U.S. Department
of Transportation

Pipeline and
Hazardous Materials
Safety Administration

400 Seventh St., S.W.
Washington, D.C. 20590

**COMPETENT AUTHORITY CERTIFICATION
FOR A TYPE B(U)F FISSILE
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0693/B(U)F-96, REVISION 0**

REVALIDATION OF FRENCH COMPETENT AUTHORITY CERTIFICATE F/379/B(U)F-96 (Aa)

This certifies that the radioactive materials package design described below 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 United States of America[2].

1. Package Identification - TN-106.

2. Packaging Description - as described in French Certificate of Approval No. F/379/B(U)F-96(Aa) dated May 3, 2002 (attached).

3. Authorized Radioactive Contents - Subject to the additional conditions listed in this certificate, the authorized contents are as described in Appendix 1a of French Certificate of Approval No. F/379/B(U)F-96 (Aa) dated May 3, 2002 (attached).

4. Criticality - The minimum criticality safety index is 0.0. The maximum number of packages per conveyance is determined in accordance with Table X of the IAEA regulations cited in this certificate.

5. 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 in accordance with the endorsed certificate.

   b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Technology (DHM-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. Records of Quality Assurance activities required by Paragraph 209 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 and consignees in the United States exporting or importing shipments under this certificate shall satisfy the requirements of Subpart H of 10 CFR 71.

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[1] "Regulations for the Safe Transport of Radioactive Materials, 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.

6. Special Conditions -

a. The content is limited to uranium dioxide (UO_2). The maximum mass of UO_2 must comply with the following table according to the enrichment in U-235 of the most highly enriched fuel element (or element part) present in the cavity and in accordance with the diameter of the internal arrangement designed for criticality purposes:

Enrichment in U-235 (% by mass)	**Mass UO_2 (kg) D = 6.0 cm**	**Mass UO_2 (kg) D = 12.0 cm**	**Mass UO_2 (kg) D = 20.3 cm**
5 < E ≤10	No restriction	No restriction	14.2
4 < E ≤ 5	No restriction	No restriction	53.0
≤4	No restriction	No restriction	No restriction

Contents that include multiple enrichments shall adhere to the limits corresponding to the highest enrichment present. Other contents such as those containing other uranium compounds, plutonium oxides, mixed oxides, solid fuel elements containing uranium, or other solid non-fissile radioactive material (except for the internal arrangement or any empty cladding having contained pellets from Content No. 1) are not authorized.

b. For transport in the United States, trunnions shall not be used as tie-down attachments. Package shall be mounted on a transport skid that cradles the package shell and is designed to meet the accelerations factors of 2g in the vertical direction, 5g in the lateral direction and 10g in the longitudinal direction shall be used.

c. Package may not be transported by air.

d. Radiation surveys of the specific areas identified in the French certificate (Appendix 0a, Section 3, "Conditions for Use of the Packaging") must include neutron dose rate measurements after loading the contents and prior to transport.

e. All sealed capsules contained within the packaging must be dry prior to transport.

f. The containment boundary seals shall be tested to show no leakage greater than 1×10^{-7} ref-cm^3/sec within the 12 month period prior to transport. prior to each shipment, after loading, the package shall show no leakage when tested to a sensitivity of at least 1×10^{-3} ref-cm^3/sec.

g. The cooling time for all contents must be a minimum of four years.

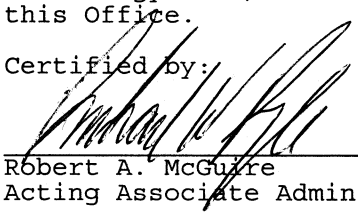
7. Marking and Labeling - The package shall bear the marking USA/0693/B(U)F-96 in addition to other required markings and labeling.

8. Expiration Date - This certificate expires on May 03, 2007.

CERTIFICATE USA/0693/B(U)F-96, REVISION 0

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 November 10, 2004 petition by Packaging Technology Inc., Tacoma, WA and in consideration of other information on file in this Office.

Certified by:



APR - 7 2006

Robert A. McGuire (DATE)
Acting Associate Administrator for Hazardous Materials Safety

Revision 0 - Issued to revalidate French Certificate of Approval No. F/379/B(U)F-96 (Aa) for limited contents and with additional conditions.

APPROVAL CERTIFICATE OF PACKAGE DESIGN

In the light of the request submitted by the **TRANSNUCLEAIRE** company in letter S/01-064 of 29 May 2001 and in the light of TRANSNUCLEAIRE Safety Analysis Report 5573-Z Rev. 2, the Competent French Authority,

certifies that the package design consisting of packaging **TN 106** described in Appendix 0a and loaded with:
- fuel pins or rods consisting of uranium oxide as described in Appendix 1a,
- fuel pins or rods consisting of plutonium oxide or mixed oxide of uranium and low plutonium content, as described in Appendix 2a,
- fuel pins or rods consisting of mixed oxide of uranium and high plutonium content, as described in Appendix 3a,
- fuel elements consisting of solid material containing uranium, as described in Appendix 5a.

complies, as a type B(U) package design loaded with fissile material and:

- loaded with solid non-fissile radioactive material as described in Appendix 4a,
- empty, contaminated or not.

complies, as a type B(U) package design,

with the stipulations of the regulations, agreements and recommendations listed below:

–Regulations for the Safe Transport of Radioactive Material from the International Atomic Energy Agency, No. TS-R-1 (1996 Edition, Revised),
- Decree of June 1st, 2001 concerning the carriage of dangerous goods by road,
- European Agreement concerning the international carriage of dangerous goods by road (ADR),
- Decree of June 5th, 2001 concerning the carriage of dangerous goods by rail,
- Regulations concerning the international carriage of dangerous goods by rail (RID),
- **Modified** Decree of March 12th, 1998 concerning the carriage of dangerous goods by inland navigation ways,
- Regulations concerning the safety of ships (RSN), section 411, enclosed to **modified** Decree of November 23th, 1987,
- International Maritime Dangerous Goods Code – International Maritime Organisation (IMDG Code),
- European Agreement concerning the international carriage of dangerous goods on the Rhine (ADNR).

This 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 is valid until **May 3rd, 2007**

Registration No.: **DGSNR/SD1/0382/2002**

PARIS, dated **May 3rd, 2002**

**For the Minister of the Economy, Finance and Industry,
and by delegation,
the Director of Nuclear Safety and Radiation Protection**

A.C. LACOSTE

**For the Minister of Public Works and the Environment
and by delegation,
the Director of Nuclear Safety and Radiation Protection**

A.C. LACOSTE

APPENDIX 0a

1. DESCRIPTION OF THE PACKAGING

The packaging, which is mostly cylindrical in shape, comprises a body, a welded front part and back part and two shock-absorbing covers.

The body bounds a cylindrical cavity of variable length which is fixed at the initial stages of manufacture, it is made up of the following from the inside outwards:

- An internal sheet stainless steel envelope,
- A primary biological shield (gamma shielding) made from lead,
- A secondary biological shield (neutron shielding) made from borated resin,
- An external sheet stainless steel envelope with a bed plate and handling and stowage devices.

The top end consists of a stainless steel flange welded to the shell to which the following is fitted:

- A revolving lead plug which provides access to the cavity,
- Two screwed clamps which hold the revolving plug in place,
- A revolving plug control orifice with a protective plug,
- A front lid for revolving plug maintenance,
- A front closure plate for loading contents,
- A vent orifice (orifice A).

The bottom end consists of a stainless steel flange welded to the shell to which the following is fitted:

- A stainless steel piston with a tungsten shield disc,
- A back closure plate providing access to the piston,
- A fill and drainage orifice (orifice B).

Two removable shock-absorbing covers made from balsa wood and plywood, covered by a stainless steel envelope are screwed to the ends to provide the packaging with shock-absorbance in the event of a drop. These shock-absorbing covers prevent access to the openings during transportation.

Leaktightness of the 6 openings (front lid, front closure plate, orifices A and B, revolving plug control, back closure plate), is ensured by double EPDM O-ring seals recessed in grooves. These systems make it possible to control leaktightness between the seals.

The main dimensions are as follows:

- Inner cavity:
  - Useful length (UL): Variable from 1000 to 2500 mm
  - Useful diameter: 203 mm

- Overall dimensions:
  - Total length: UL + 1424 mm (therefore ranges from 2424 and 3924 mm)
  - Length without shock-absorbing covers: UL + 778 mm (therefore ranges from 1778 and 3978 mm)
  - Diameter with shock-absorbing covers: 1458 mm
  - Diameter without shock-absorbing covers (at the trunnions): 958 mm
  - External diameter of the body: 820 mm

Maximum mass (in kg) of the loaded package (with shock-absorbing covers) as a function of the useful length UL (in m) is: 3374 x UL + 3910
(and therefore ranges between 7284 and 12345 kg).

The packaging is manufactured in compliance with TRANSNUCLEAIRE Safety Analysis Report 5573-Z Rev. 2 and, in particular, in accordance with TRANSNUCLEAIRE Design Drawing 5573-04 Ind. D.

2. INTERNAL ARRANGEMENTS

The contents (radioactive material) can be packaged in 2 types of internal arrangement:

- Internal arrangements which have a criticality-safety function whose geometry is preserved after normal and accident conditions of transport,

- Internal arrangements which facilitate the loading and unloading of material and/or prevent contamination of the cavity.

2.1 Internal arrangements for criticality purposes

The contents can be placed in leaktight or non-leaktight, stainless steel containers or canisters of type X2CrNi19-11 (standard NF EN 10088-2), or equivalent, with a cylindrical cross-section and variable useful diameter. The canister, whose schematic diagram can be found in Figure 2, is centred in the cavity by means of spacers. These canisters must comply with the following minimum thicknesses in accordance with the mass of the contents:

Arrangement of Internal Diameter Ø 120 mm	
Mass of contents, m in kg/m of the canister	**Minimum thickness (e) in mm**
≤ 55	3
≤ 95	5
≤ 115	6
≤ 130	7

Arrangement of Internal Diameter Ø 60 mm	
Mass of the contents, m in kg/m of the canister	**Minimum thickness (e) in mm**
≤ 10	3
≤ 18	5
≤ 27	7
≤ 32	8

The distance between spacers must be a maximum 300 mm. These spacers must be made from stainless steel type X2CrNi19-11 (standard NF EN 10088-2), or equivalent, and comply with the minimum thicknesses L shown below:

	Internal Diameter 120 mm	**Internal Diameter 60 mm**
Thickness of spacer L in mm	21	13

2.2 Internal Arrangements which Facilitate the Loading and Unloading of Material and/or which Prevent Contamination of the Cavity

The contents can be placed in internal arrangements made from aluminium or stainless steel which may or may not be leaktight.

These internal arrangements may take the form of an assembly of leaktight capsules per pin or rod, a leaktight or non-leaktight packaging canister, a holding rack, a sheath or a loading/unloading shovel for the fuel element assembly.

By capsule we mean the equivalent of leaktight fuel clad which can contain pieces of rods, pins or pellets.

By packaging canister we mean any metal container, cylindrical or otherwise, whose geometry is compatible with the cavity of packaging TN 106, whose capacity is variable and which can contain several types of fuel or radioactive materials as described in the appendices.

In the case of pins or rods, the internal arrangement may take the form of a holding rack.

These internal arrangements can be fitted together and added to the canisters mentioned in Section 2.1.

Examples of the loading/unloading shovel, the holding rack for 6 fuel rods, the leaktight capsule, the packaging canister and the sheath are given in Figures 4 to 8.

3. CONDITIONS FOR USE OF THE PACKAGING

The packaging must be used in accordance with the specifications set out in Chapter 6A of the Safety File.

- Inspection of the overall condition of the packaging prior to loading and of stowage points in particular,

- Inspection of the screws of the closure plates and lids handled during loading operations. In the event that any part should be found to be substandard, a thorough inspection of all closure plate and lid screws must be carried out.

When the packaging is loaded with the contents, it is essential to check that quality assurance inspections of **the proper closing of the canisters and containers** mentioned in 2.1 have been carried out.

The following operations will be carried out after loading the contents and prior to conveyance:

- Cavity drying (necessary only after water-filled loading),

  The cavity may be dried in a vacuum, by circulating dry hot air or by any other method which ensures a degree of dryness is achieved equivalent to that required by the following criterion concerning the re-establishment of pressure:
  Pressure ranging between 6 and 10 mbars and $\Delta P < 1$ mbar in 5 minutes.

- Screw tightening torque check,

	Front Closure Plate	Back Closure Plate	Revolving Plug Closure Plate	Orifice Closure Plates A and B	Shock-absorbing covers
Ref.	210	308	205	212/310	519
Dimensions	M16 x 35	M16 x 35	M8 x 35	M8 x 35	M20 x 55
Tightening torque in N.m	140	140	20	20	380

- Set the cavity to a negative pressure of 0.2 bar after closing the packaging. (The gas used to fill the cavity can be air or any other neutral gas.) In the particular case where the cavity is loaded with NUGG type irradiated fuel, the gas in the cavity must exclusively be a neutral gas (helium, nitrogen, etc.),

- Check that the sum of the leak rates between the seals is less than 6.65×10^{-5} $Pa.m^3.s^{-1}$ SLR,

- Install the anti-tamper seals,

- Check the non-fixed contamination level of the external surface of the package and compliance with statutory criteria,

- Check the dose rates (in compliance with the statutory allowable limits). This inspection will include verification of maximum values and the specific points expected around

certain areas of the package. For this purpose, scavenging will be carried out around the following areas:

- The area to the right of the mid-length of the packaging,
- The areas situated to the right of specific points, namely, the top and bottom trunnions, the areas where the thickness of the resin is reduced at the top and bottom ends, the closing system opposite the front shock-absorbing cover, the bottom of the packaging opposite the back shock-absorbing cover.

– Measurement of the temperature of the accessible surfaces T_C as explained in the following points a. and b,

a. Measure the temperature T_S of the accessible surfaces and the ambient temperature T_A.

b. Calculate the corrected temperature

$T_C = T_S + Tb - T_A$ (T_S, Tb, T_A expressed in °C).

Where Tb = 38°C

c. The criteria are:

If $50°C < T_C \leq 85°C$ Transport under exclusive use,

If $85°C < T_C$ Transport under exclusive use, equipped with a thermal barrier.

– In the case where stowage is liable to modify thermal dissipation, check that thermal analysis has been carried out taking into account the residual thermal power of the load, the characteristics of the stowage device used (type of canopy, collect tray, awning, etc.) and that it demonstrated compliance with the following criteria in normal transport conditions: the maximum temperature of the resin must not exceed 149°C allowing for adjustment of the thermal power of the contents to ensure that this temperature is not exceeded,

– The package must be transported in the horizontal position and must be equipped with a thermal protection barrier if the temperature of the surface exceeds the regulatory limit at thermal equilibrium,

– Fix the labels and check the regulatory markings,

– Complete the transportation documents.

4. STEPS TO BE TAKEN BY THE CONSIGNOR PRIOR TO SHIPMENT

Before each shipment, the consignor must take the following steps:

– Check compliance of the contents with the approval certificate,

5. MAINTENANCE PROGRAM

The packaging must be undergo periodic maintenance in accordance with the provisions of Chapter 7A of the Safety Analysis Report.

In particular, before the packaging is used for transportation, the following must be checked:

- Either the packaging was manufactured and brought into service less than three years ago and at the most 20 transport cycles ago, or the maintenance described below (maintenance A) was carried out less than three years ago and at the most 20 transport cycles ago :
  Inspection of the general condition of the packaging and in particular:
  - Inspection of the condition of the surface of the seal seats and stowage points (repair and polishing of the surfaces if necessary),
  - Inspection to ensure that the various removable or moving parts of the packaging are in good condition and in proper working order (plugs, closure plates, revolving plug, shock-absorbing covers, couplings, etc.),
  - Thorough inspection of tappings and screws (repair or replace if necessary),
  - Containment leaktightness check:
    Criterion: 1.33×10^{-5} $Pa.m^3s^{-1}$ SLR, the part arising from the welds should be less than 1×10^{-7} $Pa.m^3.s^{-1}$ SLR,
  - Visual inspection of the welds of the handling devices,
  - Visual inspection of the external condition (regulatory plate, inscription).
- Either the packaging was manufactured and brought into service less than six years ago and at the most 60 transport cycles ago, or the maintenance described below was carried out less than six years ago and at the most 60 transport cycles ago :
  Maintenance A in addition to:
  - Visual inspection of the internal containment,
  - Dimensional inspection of the trunnions,
  - Leaktightness check of the shock-absorbing covers,
  - Dye-penetrant testing of the welds of handling devices,
  - Replacement of fusible plugs,
  - Replacement of all seals.

6. MARKING

All packaging manufactured according to the package design covered by this approval certificate must bear the cloverleaf symbol on its outer surface, either etched, stamped or reproduced by any means so as to be fire and water resistant.
The outer surface of all TN 106 packaging shall also display the following marked legibly and durably:

- The gross allowable mass of the packaging,
- The identification number F/379/B(U)F-96 on an engraved plate,
- A serial number given by the manufacturer and specific to each packaging which complies with this design,
- The "TYPE B(U)" identification sign,
- Each package must display identification of the consignor, the consignee or both on the outer surface of the packaging,
- For each package, the UN number preceded by the letters "UN" and the official designation of transport must be marked on the outer surface of the packaging

7. NOTIFICATION AND RECORDING OF SERIAL NUMBERS

The owner of a packaging manufactured according to the design covered by this approval certificate will forward the packaging serial number to the Competent French Authority. If a packaging is withdrawn from service or changes owners, the Competent French Authority must be informed. Consequently, an owner relinquishing ownership of a packaging will forward the name of the new owner. The consignor of a packaging which complies with the design covered by this approval certificate will ensure that the packaging carries a serial number.

8. QUALITY ASSURANCE PROGRAMME

The Quality Assurance principles are described in Chapter 8A of the Safety Analysis Report.

FIGURE 1

DIAGRAM OF PACKAGING TN 106

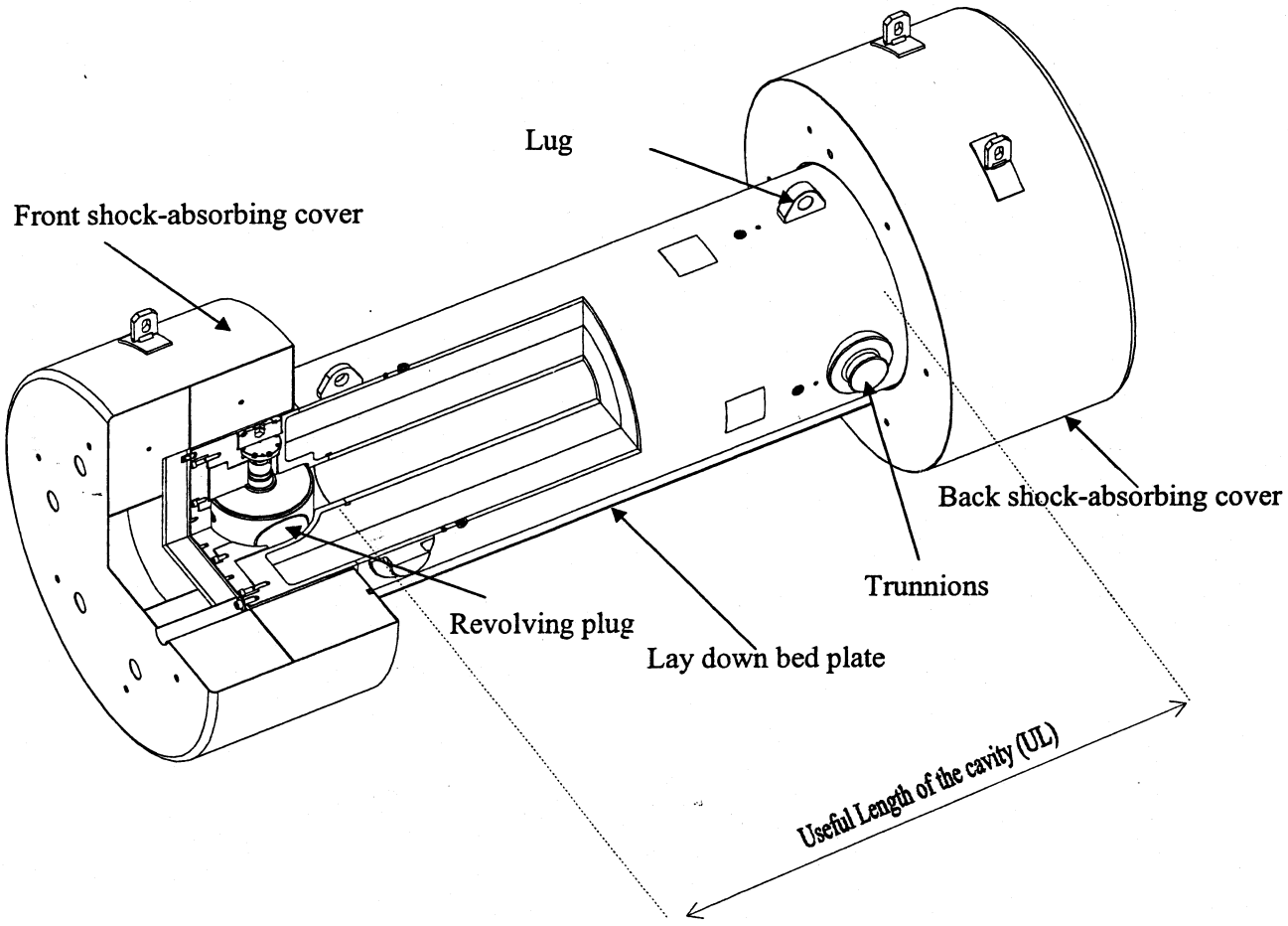


FIGURE 2

DIAGRAM OF A CANISTER

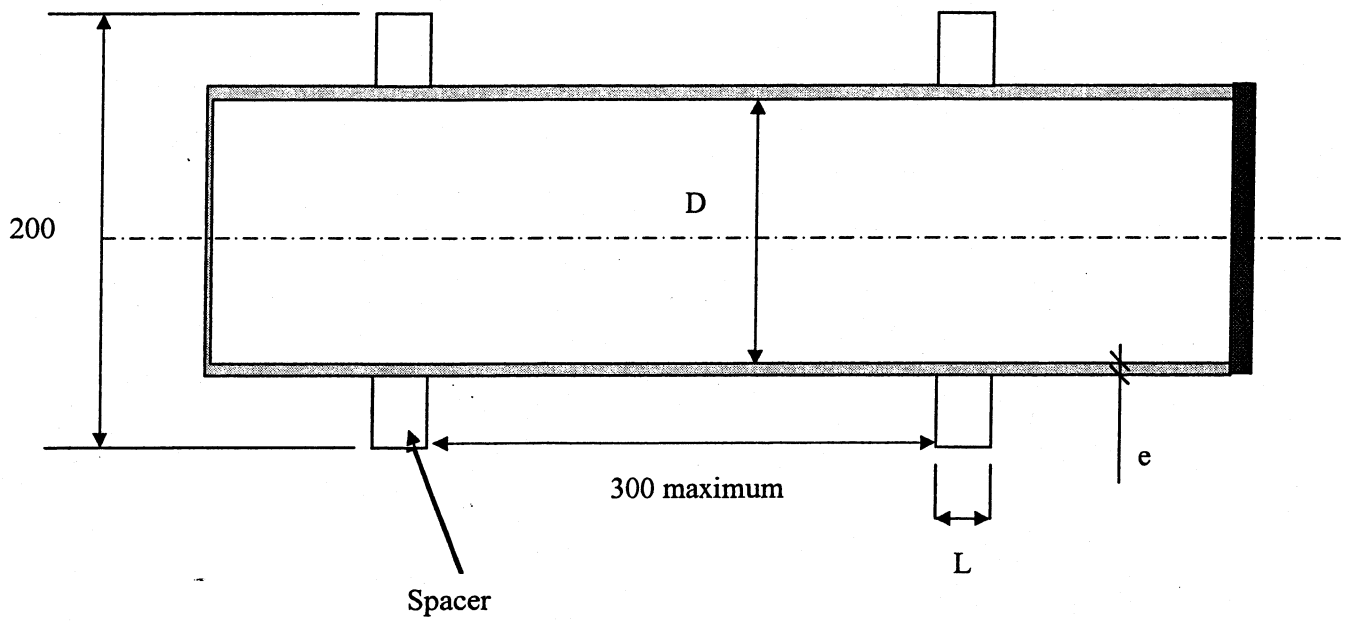


FIGURE 3

PACKAGING ORIFICE DETAILS

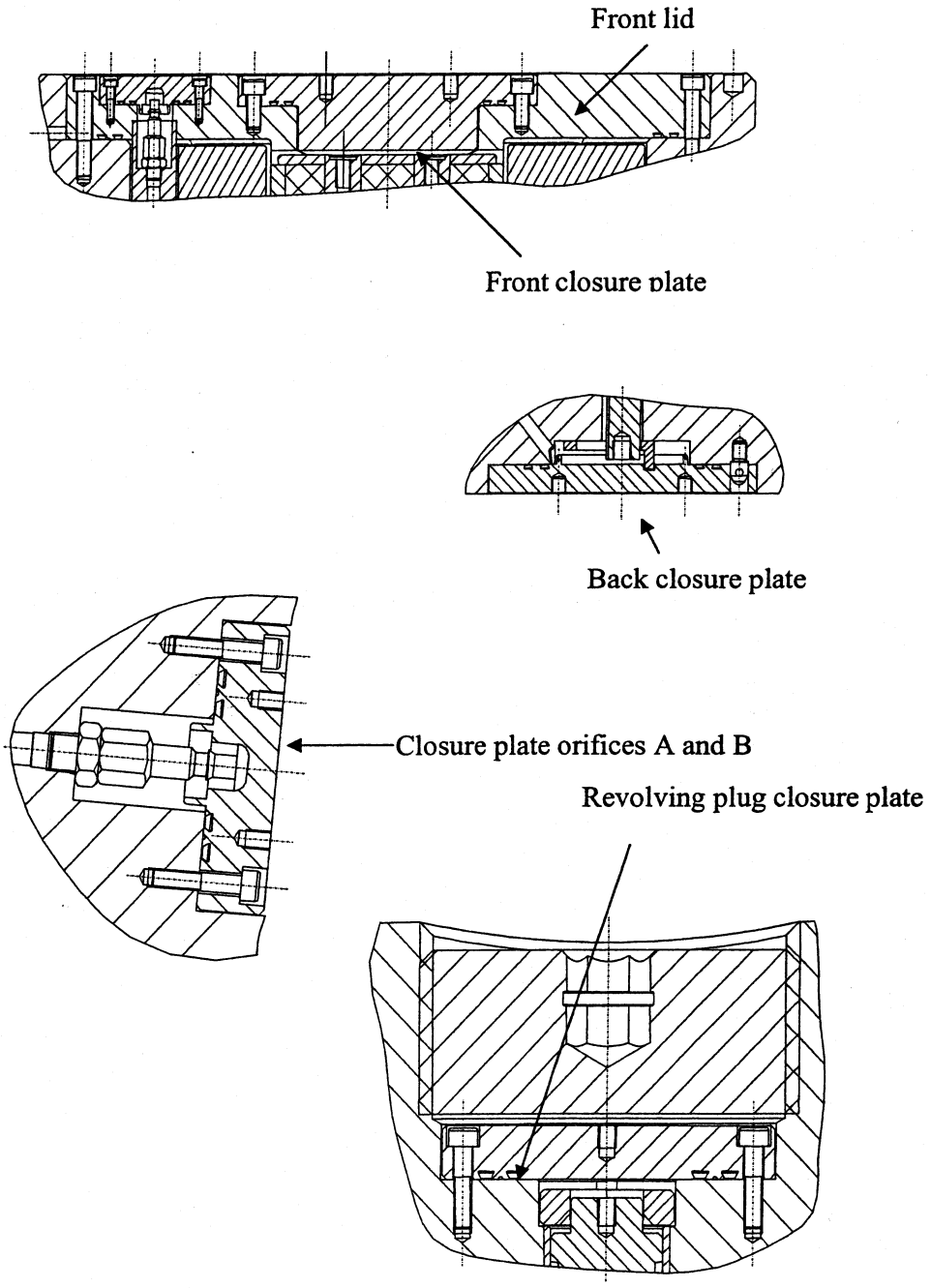


FIGURE 4

EXAMPLE OF A LOADING/UNLOADING SHOVEL

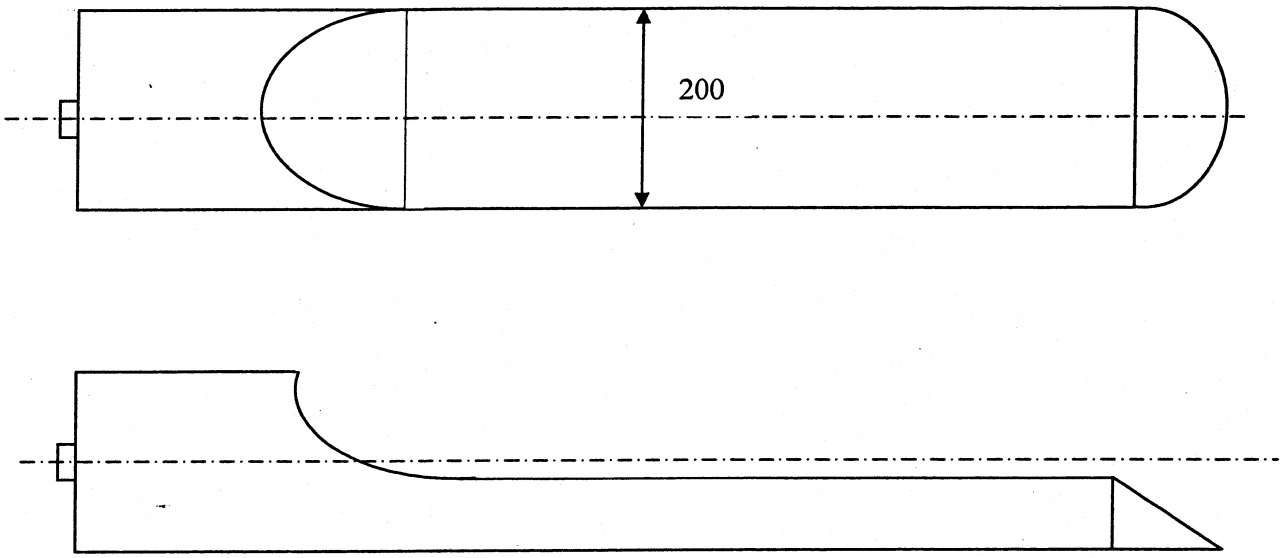
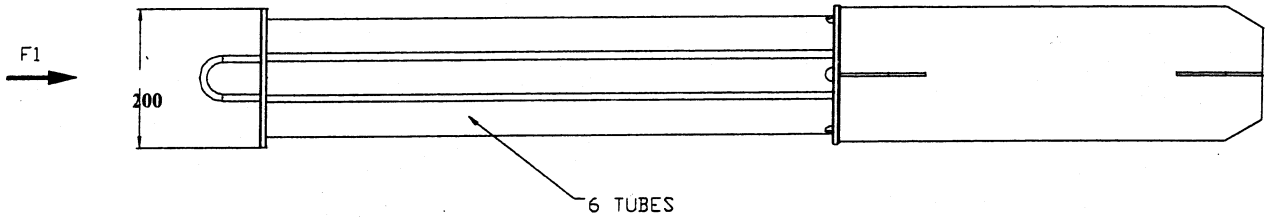
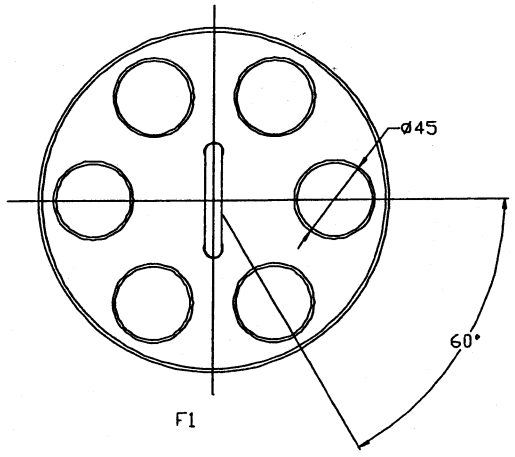


FIGURE 5

EXAMPLE OF A
6 FUEL ROD HOLDING RACK





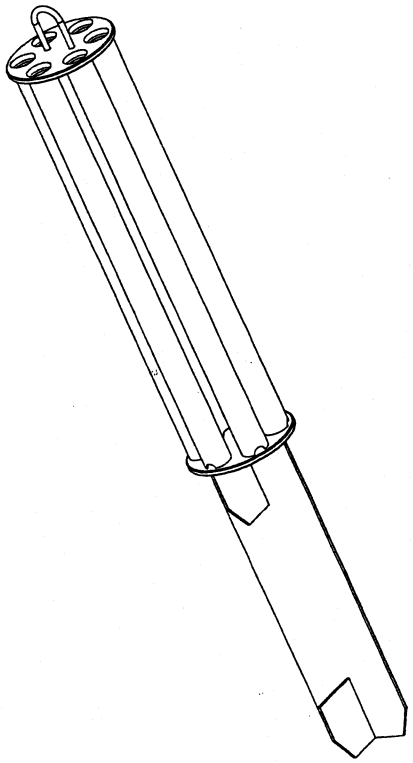
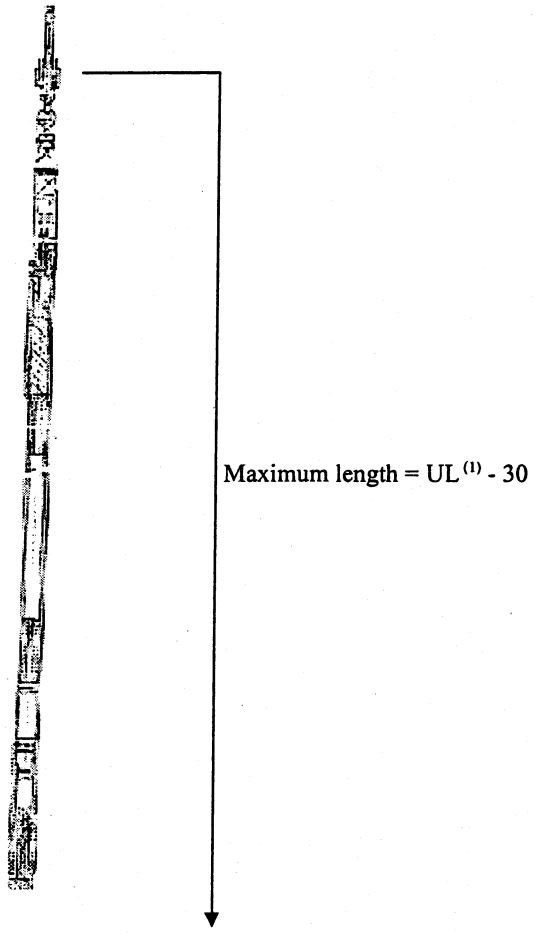


FIGURE 6

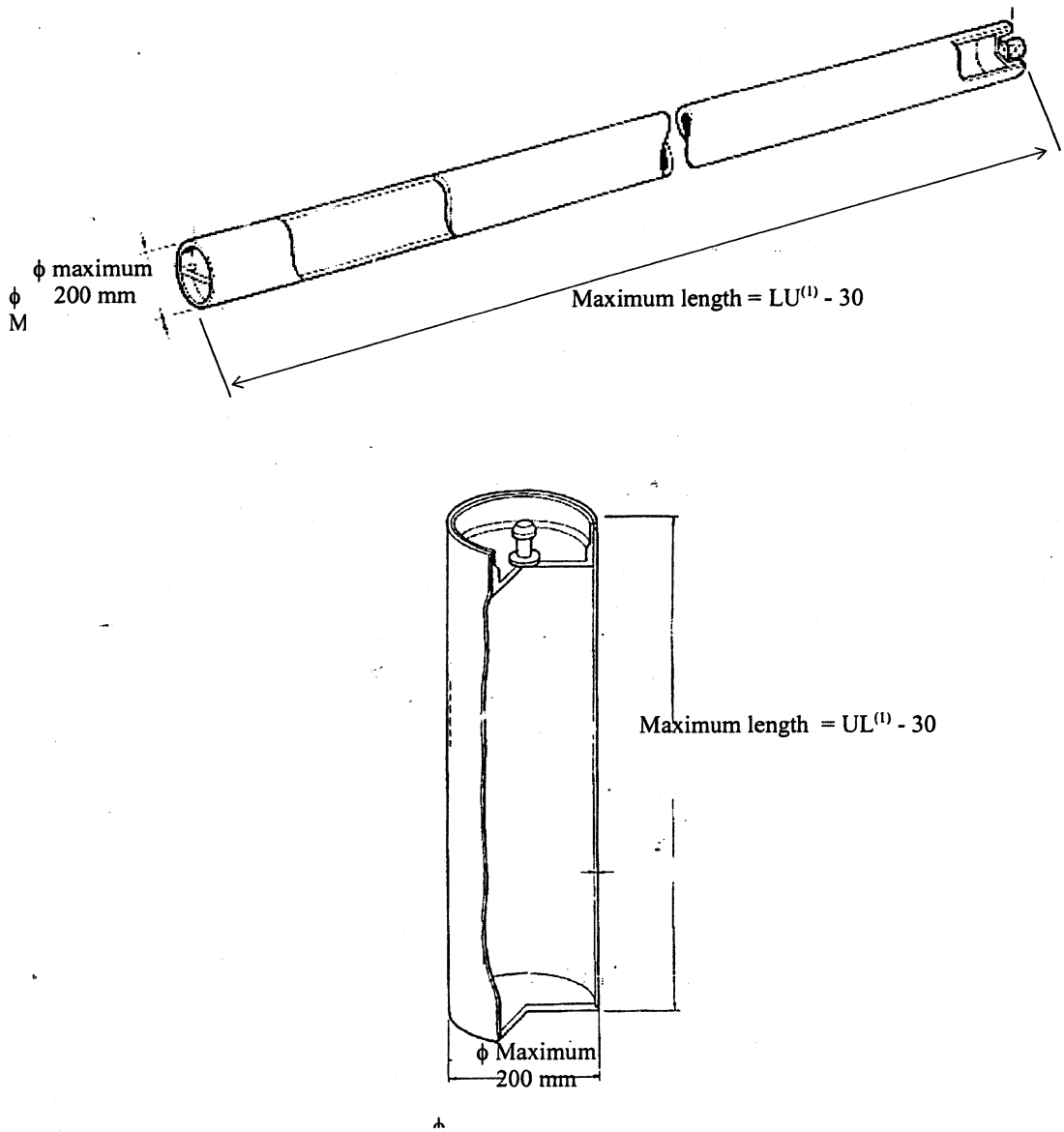
EXAMPLE OF A LEAKTIGHT CAPSULE



(1): UL: Useful length of the packaging cavity (in mm)

FIGURE 7

EXAMPLE OF A PACKAGING CANISTER

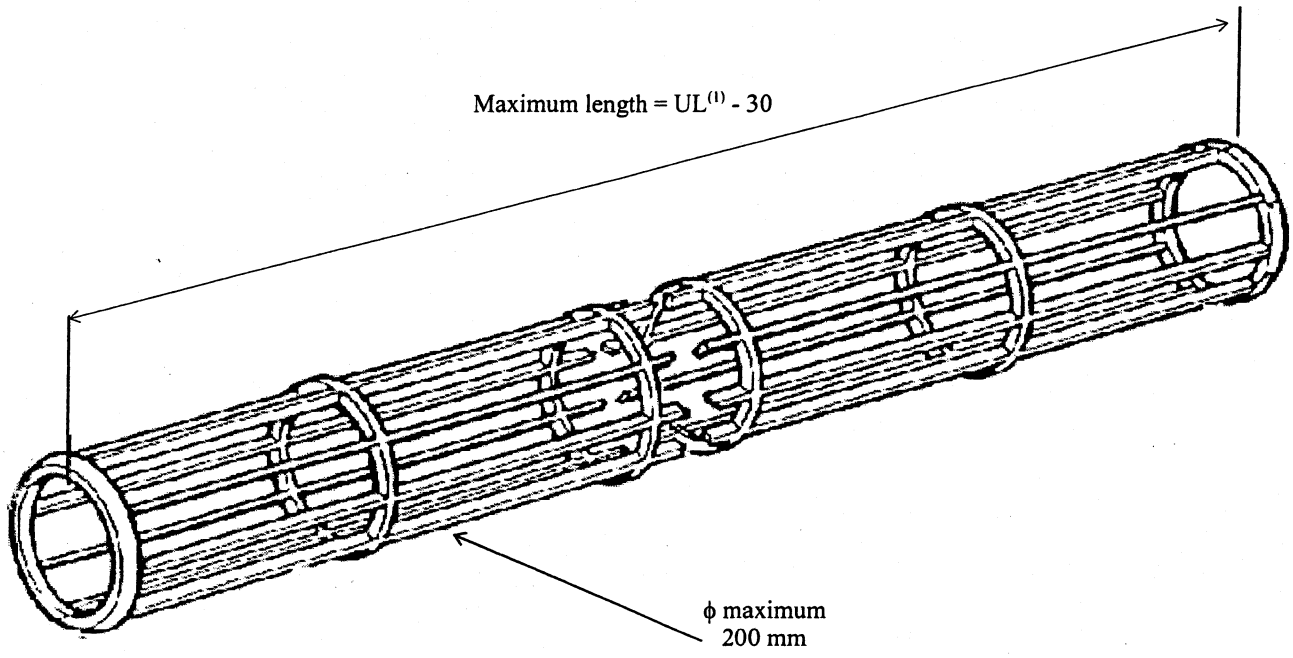


(1): UL: Useful length of the packaging cavity (in mm)

The closure system and the base of the canisters shown in this diagram are for information purposes only. Other systems may be envisaged in order to facilitate operation:

FIGURE 8

EXAMPLE OF A SHEATH



(1): UL: Useful length of the packaging cavity (in mm)

APPENDIX 1a

CONTENTS No.1

FUEL PINS OR RODS CONSISTING OF URANIUM OXIDE

1. DESCRIPTION OF THE ELEMENTS

Physical properties

These are fuel elements or pieces of fuel elements which may or may not be irradiated, typically, rods or pieces of rods whose clad may be pressurized or unpressurized. The geometric properties (diameter, thickness and nature of the cladding, etc.) does not matter. The maximum allowable mass of the contents (including the internal arrangements) must not exceed 254 kg/m of the cavity.

Geometry

The maximum cross-section of the contents must fit into a circle of diameter 203 mm.

Physical-chemical characteristics of the material

The material is uranium oxide, on its own or in inert matrices (excluding graphite and beryllium).

The density of the oxide does not matter.

Maximum quantity of fissile material

The maximum masses of uranium 235 and total uranium must comply with the values set out in the table below according to the enrichment in ^{235}U e_{max} of the most highly enriched fuel element (or element part) present in the cavity and in accordance with diameter D of the internal arrangement designed for criticality purposes:

Enrichment in ^{235}U expressed as %	**D=60 mm**	**D=120 mm**	**Cavity without internal arrangement designed for criticality purposes**	
	Mass of ^{235}U and U_t (kg)	**Mass of ^{235}U and U_t (kg)**	**Mass of ^{235}U (kg)**	**Mass of U_t (kg)**
e_{max}* ≤10	No restriction	No restriction	m ≤ 1.42	M ≤ (142/e_{max})
e_{max}* ≤5	No restriction	No restriction	m ≤ 2.33	M ≤ (233/e_{max})
e_{max}* ≤4	No restriction	No restriction	No restriction	No restriction

** The parameter e_{max} corresponds to the maximum value of the enrichment of the uranium in uranium 235 present in the cavity expressed as percentage by mass.*

Burn-up

The burn-up must be less than or equal to 100,000 MWj/tU.

Cooling time

The cooling time must be a minimum of 3 months.

Maximum quantity of fuel

The quantities of fuel and filling gas for the rods must comply with the values set out in the following table:

	Contents with at least one pressurized clad	Contents with no pressurized clad
Mass of heavy metal (kg/m of the cavity)	≤ 91	≤ 124
Mass of heavy metal contained in the clad (kg/m)	≤ 1.82	≤ 2.48
Number of rods or pins	≤ 50	any
Characteristics of the rod filling gas at 20°C (in bar.cm^3)	≤ 35 x 20	0

The elements may or may not be packaged in cladding or capsules which are sound and leaktight at the time of loading.

Maximum thermal power given off by the contents

The maximum allowable thermal power is 500 W/m of the contents. The maximum linear power per rod is limited to 71.5 W/m.

Activity

The activity of the load shall be such that, given the nature and energy of the radiation emitted, the allowable dose rate limits around the package shall not be exceeded.

In addition, this activity must be less than 75 x U_L (in PBq) where U_L is the length of the cavity in meters.

Internal Arrangements

The contents may be packaged in internal arrangements as defined in Appendix 0a.

2. SAFETY ANALYSIS REPORT

The safety analysis report justifying of this contents is report TRANSNUCLEAIRE 5573-Z Revision 2.

3. CRITICALITY ANALYSIS

The criticality study is the subject of Chapter 5A of the safety analysis report and its Appendices 5A-1, Revision 2 of 14.11.2001.

The criticality analysis allows the presence of hydrogenated materials, with the exception of all those whose concentration of hydrogen is greater than that of water, and/or the penetration of water into all free spaces of the packaging including the containment system.

The confinement system is defined in Note 5573-B-27, Revision 0, of 11/04/2002.

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

Special Precautions to be Taken during Transportation: None