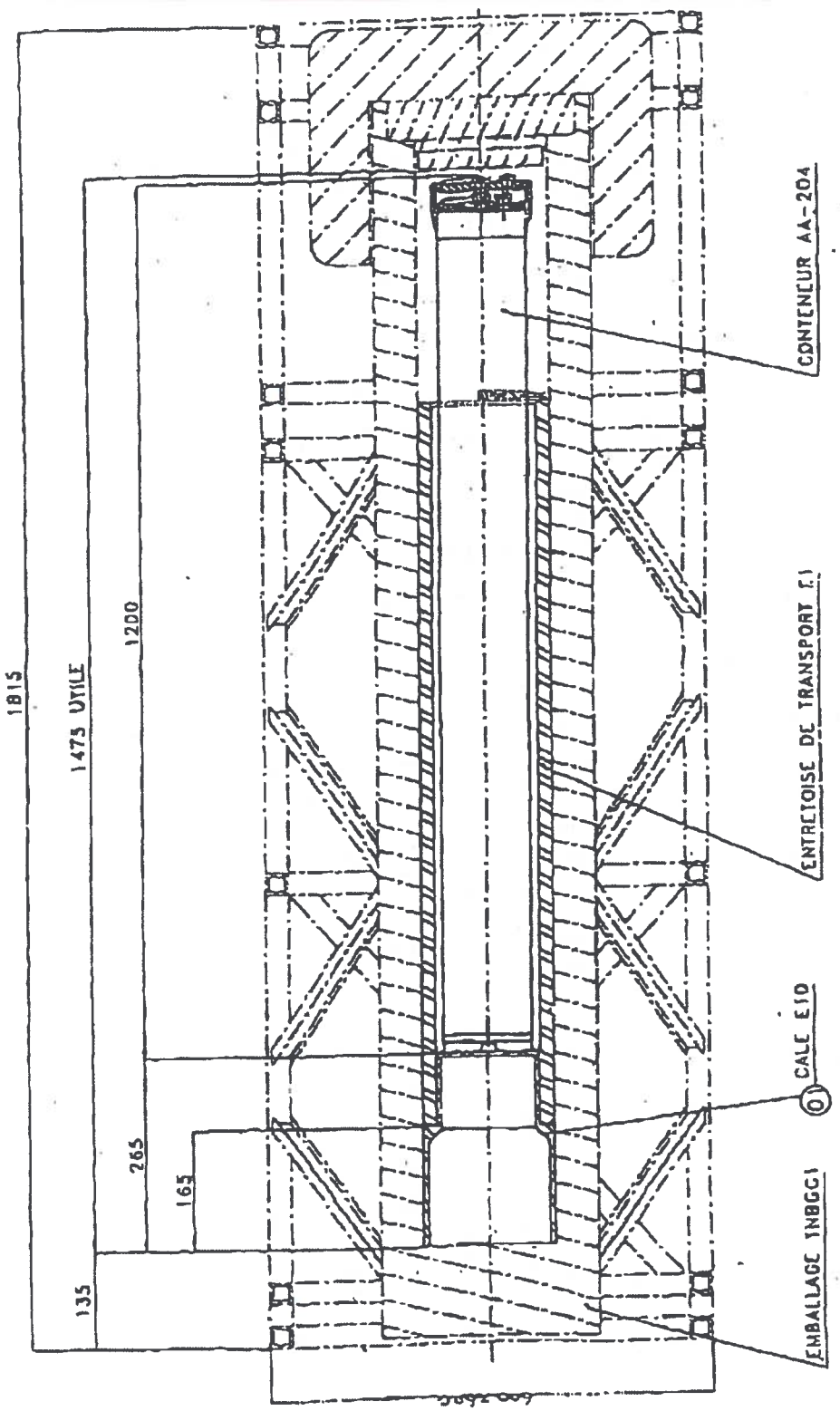
FIGURE 0.1
DRAWING OF THE TN-BGC1 PACKAGING



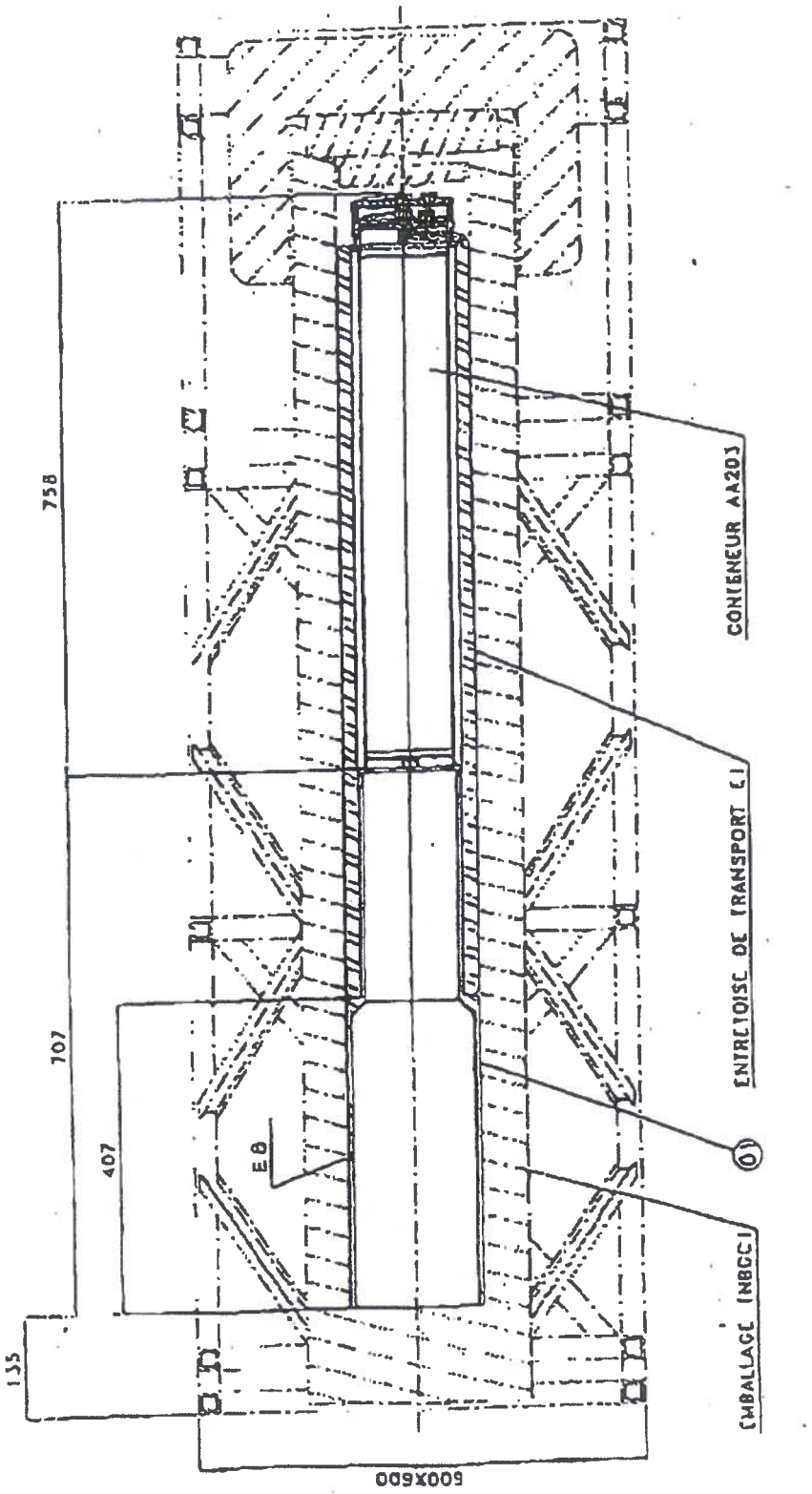
DRAWING 0.2
THE TN-BGC1 PACKAGING
LOADED WITH INTERNAL ARRANGEMENT TN 90



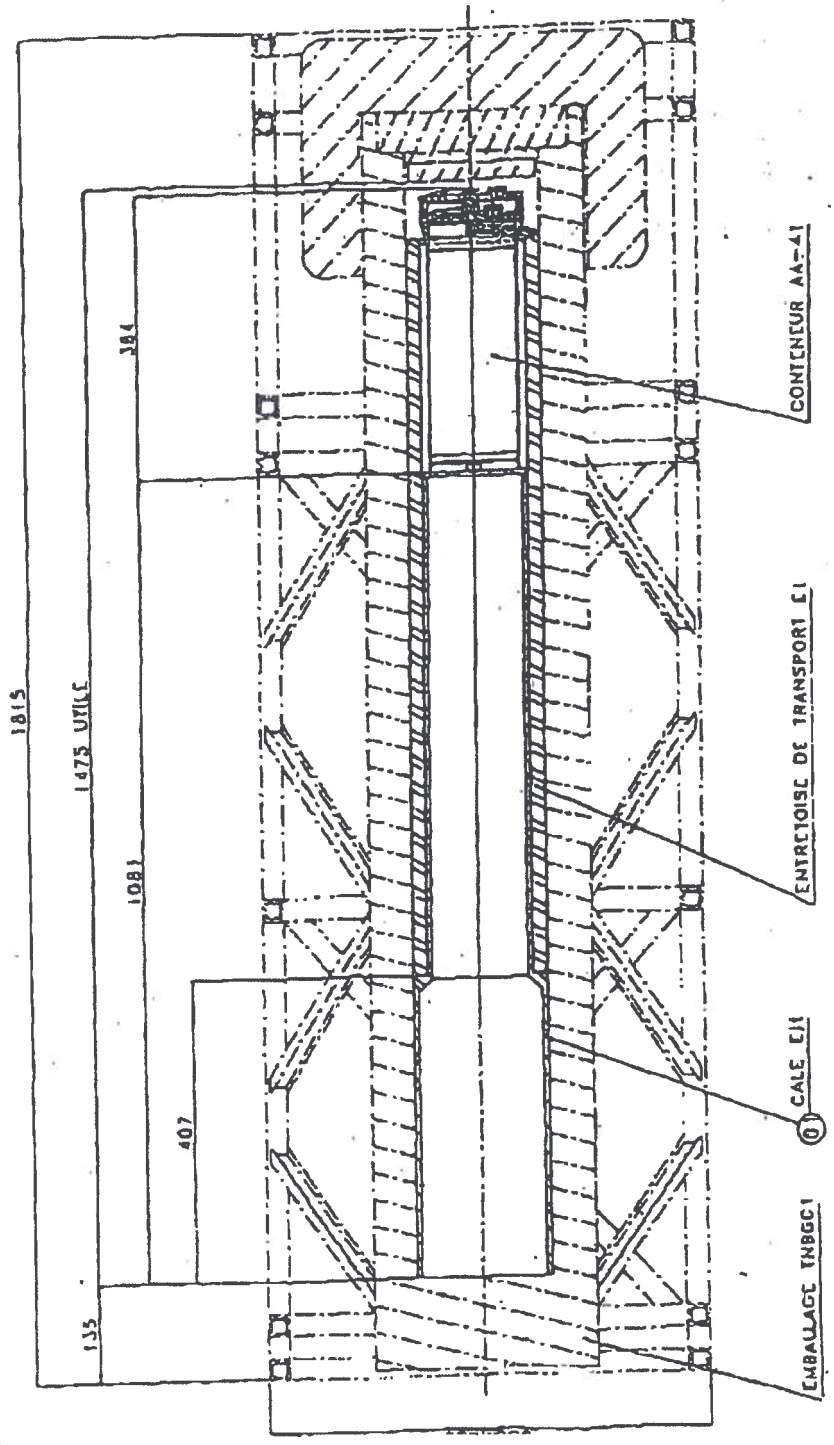
DRAWING 0.3
THE TN-BGC1 PACKAGING
LOADED WITH INTERNAL ARRANGEMENT AA204



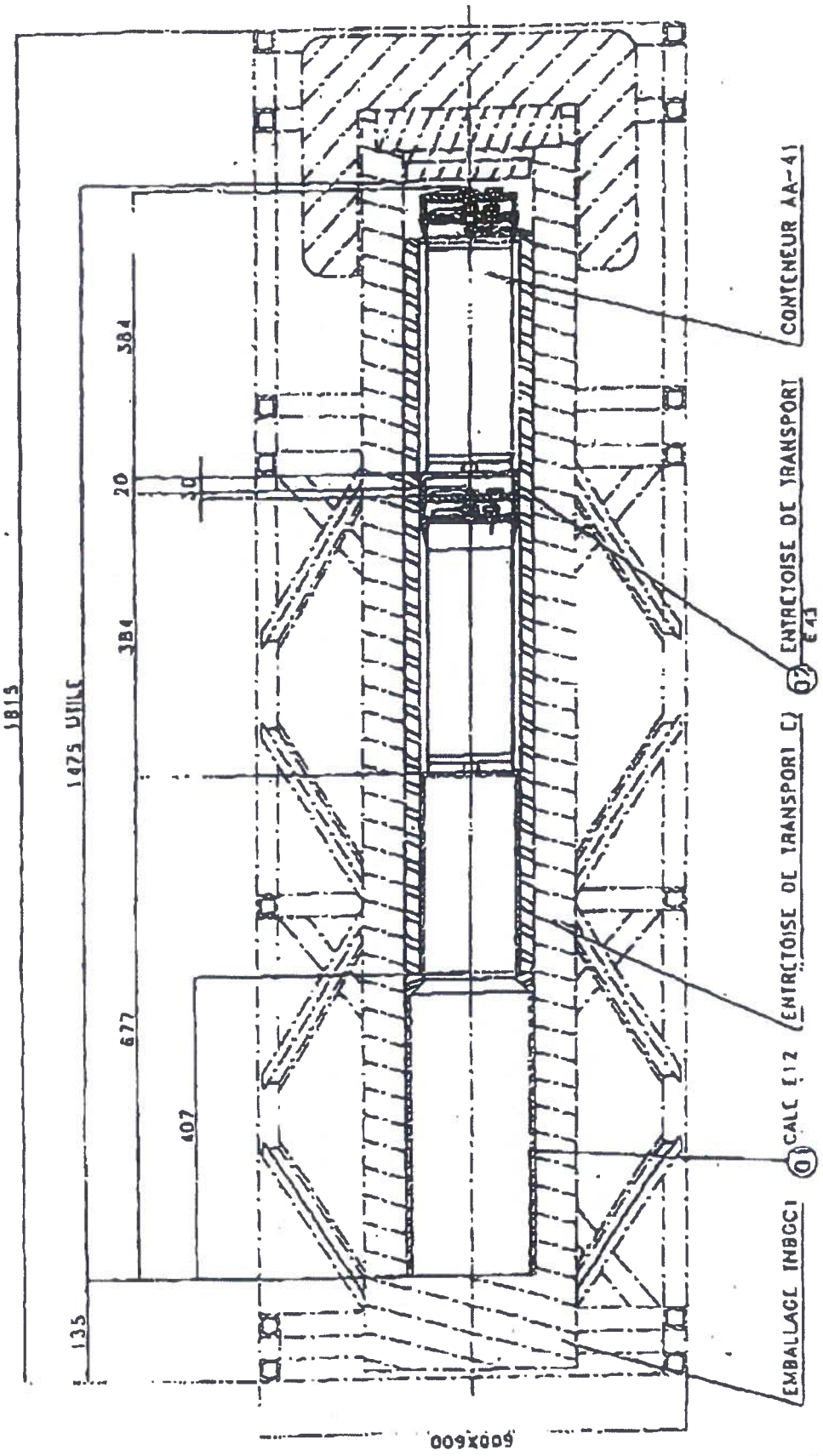
DRAWING 0.4
THE TN-BGC1 PACKAGING
LOADED WITH INTERNAL ARRANGEMENT AA203



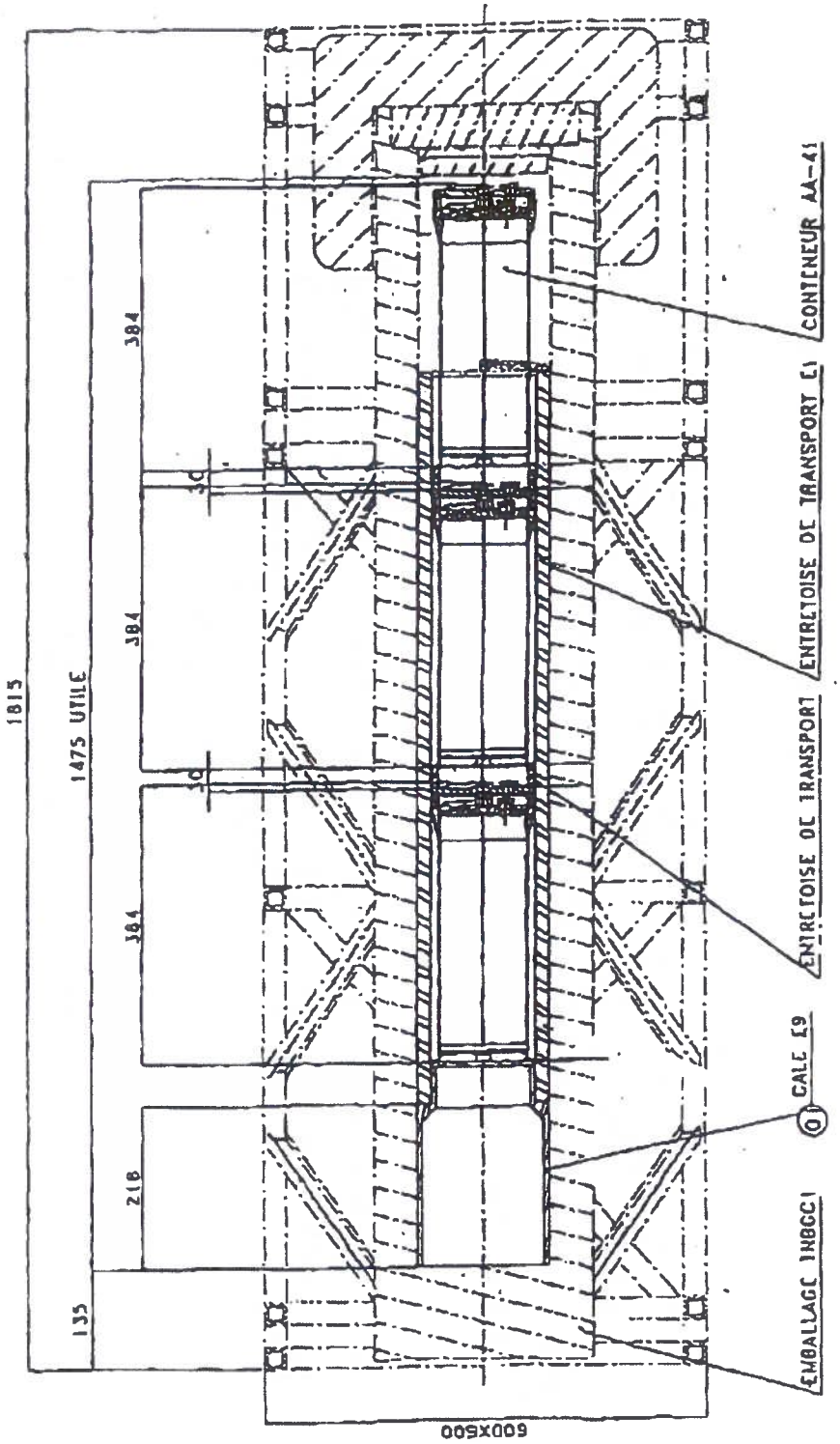
DRAWING 0.5
THE TN-BGC1 PACKAGING
LOADED WITH INTERNAL ARRANGEMENT AA41



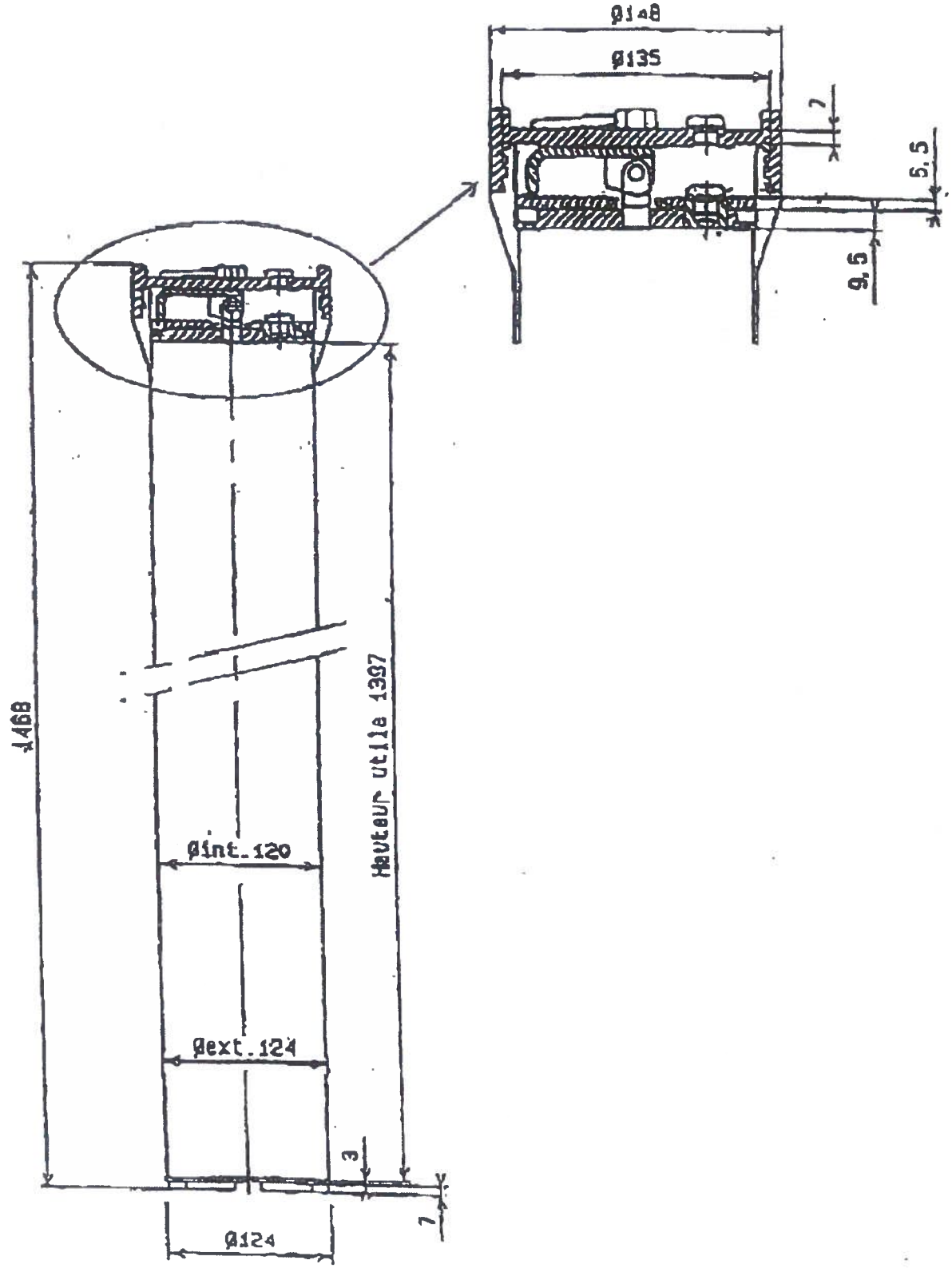
DRAWING 0.6
THE TN-BGC1 PACKAGING
LOADED WITH TWO INTERNAL ARRANGEMENTS AA41



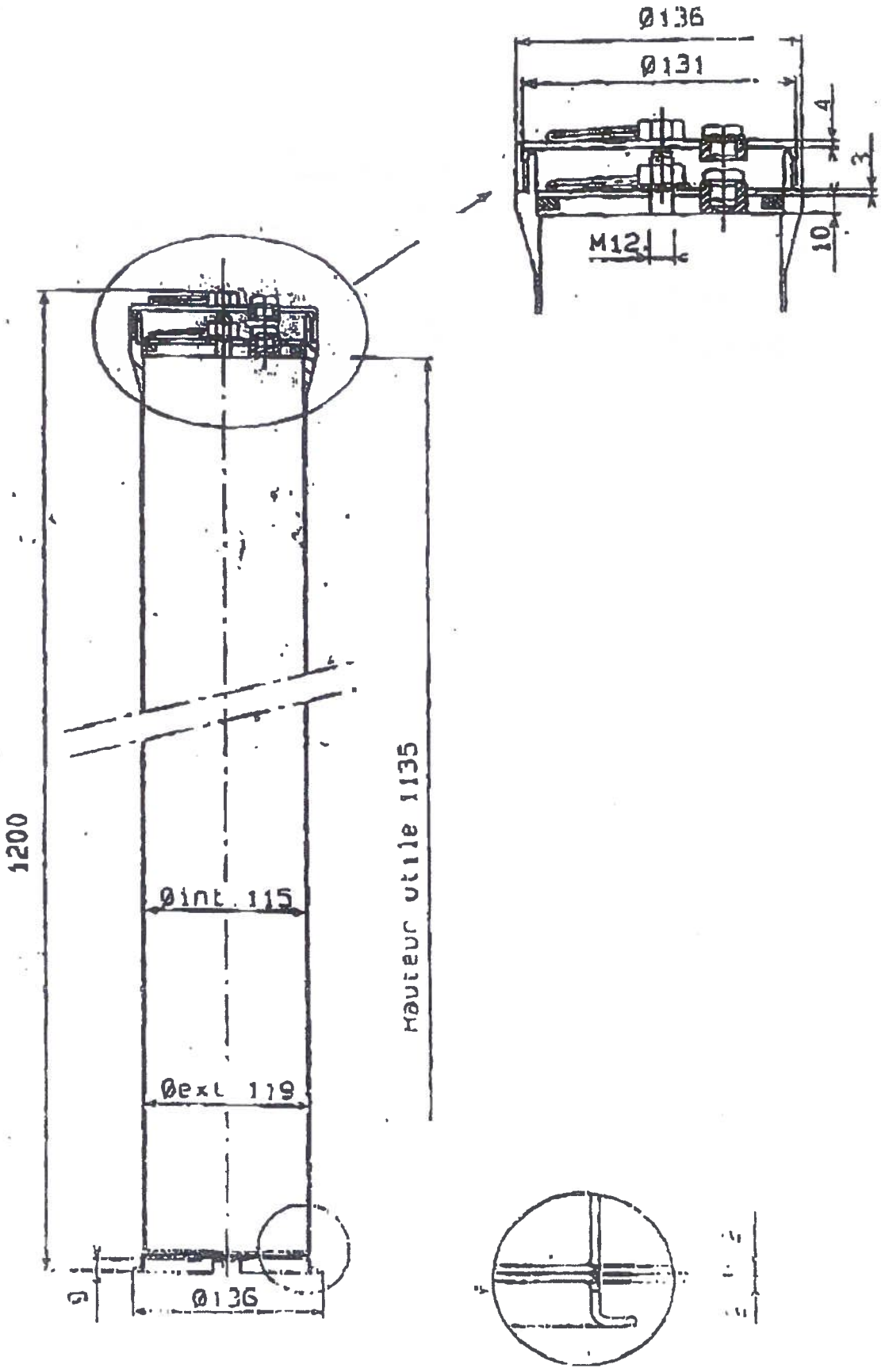
DRAWING 0.7
THE TN-BGC1 PACKAGING
LOADED WITH THREE INTERNAL ARRANGEMENTS AA41



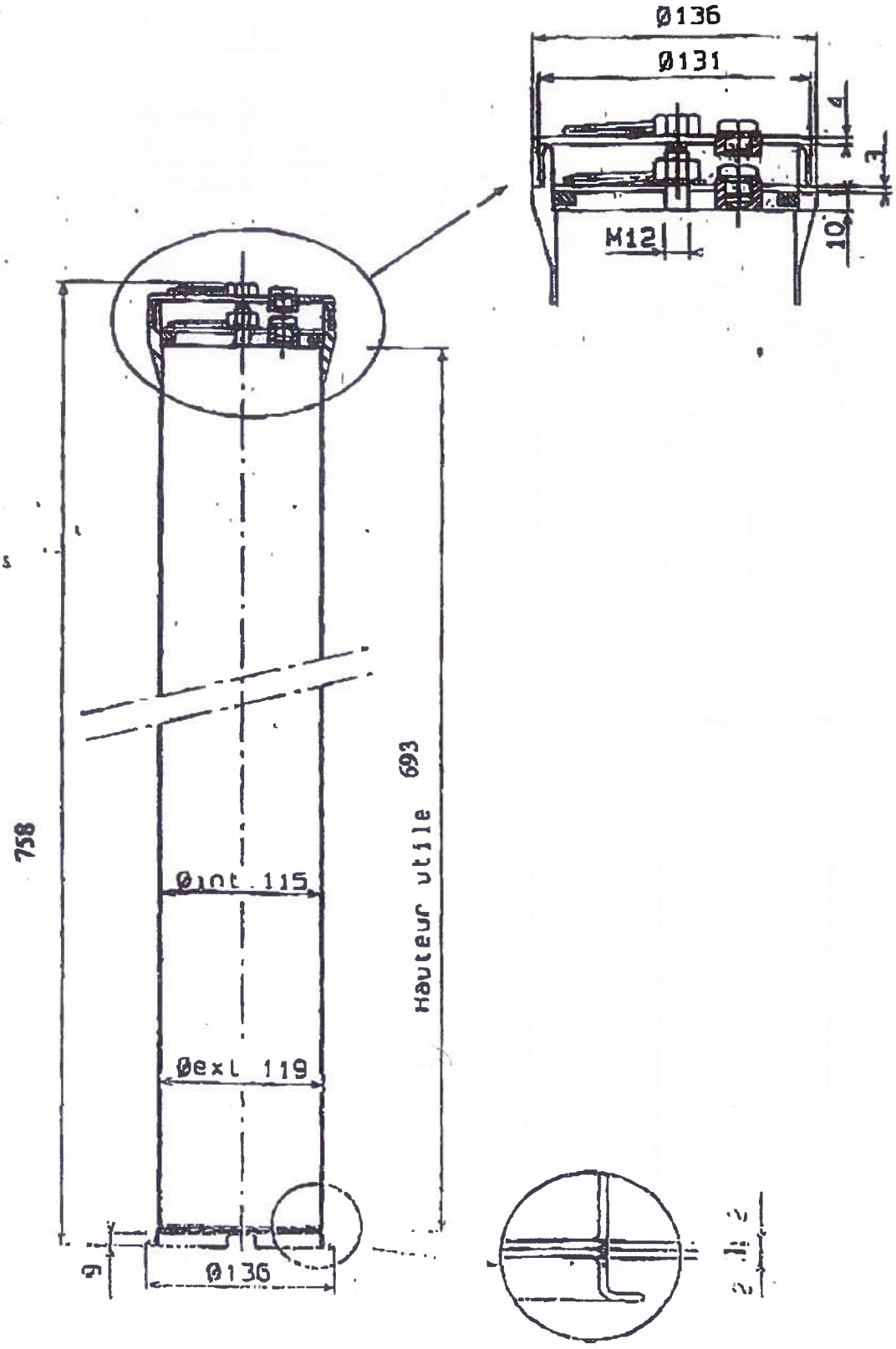
DRAWING 0.8
THE INTERNAL ARRANGEMENT TN-90



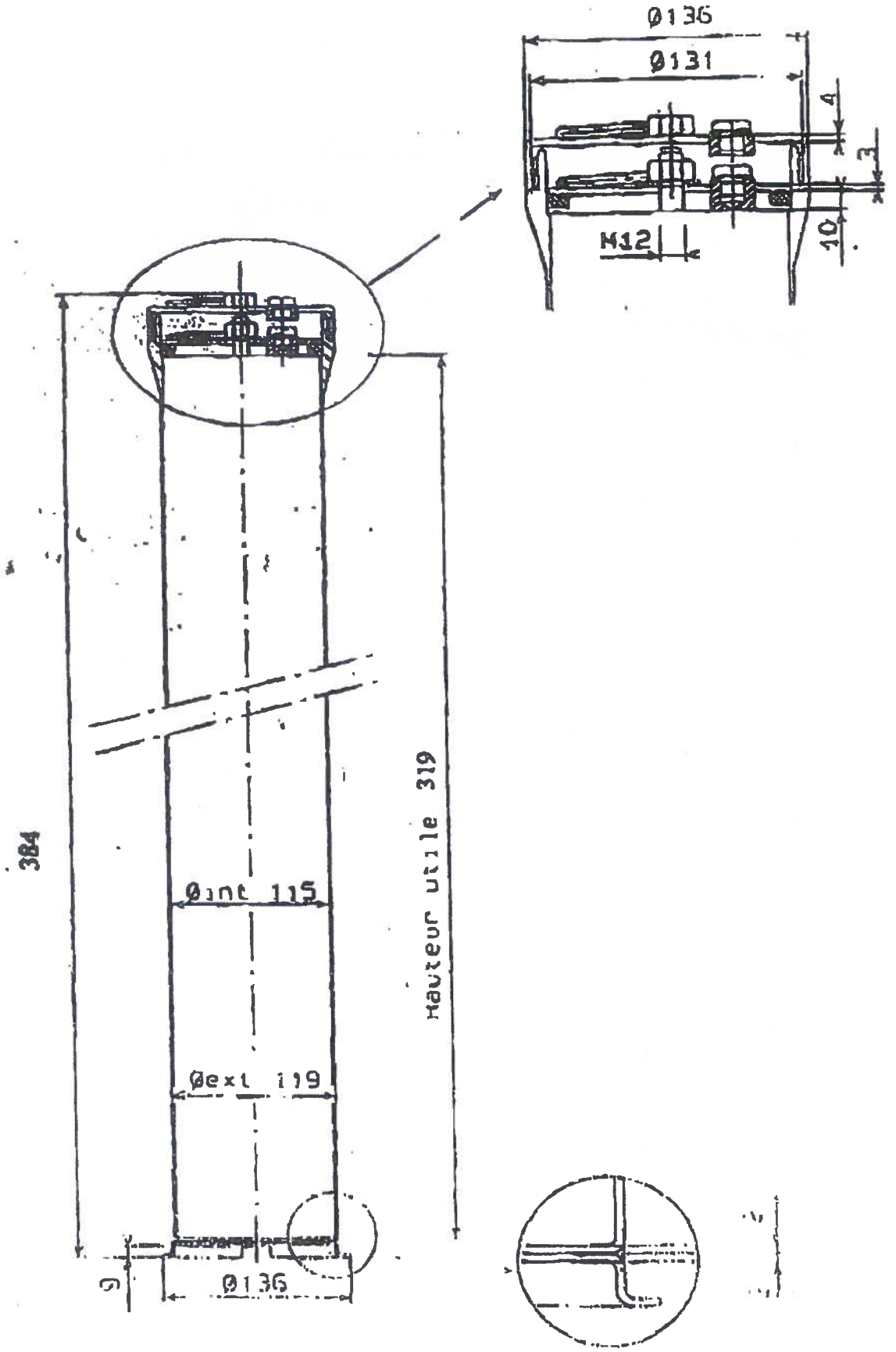
DRAWING 0.9
THE INTERNAL ARRANGEMENT AA204



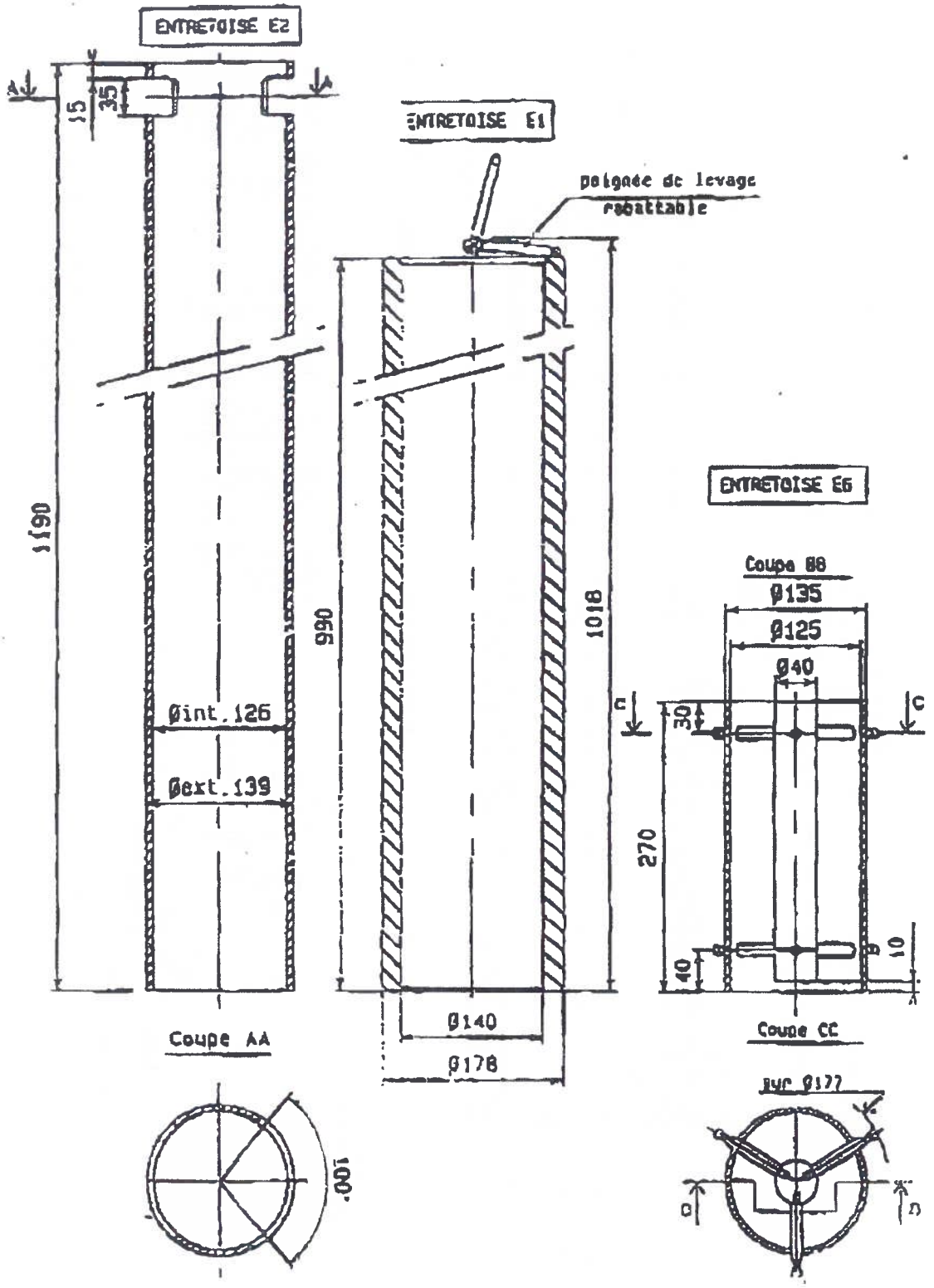
DRAWING 0.10
THE INTERNAL ARRANGEMENT AA203



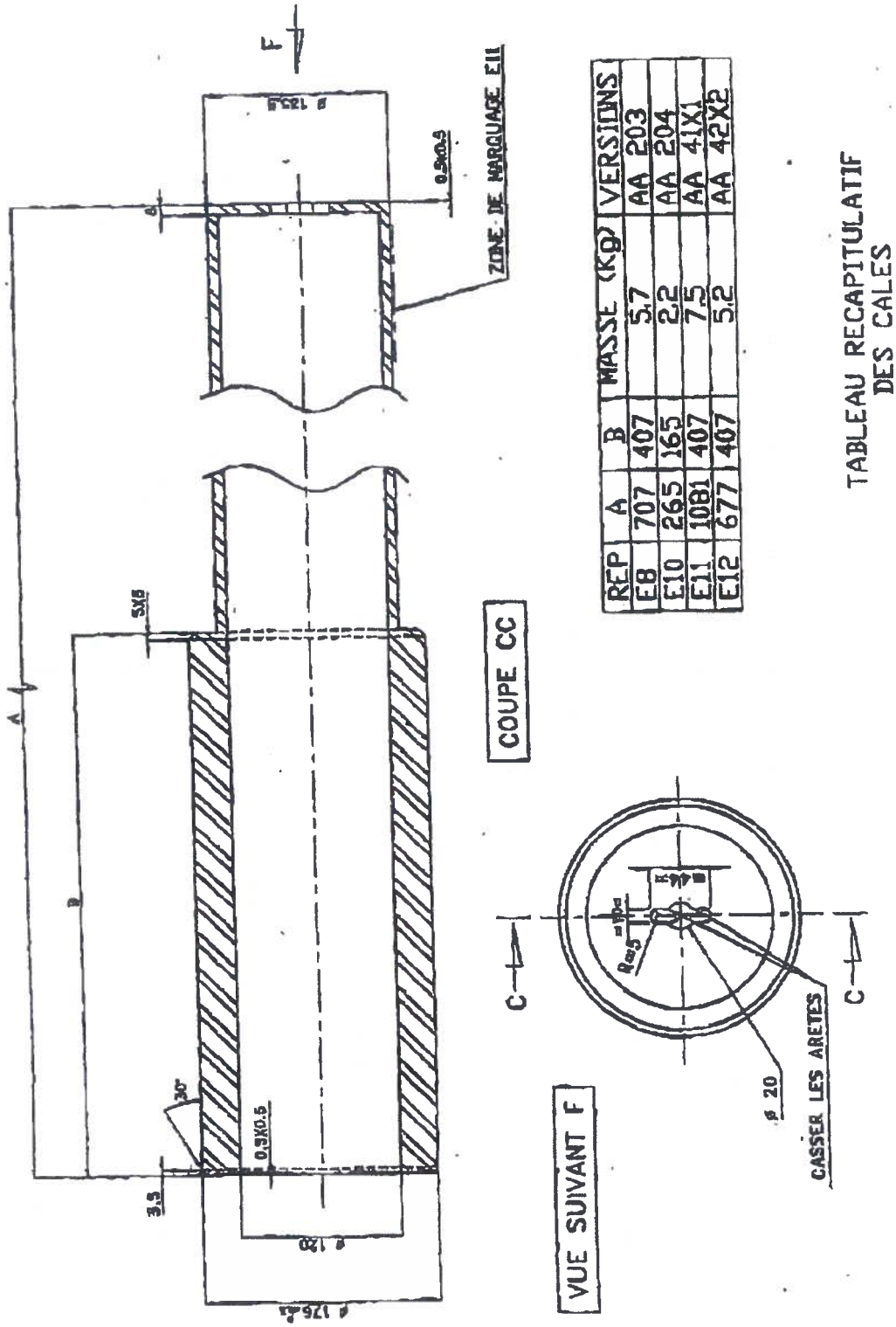
DRAWING 0.11
THE INTERNAL ARRANGEMENT AA41



DRAWING 0.12
THE SPACERS E1, E2, E6

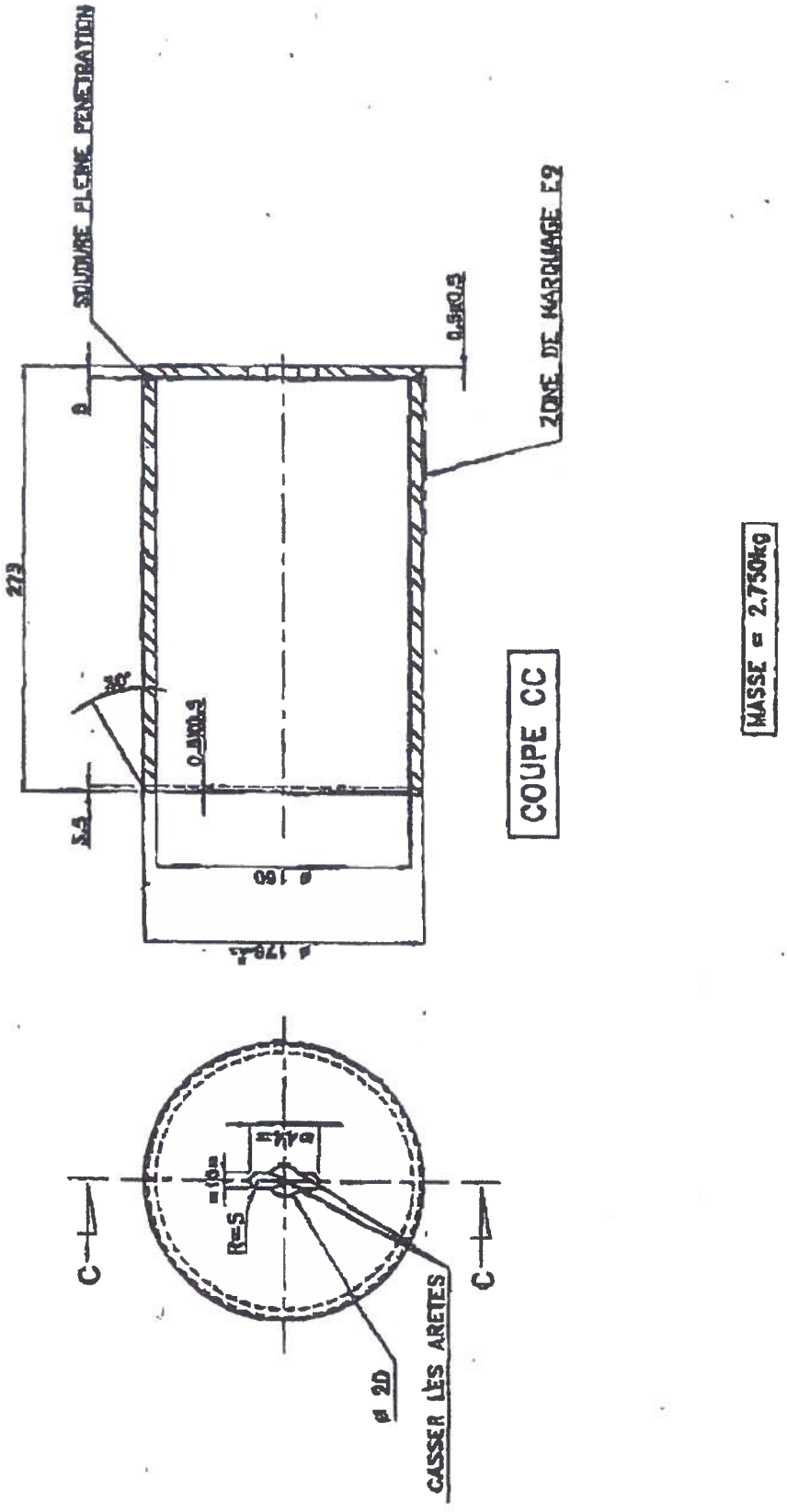


DRAWING 0.13
THE SPACERS E8, E10, E11, E12

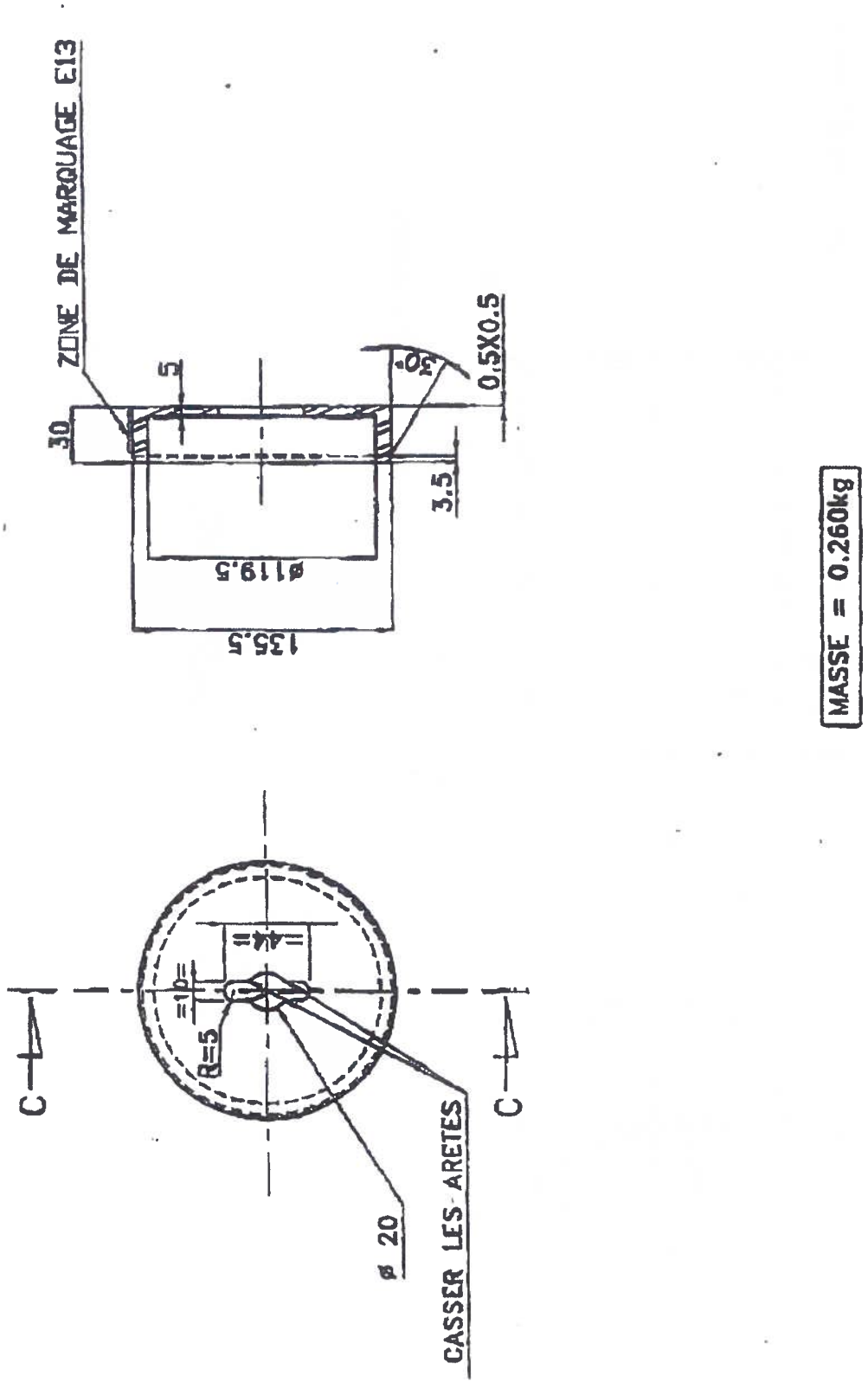


REP	A	B	MASSE (Kg)	VERSIONS
E8	707	407	5,7	AA 203
E10	265	165	2,2	AA 204
E11	1081	407	7,5	AA 41X1
E12	677	407	5,2	AA 42X2

DRAWING 0.14
THE SPACER E9



DRAWING 0.15
THE SEPARATION SPACER E13 FOR AA41



APPENDIX 11

CONTENT N°11

SOLID URANIUM-BEARING MATERIALS

1. DESCRIPTION

The content is composed from solid uranium bearing material.
The uranium is not irradiated and does not come from reprocessing,.
The presence of hydrogenated materials in which the hydrogen rate is superior to the one of the water is not authorized.

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:

GUARANTEED CONFINEMENT DIAMETER (mm)	MAXIMUM TRANSPORTED QUANTITY (kg)
$100 < \phi \leq 120$	Mass of $^{235}U \leq 7$
$60 < \phi \leq 100$	Mass of $^{235}U \leq 15$
$\phi \leq 60$	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,
- uranium tetrafluorure: UF_4
- uranium nitride : UN, U_2N_3, UN_2,
- uranium carbide : UC, UC_2 and U_2C_3.
- alloys of uranium containing one or several of the following metals : aluminium (Al), molybdenum (Mo), silicon (Si),

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 uranium powders are placed inside boxes (primary packaging); these boxes are placed in a secondary conditioning container.

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 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 160 EMBAL PFM DET 0800157 of February 26, 2008

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 attached documents 3.6-1 and 3.6-0 of chapter 3.6 of the safety report.

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 :

GUARANTEED CONFINEMENT DIAMETER (mm)	MAXIMUM TRANSPORTED QUANTITY (kg)	N	CSI
100 to 120 mm	Mass of $^{235}U \leq 7$	50	1
60 to 100 mm	Mass of $^{235}U \leq 15$	16	3.1
< 60 mm	Any mass of $^{235}U^{(1)}$	50	1

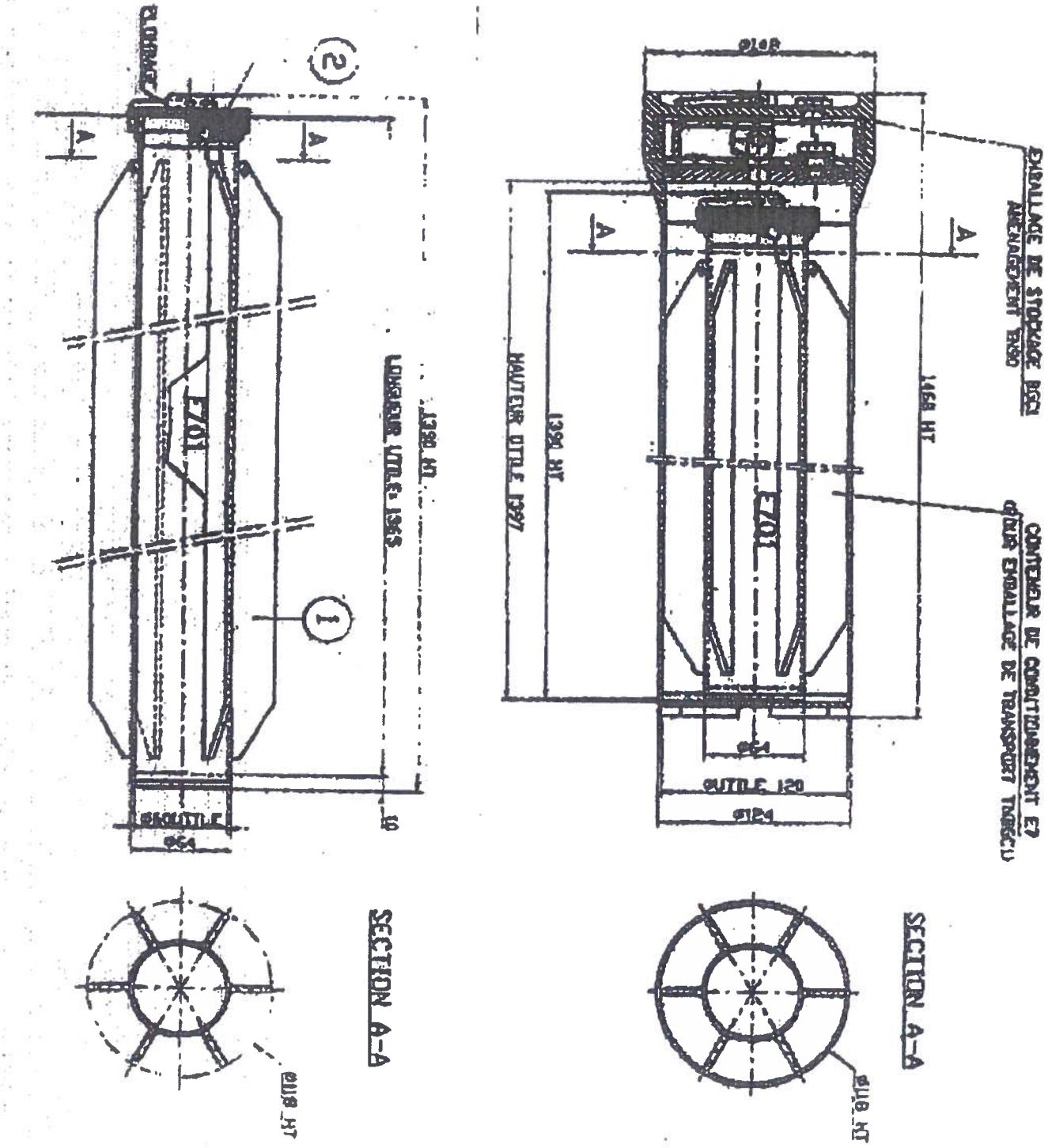
5. SPECIAL INSTRUCTIONS TO BE FOLLOWED FOR USE OF THE PACKAGING

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 11.1
THE INTERNAL ARRANGEMENT OF E7 TYPE

AND CONDITIONING OF URANIUM-BEARING MATERIALS



APPENDIX 26

CONTENT N°26

PELLETS, SECTIONS OF RODS OR RODS OF MIXED OXYDE UNRAMIUM-PLUTONIUM

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.

The Uranium does not come from reprocessing.

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

The drawings of TRIGA fuel elements, standards and thin, is presented on drawing 26-1.

The presence of hydrogenated materials in which the hydrogen rate is superior to the one of the water is not authorized.

Maximum quantity and composition

The maximum enrichment in Uranium 235 is: 20 %.

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

Maximum transportable quantities:

The maximum transportable quantities are précised in the followings tables.

- 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 2.17.2, 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.

Special dispositions
In the case of an air transportation, the water mass displays with the fissile material, independently of that contained in the hydrogenated materials of the packaging, is less than 1200g or 1950g whether it is standards or thin fuel elements.

2. INTERNAL ARRANGEMENTS

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. (drawings 0.8 to 0.11).

A primary conditioning container of E7 type (represented on the drawing 26-2) can be used with the TN 90 for a conditioning of a uranium-bearing.

The following spacers (shown on drawings 0.12 to 0.15) 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 160 EMBAL PFM DET 0800157 A of February 26, 2008.

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

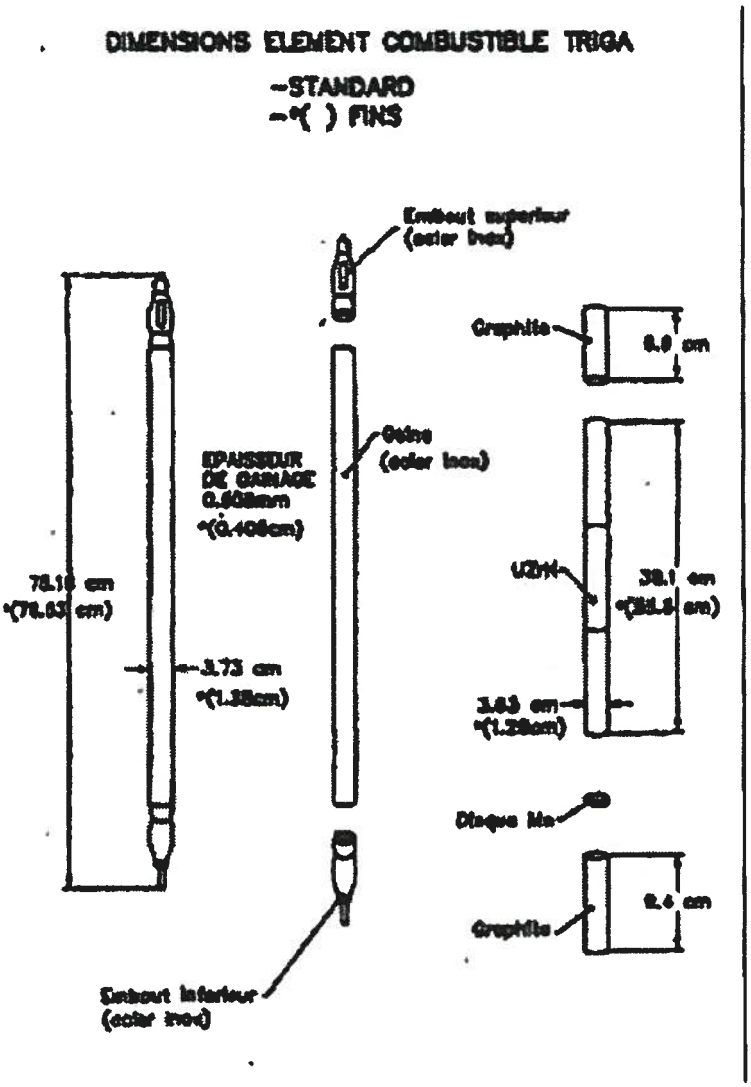
4. CRITICALITY STUDY

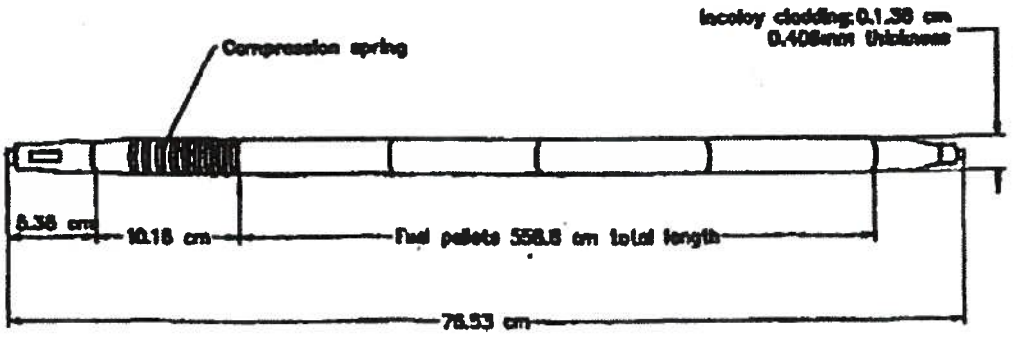
It is the subject of attached document 3.6-9 and 3.6-11 of chapter 3.6 of the Safety Analysis Report.

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 = 0 (number "N": infinite)

DRAWING 26.1
TRIGA ELEMENTS



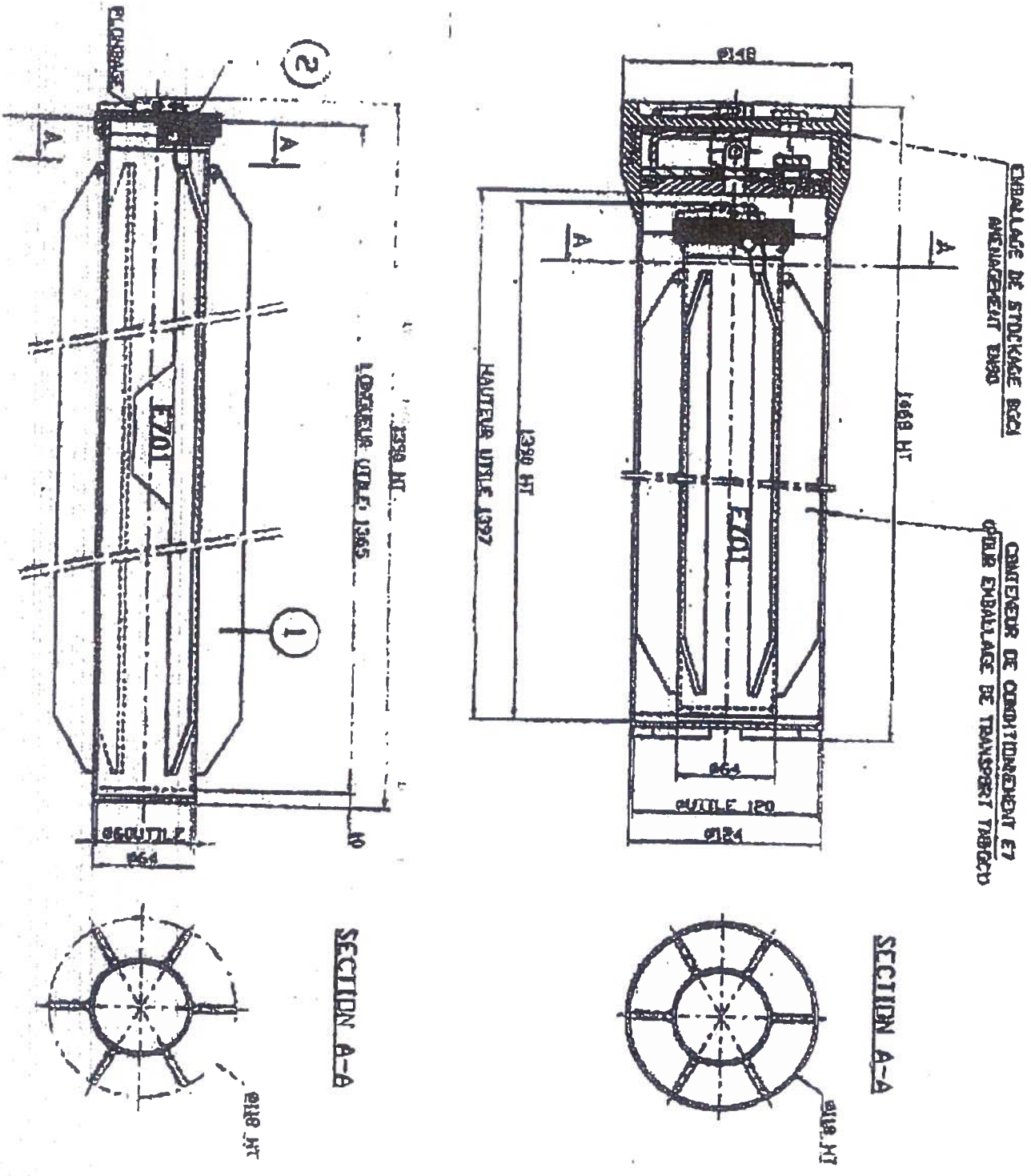


FUEL ROD DESIGN

TRIGA fuel rod for 16-rod cluster

DRAWING 26.2
THE INTERNAL ARRANGEMENT OF E7 TYPE

AND CONDITIONING OF URANIUM-BEARING MATERIALS



U.S. Department
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**Pipeline and
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