



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

400 Seventh Street, S.W.
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 8**

**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 Agency¹ and the United States of America².

1. Package Identification - TN-BGC 1.
2. Package Description and Authorized Radioactive Contents - as described in France Certificate of Competent Authority F/313/B(U)F-96, Revision Haf (attached). Contents are restricted to 15 grams or less of fissile material described in Appendix 29af of French Certificate of Approval No. F/313/B(U)F-96, Revision Haf.
3. Criticality - The minimum criticality safety index is 5.0. 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.
 - 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.

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.

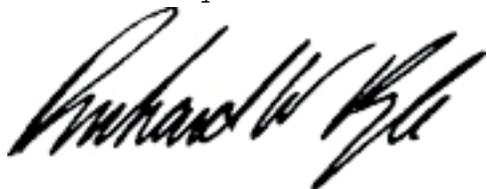
² Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

CERTIFICATE USA/0492/B(U)F-96, REVISION 8

- 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 regulations¹ shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors and consignees in the United States exporting or importing shipments under this certificate shall satisfy the requirements of Subpart H of 10 CFR 71.
- 5. Special Condition - USA/0492/B(U)F-96, Revision 6 and USA/0492/B(U)F-96, Revision 7 remain valid through their expiration date.
 - 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 April 01, 2007.

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 February 01, 2006 petition by Packaging Technology, Inc., Tacoma, WA and in consideration of other information on file in this Office.

Certified By:



Robert A. McGuire
Associate Administrator for Hazardous Materials Safety

Apr 07 2006
(DATE)

Revision 8 - Issued to revalidate French Certificate of Approval No. F/313/B(U)F-96, Revision Haf, for FUTURIX/FTA DOE 1 to DOE 4 fuel pins. At the request of the applicant, package may not contain more than 15 grams of fissile material.

**CERTIFICATE OF APPROVAL
OF A PACKAGE DESIGN**

**F/313/B(U)F-96 (Haf)
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The French Competent Authority,

Further to the request made by **Commissariat à l'Energie Atomique** in the letter DPSN/SSR/2005/041/GB dated February 18, 2005;

Further to the Safety Analysis Report EMB TNBGC PBC DS- CA000001B dated August 20, 2003, and the notes listed in the fax CEA/DEN/CAD/DTAP/SET DO177 dated April 7, 2004, and the fax CEA/DEN/CAD/DTAP/SET DO 247 dated May 14, 2004, and the technical note 160 EMBAL PFM NOT 05000257 A dated February, 9, 2005,

Hereby certifies that the package design comprising the **TN-BGC 1** packaging described hereinafter in Appendix 0 revision (af) loaded with one of the following contents:

- content No. 28 : pins FUTURIX/Concept (described in appendix 28 revision af) ;
- content No. 29 : pins FUTURIX/FTA DOE 1 to DOE 4 (described in appendix 29 revision af) ;
- content No. 30 : pins FUTURIX/FTA ITU 5 and 6 - CEA 7 and 8 (described in appendix 30 revision af) ;

Complies, as a Type B(U) package with fissile material, with the requirements of the regulations, agreements and recommendations listed below:

- Regulations for the Safe Transport of Radioactive Materials, International Atomic Energy Agency, 1996 Edition (Revised), No. TS-R-1 (ST-1, Revised),
- European Agreement concerning the international carriage of dangerous goods by road (restructured ADR),
- Regulations concerning the international carriage of dangerous goods by rail (RID),
- International Maritime Dangerous Goods Code, International Maritime Organization (IMDG and OMI codes),
- Decree of June 1, 2001 modified concerning the carriage of dangerous goods by road (decree ADR),
- Decree of June 5, 2001 concerning the carriage of dangerous goods by rail (decree RID),
- Decree of November 23, 1987 modified concerning the Safety of Ships, section 411 (decree RSN).

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

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

Registration No. **DGSNR/SD1/ 0755 /2005**.

PARIS, October 27, 2005.

**Pour le ministre de l'économie,
des finances et de l'industrie,
par délégation :**

**Pour le ministre de l'écologie et
du développement durable,
par délégation :**

SUMMARY OF CERTIFICATES ISSUANCES

Issuance	Expiration	Type of issuance and changes	Type of certificate	Revision indicia							
				body	t	0	1	2	3	4	5
08/06/04	30/06/08	Renewal	B(U)F-96	Haa	-	aa	-	aa	-	aa	-
15/07/04	30/06/08	Renewal	B(M)F-96 T	Hab	ab	ab	ab	-	ab	-	ab
		Reserved		Hac							
		Reserved		Had							
29/09/04	30/06/08	Amendment to Haa	B(U)F-96	Hae	-	ae	-	-	-	-	-
27/10/05	30/06/08	Amendment to Haa	B(U)F-96	Haf	-	af	-	-	-	-	-

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

APPENDIX 0
PACKAGING TN-BGC 1

1. DESCRIPTION OF THE PACKAGING

The packaging is designed, fabricated, inspected, tested and maintained in accordance with the Safety Analysis Report EMB TNBGC PBC DS- CA000001B dated August 20, 2003.

The packaging, consisting of a rectangular cage inside which is fastened a body with a general cylindrical shape, fitted with a closure system and a cover, is shown in figure 0.1

Design drawings are as follow:

- Overall design drawing: TN 9990-65 (C).
- Cage: TN 9990-118 (B).
- Plug assembly: TN 9990-117 (B).

Main dimensions of the packaging are as follow:

- Cross-section of cage: 600 × 600 mm².
- Overall length of cage: 1,821 mm.
- Diameter of the main section of the body: 295 mm.
- Diameter of cover: 466 mm.
- Overall length of the packaging including the cover: 1,808 mm.

The maximum mass of the package loaded and in transport configuration is 396 kg; the packaging unloaded is 280 kg.

When considering the tolerances on the dimensions and densities of balsa and poplar woods contained in the packaging (top cover and bottom), the total mass of water in these parts is less than 1,670 grams.

The package is constituted of two main assemblies as described below.

1.1 Cage

The cage is a tube structure in aluminum with a cross section of 30 × 30 mm and 2 mm thick.

Forklift path reinforced by angle plates are provided at two levels to allow the handling of the package with a fork lift truck.

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 clearance for the screws that fasten the body holding struts.

1.2 Body

The cavity, with an internal useful diameter of 178 mm and a useful length 1,475 mm, consists of a 6 mm thick stainless steel shell (insuring the main radial gamma rays shielding), and of a 8 mm thick stainless steel bottom plate.

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

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

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, bears on the body flange.

At the plug centre point, a port fitted with a quick connection allows the depressurization of the packaging before shipment, and the return to atmospheric pressure on arrival before unloading. This port is closed by a cap.

Two pairs of O-ring seals insure the leak-tightness between the plug and the body, and the leak-tightness of the quick connection cap. The space between the O-rings communicates with a common test port allowing testing the leak-tightness of the closure system.

The two O-ring seals that define the containment system are made of THT silicone, with a shore hardness of 65; they are referenced item 11 and 13 on the drawing TN 9990 65 (C), the two other O-rings, referenced item 12 and 14, are made of Viton.

1.4 Impact limiters

An impact limiter 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 Handling and tie-down points

The cage around the packaging is used for handling and tie-down.

The package may be handled and transported in vertical and/or horizontal position.

In **vertical position**, the package may be handled in two ways:

- By a forklift truck thanks to the forklift paths in the cage (two possible level);
- By slings tied around the tubes reinforcing the cage corners at the top side.

In **horizontal position**, the package may be handled by two slings tied around the cage.

When transported in vertical position, the package may be tied down in two ways:

- Chocking at the bottom and use of slings at mid-length,
- Chocking with spreaders at two different levels.

When transported in horizontal position, the tie down is chocking around the cage and use of slings over the cage.

1.6 Safety functions

The main safety functions are:

- **Containment** is insured by the containment vessel constituted of the inner shell and the bottom, the closure plug and its quick connection, both equipped with silicone O-ring seals.
- **Radiation protection** is insured by:
 - The radial shielding made of the inner shell (6 mm) and outer shell (1.5 mm) for the main gamma rays shielding, and the resin (50 mm, 48 mm minimum) for the neutron shielding.
 - Shielding at the bottom constituted of the stainless steel bottom (8 mm) with the two end closure plates (2×1.5 mm), the carbon steel of the distribution plate (25 mm) for the gamma rays shielding, and by the resin (25 mm, 24 mm minimum) and wood (65 mm) for the neutron shielding.
 - Shielding at the top end constituted of the stainless steel plug and the cover sheets (gamma rays shielding), the resin and wood inside the cover (neutron shielding).
- **Safety criticality** is insured by the confinement system constituted of the content described in appendices and of:
 - The packaging: its geometry (maximum outer diameter of the packaging for interaction, cage), materials, composition and thickness of the neutron absorber resin (hydrogen and boron content, thickness of charred resin);
 - Internal arrangements: spacers' geometry and material (aluminum), container geometry (diameter, thickness) and material.
- **Dissipation of the thermal power** is insured by radiation exchange between the content and the packaging, by conduction in the body, and by exchange between the package with ambient air.
- **Impact limitation** is insured by the cover and the cage.
- **Protection against fire** is insured by the radiation protection. The body is equipped with fusible plugs to prevent overpressure from gas generation.

2. MEASURES TO BE TAKEN BY THE CONSIGNOR PRIOR TO SHIPMENT

The package shall be used according to procedures compliant with the provisions of Chapter 11 of the Safety Analysis Report.

Prior to shipment, the consignor shall check that all following controls have been correctly performed, according to a list pre-established in compliance with the condition of use of the package from Chapter 10 of the Safety Analysis Report, that the results of the controls meet the criteria, and that the list is correctly initialed by an official:

- Check the package has been maintained according to section 3 of this appendix,
- Check the content is in compliance with the certificate of approval,
- Perform a leak tightness test with a criteria of 6.66×10^{-4} Pa.m³/s SLR,
- Check the tightening torque of the package bolts complies with Table 1,
- Check the preload force on the plug is 30 kN,
- Check the external contamination on the package (according to the regulatory criteria),
- Check the external dose rate around the package (according to the regulatory criteria), especially on the following points: at contact and 1 m away, in radial and axial direction.

- Check that the stickers and regulatory labels are present. The package identification mark is F/313/B(U)F-96,
- Check that seals have been placed to prevent disassembly of the cover.

Table 1: Summary of tightening torques for bolts

Bolts or nuts	tightening torques
Quick connection port cap	50 N.m
O-ring test port cap	10 N.m

3. MAINTENANCE PROGRAM

The package maintenance program is described in Chapter 11 of the Safety Analysis Report.

Especially,

- Prior to any transport:
 - Inspect gasket seats surfaces on the body and on the cover, inspect O-ring seals and replace it if necessary,
 - Check that there is no damage on 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-ring seals,
 - Carry out detailed inspection of threads,
 - Inspect closure system,
 - Perform a leak-tightness test of the closure system (criterion: 6.66×10^{-5} Pa.m³/s SLR).
- Every forty transports (or every six years) :
 - Perform a neutron scanning to ensure that the neutron shielding is still effective,
 - Perform an overload test on handling points (angled bars on top of the cage),
 - Perform a leak-tightness test of the containment boundary (closure system and body (criterion: 6.66×10^{-5} Pa.m³/s SLR)).

4. NOTIFICATION AND REGISTRATION OF SERIAL NUMBERS

The owner of a packaging manufactured according to the design covered by this certificate shall forward the packaging serial number to the competent authority. Should a packaging be disposed of or 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. The consignor of a packaging compliant with the design covered by this certificate shall check that the packaging bears a serial number.

5. QUALITY ASSURANCE

Quality Assurance requirements applying to the design, fabrication, inspection, tests, maintenance, and use of the package shall be compliant with Chapter 12 of the Safety Analysis Report.

6. ADDITIONAL REQUIREMENTS IN CASE OF ENCLOSED SHIPMENT

Transport in an enclosed conveyance is authorized.

FIGURE 0.1
SKETCH OF TN-BGC 1 PACKAGING

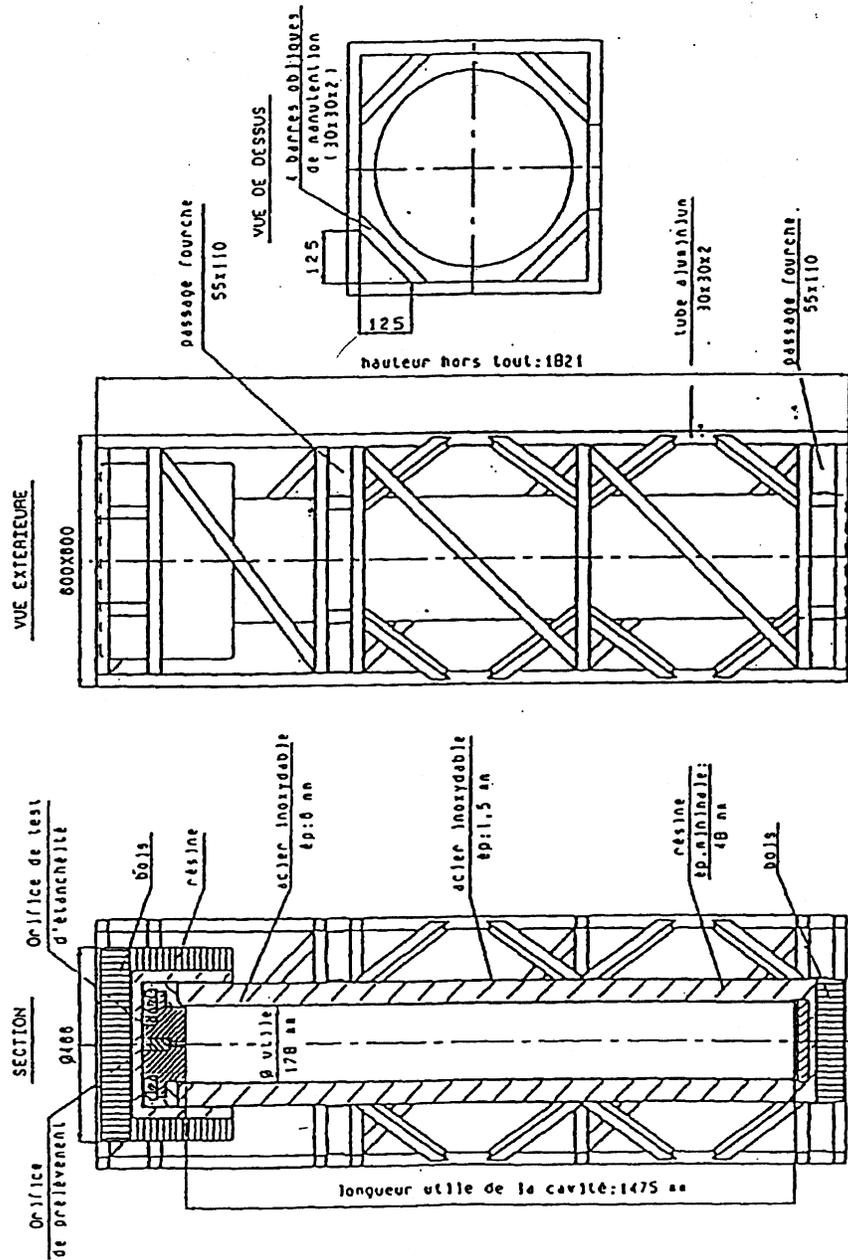


FIGURE 0.2

SKETCH OF TN-BGC 1 PACKAGING LOADED WITH INTERNAL ARRANGEMENT TN 90

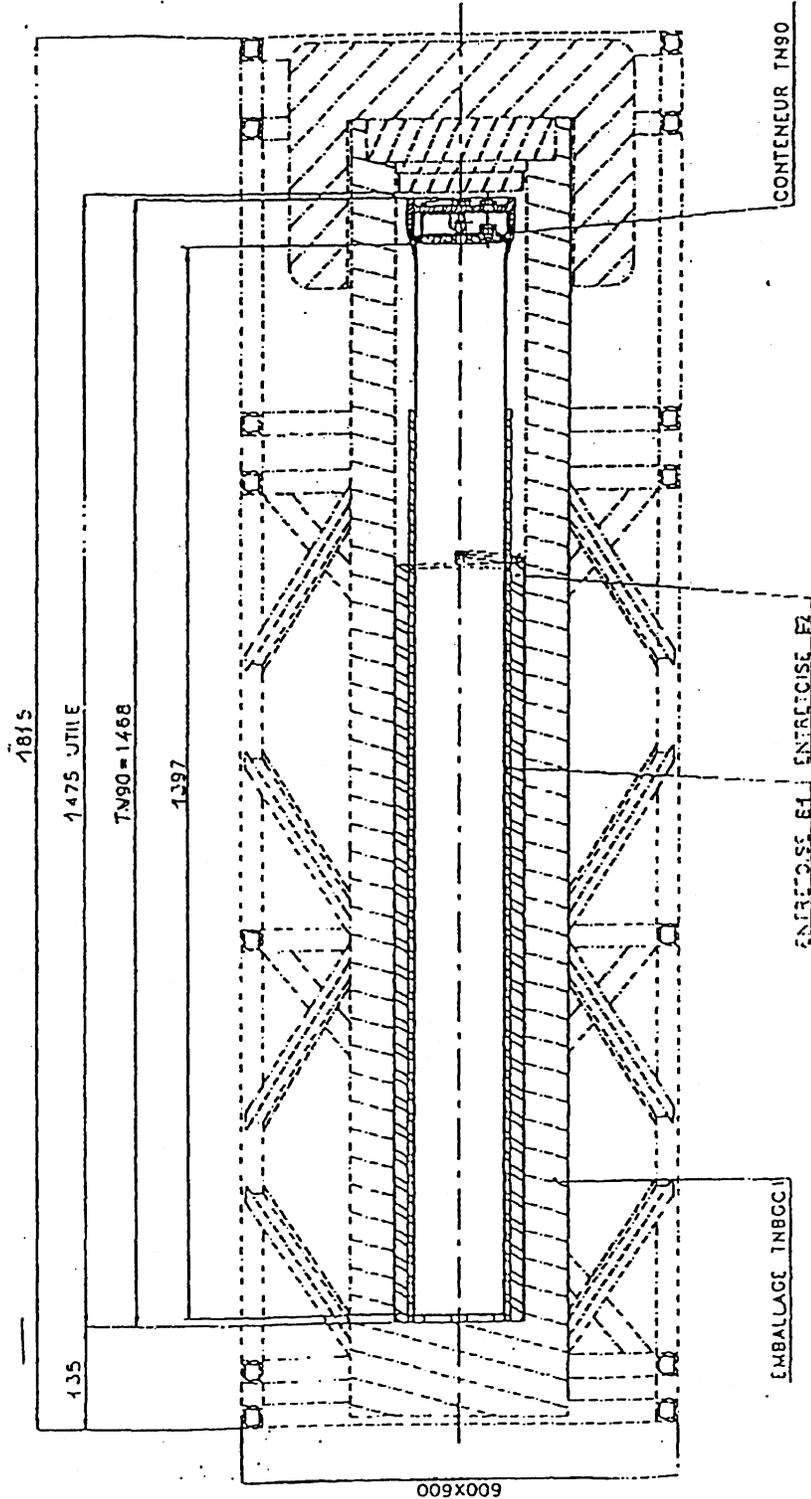


FIGURE 0.3
SKETCH OF INTERNAL ARRANGEMENT TN 90

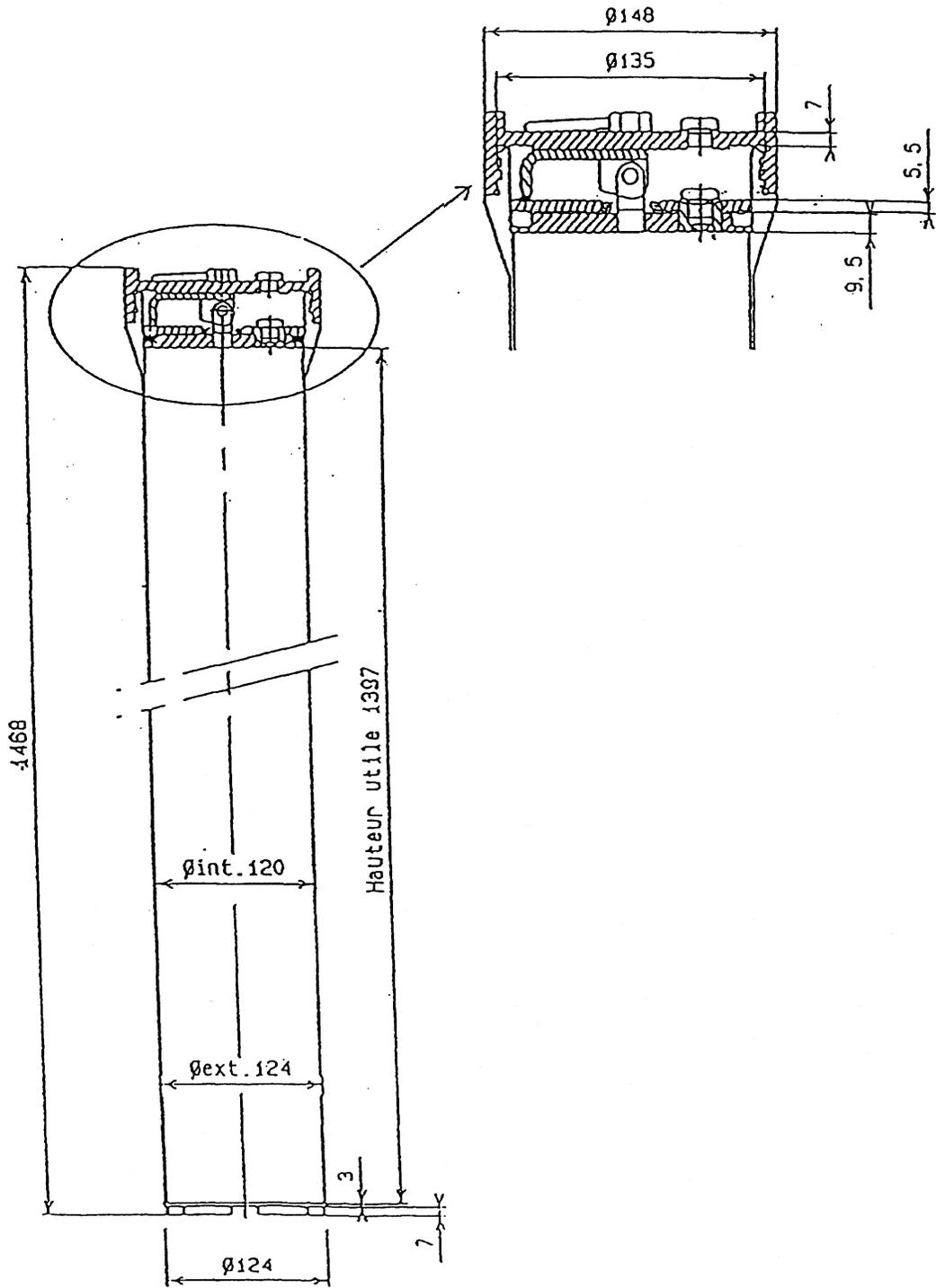
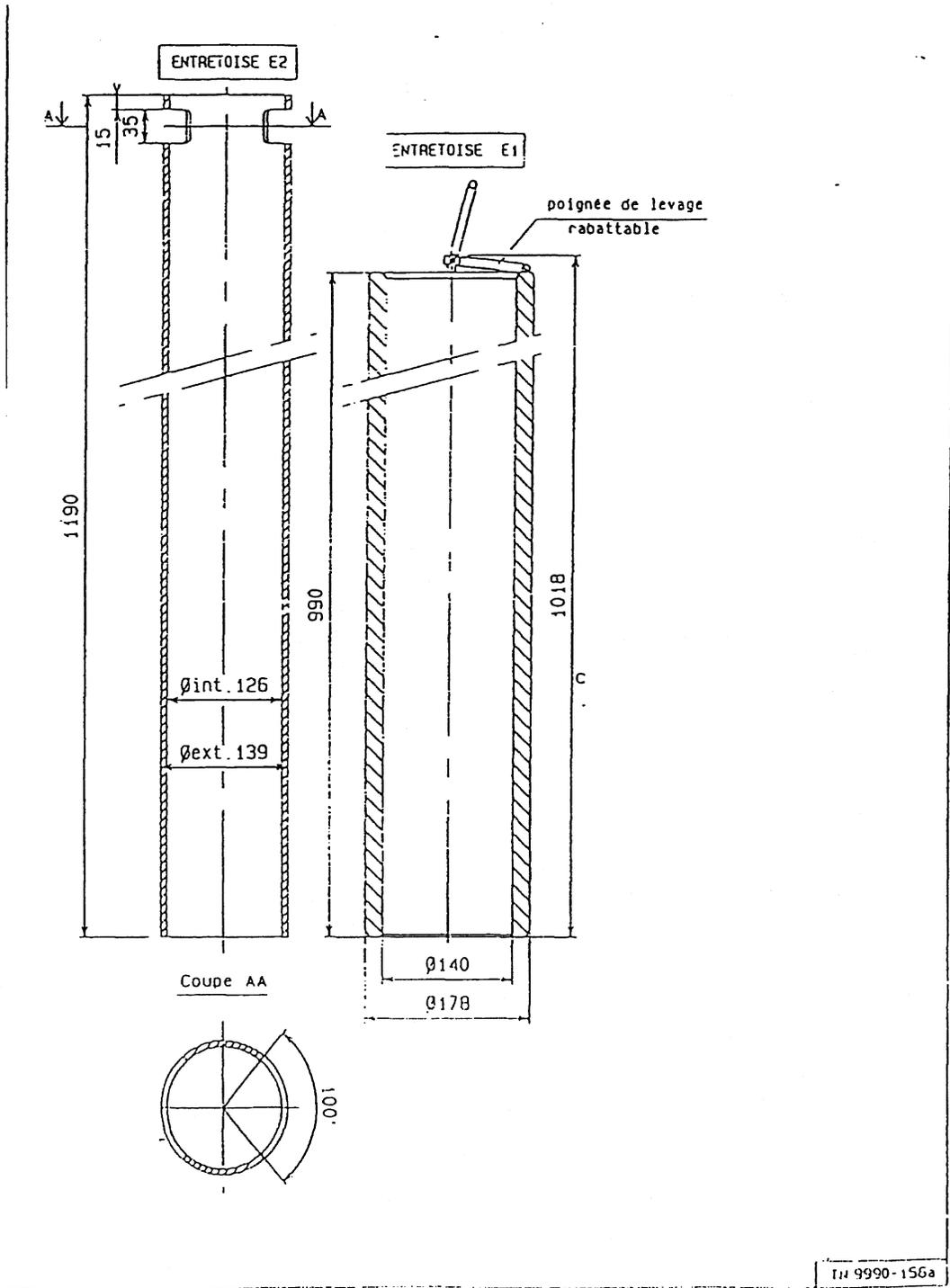


FIGURE 0.4
SKETCH OF SPACERS E1, E2



APPENDIX 29

CONTENT N° 29

FUTURIX/FTA DOE PINS

1. AUTHORIZED CONTENT

Description of the content

The content consists of 1, 2, 3 or 4 pins among the 4 pins called FUTURIX/FTA DOE1, FUTURIX/FTA DOE2, FUTURIX/FTA DOE3, and FUTURIX/FTA DOE4.

FUTURIX/FTA DOE pins are stainless steel type AIM1 clad pins (standard cladding material for the Phenix reactor pins); with an outer diameter of 6.55 mm and a total length of 352 mm, closed at both ends by a leak tight plug (welded), and filled with inert gas (mixture of inert gas and helium).

The pins contain experimental fuel, on a 100 mm length inside each pin. The remaining inner volume consists of:

- A plenum for gas expansion generated during irradiation.
- A metallic sodium bond, representing a volume less than 2 cm³.

The pins sketch is shown on figure 1.

The experimental fuel material is different in each pin. Pins DOE1 (UPuAmNpZr) and DOE2 (PuAmZr) are metallic alloy. Pins DOE3 ((UPuAmNpZr)N) and DOE4 ((PuAmZr)N) are nitride fuel.

The maximum mass of radioactive material within the four pins is 61.60 g, including 0.11 g of Pu241.

Special form

No special form material.

Maximum thermal power generated by the content

The maximum thermal power generated by the content is less than 2 W.

Activity

Activity of the content shall be such, taking into account the nature and energy of the radiation, that regulatory limits for dose rates shall not be exceeded.

The specific activity of the content shall be less than 52 A₂/g, except if the content is the FUTURIX/FTA DOE4 pin alone in the package.

Transport of the FUTURIX/FTA DOE4 pin alone is forbidden.

2. INTERNAL ARRANGEMENTS

Pins may be held in tube sleeves. Pins or tube sleeves may be transported in a rack.

The secondary conditioning container shall be the TN90. It is shown on the figure page 7 of appendix 0.

Spacers E1 and E2 (see figures page 8 of appendix 0) shall be used with the TN 90 container within the packaging cavity.

The maximum total weight loaded within the TN-BGC 1 packaging cavity (meaning spacers + container + content) is 116 kg.

3. SAFETY ANALYSIS REPORT

The Safety Analysis Report is the reference EMB TNBGC PBC DS- CA000001 B dated August 20, 2003 with additional documents listed in the fax CEA/DEN/CAD/DTAP/SET DO 177 dated April 7, 2004, with the fax CEA/DEN/CAD/DTAP/SET DO 247 dated May 14, 2004, and with the technical paper 160 EMBAL PFM NOT 05000257 Ind.A dated February 9, 2005.

4. CRITICALITY

It is performed in Chapter 9 of the Safety Analysis Report reference EMB TNBGC PBC DS- CA000001 B dated August 20, 2003, in the additional calculation EMB TNBGC PBC DS- CA000481 A dated January 5, 2004, and in the fax CEA/DEN/CAD/DTAP/SET DO 247.

The confinement boundary consists of:

- The packaging: its geometry (maximum diameter of the package to favor interactions, cage), the material, composition and thickness of the neutron absorber resin (hydrogen and boron content, thickness of charred resin).
- Internal arrangements: spacer's geometry, spacer's material (aluminum), container geometry (diameter, thickness), container material.
- Fissile material: criticality control by geometry and a mass limitation of fissile material, composition of the fissile material, nature of the content.

The assumptions are:

- Isolated package :
 - Water leakage in all free space of the package, including inside internal arrangements within the packaging cavity.
 - Cage and impact limiters are neglected.
 - The package is surrounded by a 20 cm thick layer of water.
 - The package is damaged, as after the regulatory normal and accidental conditions of transport (mechanical and thermal tests).
- Array of packages :
 - Water leakage in all free space of the package, including inside internal arrangements within the packaging cavity.
 - Cage and impact limiters are neglected.

- Space between packages is filled with air, and the array of packages is surrounded by a 20 cm thick layer of water as a reflector.
 - Packages are damaged as after the regulatory normal and accidental conditions of transport (mechanical and thermal tests); especially a layer of charred resin is replaced by air on a 10 mm thickness.
 - The array form is triangular.
 - The fissile material is arranged to maximize neutron interaction.
- The fissile material is a homogenized medium of $^{239}\text{Pu}_{\text{metal}} - \text{H}_2\text{O}$.

Criticality Safety Index: CSI = 5 (N number = 10).

5. PARTICULAR CONDITIONS

Packaging internal cavity as well as the internal arrangement cavity shall be filled with inert gas, as nitrogen or argon, prior to shipment, with a pressure of 1 bar absolute.

FIGURE 1
SKETCH OF THE FUTURIX/FTA DOE 1 à DOE 4 PINS

