INSTRUCTIONS FOR THE USE OF THE TN-MTR CASK

CONTENTS

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SUMMARY

The cask must be used according to procedures complying with the specifications in Chapter 6A of the Safety Analysis Report.

In particular, after the loading of fuel assemblies (excluding CESOX content and caesium trap) and before the submittal of the package for transport:

- In the case of loading/unloading underwater: vacuum-dry the cavity by blowing dry, hot air or by any other method enabling the reaching of a drying level equivalent to the one corresponding to the criterion in Appendix 6A.1.

- In all cases, including loading/unloading underwater:

  - Pressure reduction in the cavity to 0.35 bar absolute upon completion of drying. The filling gas will be determined versus the transported thermal power, according to table 6A.2.

  - Checking of tightening of the lid screws, and the two closure plates in accordance with the requirements in table 6A.1. Tightening to the specified torque (with its uncertainty) is guaranteed by using a class B precision torque wrench (± 10%).

  - The leak test will be performed to fulfil the criteria in table 6A.3. For all leak tests, the leakage rate measurement uncertainties must be taken into account.

In particular, when loading a sealed radioactive source content in a special CESOX content form, it must be ensured:

- That the internal cavity of the cask, the internal fittings and the external surfaces of the CESOX radiological protection are decontaminated so that the non-fixed contamination complies with the following criteria (mean limits applicable for any area of 300 cm² of any part of the surface):
  - the surface activity is less than 4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;
  - the surface activity is less than 0.4 Bq/cm^2 for the other alpha emitters.
- Pressure reduction in the cavity to 0.35 bar absolute. The cavity is filled with air.
- Inspection of the torquing of the lid screws to the torques specified in table 6A.1. Tightening to the specified torque (with its uncertainty) is guaranteed by using a class B precision torque wrench (± 10%).
- The leak test will be performed to fulfil the criteria in table 6A.3. For all leak tests, the leakage rate measurement uncertainties must be taken into account.

In particular, during loading/unloading of the content of type “beryllium reflective elements”, ensure that:

- these loading/unloading operations proceed only underwater,
- during loading, the beryllium elements are secured in order to limit as far as possible any axial gaps in the housings.

In particular, when loading the caesium trap content, ensure that:

- the cavity of the internal fittings cavity is inerted with argon to a maximum pressure of 1.2 bars absolute
- the internal cavity of the cask and the internal fittings are decontaminated so that the non-fixed contamination complies with the following criteria (mean limits applicable for any area of 300 cm² of any part of the surface):
  - the surface activity is less than 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;
  - the surface activity is less than 40 Bq/cm^2 for the other alpha emitters.
- Inerting of the cask cavity according to the gas defined in table 6A.2 to a maximum pressure of 1.2 bars absolute.
- Inspection of the torquing of the lid screws to the torques specified in table 6A.1. Tightening to the specified torque (with its uncertainty) is guaranteed by using a class B precision torque wrench (± 10%).
- The leak test will be performed to fulfil the criteria in table 6A.3. For all leak tests, the leakage rate measurement uncertainties must be taken into account.

In particular, when loading the gisete content, ensure that:

- the internal cavity of the cask, the internal fittings and the external surfaces of the isotope generators are decontaminated so that the non-fixed contamination complies with the following criteria (mean limits applicable for any area of 300 cm² of any part of the surface):
  - the surface activity is less than 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;
  - the surface activity is less than 40 Bq/cm^2 for the other alpha emitters.
- The cavity is at atmospheric pressure according to the gas defined in table 6A.2.
- Inspection of the torquing of the lid screws to the torques specified in table 6A.1. Tightening to the specified torque (with its uncertainty) is guaranteed by using a class B precision torque wrench (± 10%).
- The leak test will be performed to fulfil the criteria in table 6A.3. For all leak tests, the leakage rate measurement uncertainties must be taken into account.

In all cases, irrespective of the cask contents, before submittal of the package for transport, the following will be done:

- The radiological inspections on the radiation intensity and non-contamination of the cask (in accordance with the regulatory permissible limits).
- The measurement of the temperatures on the accessible surfaces if the cask is loaded and the compliance with the criterion in appendix 6A.2.
- The fitting of the safety seals.
- The tie-down of the cask on the conveyance. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.

Irrespective of the transport mode and the configuration adopted, the cask must be transported in its ISO overpack (or equivalent).

The empty cask possibly loaded with internal fittings can be transported as an excepted package, provided the specific contamination and radiation intensity criteria are fulfilled.

In the case of rail transport, gravity shunting is prohibited, and the RID label no. 15 <1> must be affixed to the wagon in which the package is transported.

The welds on the tie-down lugs must be visually checked before each shipment.

1. GENERAL

This chapter contains the minimum instructions for use regarding safety of the TN-MTR package design in the following cases:

- loading/unloading of fuel elements or reflectors in wet condition:
  - with the standard lid;
- loading/unloading of fuel elements in dry condition:
  - with the SEC lid,
  - with the standard lid;
- loading/unloading of the CESOX content;
- loading/unloading of the caesium trap content;
- loading/unloading of the gisete content.

It also contains instructions for use and regulatory criteria that the shipper must follow for transport of the empty cask as an excepted package.

Of course, the operating instructions are liable to improvement, taking into account the unique requirements of each user, special precautions which may be applied by the Competent Authority, rules and codes applicable in the countries within which the cask is to be used and past experience.

Specific procedures may be drawn up from these instructions by users, including a check list that all operations have been correctly applied.

Note:

- In the rest of this chapter, the reference numbers in brackets refer to the bill of materials presented in Chapter 0, and also on the cask concept drawings (see Chapter 0 appendix 1).
- The word canister is taken to mean any can, canister or case authorised in Chapters 0A, with the exception of BR2 cans since the content of the latter is loaded and unloaded outside the cask. In this chapter, the procedures to follow for the BR2 can of the failed or disassembled BR2 content are those corresponding to a configuration without canister.
- For the attachment screws on the lid, orifice closure plates and shock absorbing cover, light lubrication must be applied to the screws using a “NEVER SEEZ High Temperature Stainless Nuclear Grade” lubricant (or similar regarding the friction coefficient) in order to ensure there is a thin film of grease on all the threads right around the screws and over the entire surface under the screw heads.
- The closure of all the cask screwed elements must preferentially be performed according to a “criss-cross or star” torquing method; another method may be used subject to prior approval by the designer.
- All the tightening operations will be performed using a class B precision torque wrench (± 10%) for screws where the tightening torques are indicated in table 6A.1.
- For all leak tests, the leakage rate measurement uncertainties must be taken into account.
- Irrespective of the transport mode and the configuration adopted, the cask must be transported in its ISO overpack (or equivalent).

– In the case of rail transport, gravity shunting is prohibited, and the RID label no. 15 <1> must be affixed to the wagon in which the package is transported.
– The welds on the tie-down lugs must be visually checked before each shipment.
– It is authorised to install tools on the cask tie-down lugs provided the maximum mass of the cask when handled (including tools) remains less than 30,100 kg as defined in Chapter 0 and that the load on one lug remains less than the load sustained during transport, i.e. 291 kN (see Chapter 1-3).

2. USING THE CASK WITH THE STANDARD LID (EXCLUDING CESOX CONTENT AND CAESIUM TRAP)

When the TN-MTR cask is equipped with the standard lid, the content can be loaded or unloaded underwater or in a cell if the opening diameter of the cell allows the lid to pass through.

The main instructions for use of the cask in the case of loading/unloading underwater are as follows (for loading/unloading in dry condition, the instructions are identical to those of the SEC lid).

2.1. Receiving the cask

The cask is delivered to the site on its vehicle. The following must be done as a minimum:

– Check compliance of the transport documents and especially the labelling of the cask and the vehicle,
– Check the cask condition and the presence of the safety seals,
– Release the cask from the vehicle, place the lifting beam on the cask trunnions and transfer the cask to its preparation area.

2.2. Preparing the cask before loading or unloading

Preamble:

The underwater loading/unloading operations described below are performed with a tool system specially developed by TN International. This tool system (called orifice B tool) uses cask orifice B and provides access to the cask cavity without breaking the containment.

It is also possible to use orifice A with another tool (orifice A tool) to perform some operations such as pressure adjustment in the cavity and cavity flooding and drying.

The cask is on its preparation area. The following must be done as a minimum:

– Unscrew the cover fastening screws (151), fit 4 M30 rings into the cover handling tappings and place the cover in its storage area.
– Unscrew the screws (350) and take off orifice B closure plate.
– Position the special-purpose tool on orifice B.
– Unscrew the tightening ring of the cover plate (336), check the pressure in the cask cavity.
– Restore the atmospheric pressure in the cavity.
– Remove the orifice cover plate (335) and make sure that there is no hang-up.

- Connect the flooding and vent/effluent lines to the tool installed on orifice B.
- Fill the cavity with water via the dip tube (180).
- Position the lid gripper on the lid.
- Remove all the screws (150) from the lid.
- Install the cask protectors against contamination in the pool, including the 9 plugs of the "Poral" pellets on the cask body.

2.3. Loading/unloading the cask

2.3.1. Without using canisters

The cask is filled with water, the following must be done as a minimum:

- Transfer the latter to the pool.
- Remove the lid and place it in its storage area after rinsing.
- Visually check the basket and verify there are no foreign objects in the basket housings
- If required, plug the housings to be left empty in accordance with the requirements indicated on the loading plan.
- Load/unload the cask (fuel elements or BR2 cans and wedges if necessary).
- If necessary remove the housing plugging devices.
- Refit the cask lid
- Transfer the cask to the preparation zone then decontaminate it.
- Position the parts protecting the cask against contamination in the pool, in particular the "Poral" pellet plugs after they have been decontaminated.

2.3.2. With use of canisters

The cask is filled with water, the following must be done as a minimum:

- Transfer the latter to the pool.
- Remove the lid and place it in its storage area after rinsing.
- Visually check the basket and verify there are no foreign objects in the basket housings
- If required, plug the housings to be left empty in accordance with the requirements indicated on the loading plan.
- Load/unload the cask.

Loading:

- load the canisters and the wedges if necessary into the cask if they have not been previously positioned during cask configuring, as per the pre-defined loading plan;
- Unlock the canister and place the plug in its storage area;

– load the fuel element;

– lock the canister with the transport plug.

– If necessary remove the housing plugging devices.

For unloading there are three possibilities:

1- - unload the canister directly, handling it using the transport plug gripping system

or

2- - unlock the transport plug, place the plug in its storage area and install the storage plug, then unload the canister by handling it using the handling plug gripping system

or

3- - unlock the canister and place the plug in its storage area;

- unload the fuel element;

- lock the canister with its plug.

– Position the lid on the cask,

– Transfer the cask to the preparation zone and decontaminate it,

– Position the parts protecting the cask against contamination in the pool, in particular the "Poral" pellet plugs after they have been decontaminated.

2.4. Preparation before shipment

– Dry and wipe off the water on the lid surface and in the tappings of the fastening screws of the lid (150) and cover (151),

– Take off the lid gripping tool,

– Fit all the lid fastening screws (150) without tightening them. Wait for a minimum time of 10 minutes before tightening the screws in accordance with the requirements in table 6A.1. The waiting time is justified in Appendix 6A.4.

– Drain the cavity using the B orifice tool.

– Connect the drying line to the orifice B tool,

– Dry the cavity by blowing dry, oil-free air (or even hot air) and then by creating a vacuum, or by any other method enabling the reaching of a drying level equivalent to the one corresponding to the pressure rise criterion in appendix 6A.1,

– By raising the pressure, leak-test the lid gaskets. Also leak-test the M20 plug for the beryllium element content,

– Adjust the cavity pressure to 0.35 bars absolute then install the orifice cover plate and its clamping ring. The choice of cavity fill gas must be in agreement with table 6A.2.

– Remove the orifice B tool and install the orifice B closure plate. Tighten the orifice closure plate screws in accordance with the requirements in table 6A.1.

- Leak-test the orifice A closure plate and the orifice B closure plate by increasing the pressure. The closure plate inner gaskets must be tested by volumetric inspection (or by an equivalent method), Also leak-test the M20 plugs on the test orifices of the 2 closure plates in the case of the beryllium element content.
- Check that the leak-tightness criteria of table 6A.3 are met. The measurement uncertainties on the leakage tests must be taken into account.
- Conduct the radiological inspections on the radiation intensity and non-contamination of the cask, according to the required zones in Appendix 6A.3. Check compliance with the regulatory criteria.
- Position the cover on the cask, tighten the screws (151) according to the requirements in table 6A.1 and affix the safety seals to the cover.
- Take the lifting rings off the cover.
- Complete the radiological inspections.
- Take the temperature measurements on the accessible surfaces if the cask is loaded and meet the criterion of appendix 6A.2,
- Carry out package regulatory labelling and marking,
- Install the lifting beam on the cask,
- Check the cleanliness of the vehicle, together with the non-obstruction of its openings,
- Transfer the cask to the vehicle and deposit it,
- Stow and tie down the cask on the vehicle. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.
- Conduct the radiological inspections around the vehicle,
- Position the regulatory placards and warning signs on the vehicle,
- Complete the transport documents.

2.5. Inspection before shipment

During each transport cycle, the users will make sure to perform the following inspection operations:

- Visually inspect the overall cask condition (cover, trunnions, lids, tie-down lug welds, etc.).
- Inspect the removed screws (including the lid and closure plate screws) and replace if necessary.
- Inspect the lid and closure plate gasket bearing surfaces; inspect the gaskets and replace if necessary.
- Check that the test plugs are not damaged and replace if necessary.

3. USE OF THE CASK WITH THE SEC LID (EXCLUDING CESOX CONTENT AND CAESIUM TRAP)

When the TN-MTR cask is equipped with the SEC lid, it is only possible to perform the loading/unloading operations in dry conditions under shielded cells.

In this configuration, the main instructions for using the cask are as follows:

3.1. Receiving the cask

The cask is delivered to the site on its vehicle. The following must be done as a minimum:

- Check compliance of the transport documents and especially the labelling of the cask and the vehicle.
- Check the cask condition and the presence of the safety seals.
- Release the cask from the vehicle, place the lifting beam on the cask trunnions and transfer the cask to its preparation area.

3.2. Preparing the cask before loading or unloading

Preamble:

The operations to obtain atmospheric pressure or reduce pressure can be performed via orifices B or via orifice A.

The cask is on its preparation area. The following must be done as a minimum:

- Unscrew the cover fastening screws (151), fit 4 M30 rings into the cover handling tappings and place the cover in its storage area.
- Restore the atmospheric pressure in the cavity by means of orifice A.
- Unscrew the screws (150) of the upper lid (801) and remove the latter.

3.3. Loading/unloading the cask

With or without using canisters

The cask is at atmospheric pressure and the top lid has been removed. As a minimum the following must be done:

- Position the aligning parts under the cell. These parts are used to maintain the containment between the cask cavity and the cell.
- Transfer the cask under the cell and fit the latter to the cell.
- Take off the cell plug then the cask plug (802) and place them inside the cell.
- Visually check the basket and verify there are no foreign objects in the basket housings
- If required, plug the housings to be left empty in accordance with the requirements indicated on the loading plan.
- Load/unload the cask (fuel elements or BR2 cans and wedges if necessary).

With use of canisters

Loading:
- load the canisters into the cask if they have not been previously positioned during cask configuring, as per the pre-defined loading plan
- unlock the canister and place the plug in its storage area
- load the fuel element
- lock the canister with the transport plug

For unloading there are three possibilities:

1- unload the canister directly, handling it using the transport plug gripping system

or

2- unlock the transport plug, place the plug in its storage area and install the storage plug, then unload the canister by handling it using the storage plug gripping system

or

3- - unlock the canister and place the plug in its storage area

- unload the fuel element

- lock the canister with its plug

–If necessary remove the housing plugging devices.

–Put the plug (802) back on the cask, taking care of its indexing so as not to damage the dip tube and re-close the cell,

–Release the cask from the cell and take off the aligning parts,

–If needed, decontaminate the accessible surfaces.

–Position the upper lid (801) on the cask.

–Transfer the cask to the preparation zone.

3.4. Preparation before shipment

– Fit all the lid fastening screws (150) without tightening them. Wait for a minimum time of 10 minutes before tightening the screws in accordance with the requirements in table 6A.1. The waiting time is justified in Appendix 6A.4.

– By raising the pressure, leak-test the lid gaskets.

– Adjust the pressure in the cavity to 0.35 bar absolute. Ensure that the filling gas meets the thermal power criteria in table 6A.2. Remove the orifice A tool and install the orifice A closure plate. Tighten the orifice closure plate screws in accordance with the requirements in table 6A.1.

– Leak-test the orifice A closure plate and the orifice B closure plate by increasing the pressure. The closure plate inner gaskets must be tested by volumetric inspection (or by an equivalent method),

– Check that the leak-tightness criteria of table 6A.3 are met. The measurement uncertainties on the leakage tests must be taken into account.

- Conduct the radiological inspections on the radiation intensity and non-contamination of the cask, according to the required zones in Appendix 6A.3. Check compliance with the regulatory criteria.
- Position the cover on the cask, tighten the screws (151) according to the requirements in table 6A.1 and affix the safety seals to the cover.
- Take the lifting rings off the cover and fit the protection plugs of the M30 tapped holes and cover screw sleeves.
- Take the temperature measurements on the accessible surfaces if the cask is loaded and meet the criterion of appendix 6A.2.
- Carry out package regulatory labelling and marking.
- Transfer the cask to the vehicle and deposit it.
- Stow and tie down the cask on the vehicle. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.
- Conduct the radiological inspections around the vehicle.
- Position the regulatory placards and warning signs on the vehicle.
- Complete the transport documents.

3.5. Inspection before shipment

During each transport cycle, the users will make sure to perform the following inspection operations:

- Visually inspect the overall cask condition (cover, trunnions, lids, tie-down lug welds, etc.).
- Inspect the removed screws (including the lid and closure plate screws) and replace if necessary.
- Inspect the lid and closure plate gasket bearing surfaces; inspect the gaskets and replace if necessary.
- Check that the test plugs are not damaged and replace if necessary.

4. USING THE CASK WITH THE CESOX CONTENT

For this package design, the TN-MTR cask is equipped with the standard lid. The CESOX content can only be loaded or unloaded in dry condition.

In this configuration, the main instructions for using the cask are as follows:

4.1. Receiving the cask

The cask is delivered to the site on its vehicle, that may or may not be equipped with the CESOX internal fittings. The following must be done as a minimum:

- Check compliance of the transport documents and especially the labelling of the cask and the vehicle.
- Check the cask condition and the presence of the safety seals.

– Check using the Transport File that the radiological condition (contamination) is compatible with this type of loading.

– Release the cask from the vehicle, place the lifting beam on the cask trunnions and transfer the cask to its preparation area.

4.2. Preparing the cask before loading or unloading

Preamble:

The operations to obtain atmospheric pressure or reduce pressure can be performed via orifice B or via orifice A.

The cask is on its preparation area. The following must be done as a minimum:

– Unscrew the cover fastening screws (151), fit 4 M30 rings into the cover handling tappings and place the cover in its storage area.

– Unscrew the screws (350) and take off the orifice A closure plate,

– Position the orifice A tool if necessary,

– Restore the atmospheric pressure in the cavity.

– Position the lid lifting parts on the lid,

– Remove all the screws (150) from the lid.

– Remove the lid and place it in its storage area,

4.3. Loading/unloading the cask

– Load/unload the cask:

  – Loading:

    – Ensure the contamination readings for the cask's internal cavity, the internal fittings and the external surfaces of the CESOX radiological protection are within the following limits: (Mean limits applicable for any area of 300 cm^2 of any part of the surface):

      - the surface activity is less than 4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;

      - the surface activity is less than 0.4 Bq/cm^2 for the other alpha emitters.

    – Position the radial wedge at the bottom of the cavity (if it has not already been installed), and remove the handling rings once the wedge is in place. Check there are no foreign objects within the radial wedge housing.

    – Load the CESOX content using the handling system (rings, lifting beam, etc.), remove these handling systems once the content has been positioned.

    – Position the axial wedge using the handling rings, and remove these handling devices once the wedge is in place,

    – Position the lid on the cask,

- Unloading:
  - Proceed in reverse order to the above loading operations.

4.4. Preparation before shipment

- Take off the lid lifting parts,
- Fit all the lid fastening screws (150) without tightening them. Wait for a minimum time of 10 minutes before tightening the screws in accordance with the requirements in table 6A.1. The waiting time is justified in Appendix 6A.4.
- By raising the pressure, leak-test the lid gaskets.
- Adjust the pressure in the cavity to 0.35 bar absolute. The cavity is filled with air; Remove the orifice A tool and install the orifice A closure plate. Tighten the orifice closure plate screws in accordance with the requirements in table 6A.1.
- Leak-test the orifice A closure plate and the orifice B closure plate by increasing the pressure. The closure plate inner gaskets must be tested by volumetric inspection (or by an equivalent method),
- Check that the leak-tightness criteria of table 6A.3 are met. The measurement uncertainties on the leakage tests must be taken into account.
- Conduct the radiological inspections on the radiation intensity and non-contamination of the cask, according to the required zones in Appendix 6A.3. Check compliance with the regulatory criteria.
- Position the cover on the cask, tighten the screws (151) according to the requirements in table 6A.1 and affix the safety seals to the cover.
- Take the lifting rings off the cover and fit the protection plugs of the M30 tapped holes and cover screw sleeves.
- Complete the radiological inspections,
- Take the temperature measurements on the accessible surfaces if the cask is loaded and meet the criterion of appendix 6A.2.
- Carry out package regulatory labelling and marking.
- Position the lifting beam on the cask,
- Transfer the cask to the vehicle and deposit it.
- Stow and tie down the cask on the vehicle. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.
- Conduct the radiological inspections around the vehicle.
- Position the regulatory placards and warning signs on the vehicle.
- Complete the transport documents.

4.5. Inspection before shipment

During each transport cycle, the users will make sure to perform the following inspection operations:

– Visually inspect the overall cask condition (cover, trunnions, lids, tie-down lug welds, etc.).

– Inspect the removed screws (including the lid screws) and replace if necessary.

– Inspect the lid and closure plate gasket bearing surfaces; inspect the gaskets and replace if necessary.

– Check that the test plugs are not damaged and replace if necessary.

5. USING THE CASK WITH THE CAESIUM TRAP CONTENT

For this package design, the TN-MTR cask is equipped with the standard lid. The caesium trap content can only be loaded or unloaded in dry condition.

The caesium trap content is described in chapter 0A-13 of this file. It consists of internal fittings in which a caesium trap is placed.

5.1. Loading/unloading the caesium trap in the internal fittings

Prior to loading the caesium trap in the internal fittings, the following must be done as a minimum:

– Check the caesium trap complies with the definition of content in Chapter 0A-13. In particular:

– Ensure the non-fixed contamination readings on the caesium trap's external surface comply with the following limits: (Mean limits applicable for any area of 300 cm^2 of any part of the surface):

- the surface activity is less than 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;

- the surface activity is less than 40 Bq/cm^2 for the other alpha emitters.

– Ensure the dose equivalent rates in contact with the surface of the caesium trap are less than or equal to 2 mSv/h.

<u>Loading the caesium trap:</u>

The internal fittings are placed in their preparation area, without their lid (200), flange (300) or wedges (500).

– Load the caesium trap in the internal fitting body using a handling system (rings, lifting beam, etc.), remove these handling systems once the trap has been positioned.

– Place the flange (300) on the top disc (103) of the internal fittings using a handling system (rings, lifting beam, etc.), remove these handling systems once the flange has been positioned.

– If necessary place the wedges (500) on the caesium trap to comply with the maximum 4 mm axial gap between the content (caesium trap + wedge) and the internal fitting's lid (200), as defined in the safety requirement drawing in Chapter 0A-13-1,

– Position the lid (200) of the internal fittings using a handling system (rings, lifting beam, etc.), remove these handling systems once the flange has been positioned.

- Position and tighten the screws (V1) and washer (R1).
- Inert the cavity of the internal fittings with argon to a maximum pressure of 1.2 bars absolute

Unloading of the trap:

- Restore the atmospheric pressure in the cavity of the internal fittings.
- Unscrew the V1 screws on the lid (200) and remove it using a handling system (rings, lifting beam, etc.).
- Remove the wedges (500) then the flange (300) using a handling system (rings, lifting beam, etc.).
- Unload the caesium trap using a handling system (rings, lifting beam, etc.).

5.2. Preparing the cask before loading or unloading

The cask is on its preparation area. The following must be done as a minimum:

- Unscrew the cover fastening screws (151), fit 4 M30 rings into the cover handling tappings and place the cover in its storage area.
- Unscrew the screws (350) and take off the orifice A closure plate,
- Position the orifice A tool if necessary,
- Restore the atmospheric pressure in the cavity.
- Position the lid lifting parts on the lid,
- Remove all the screws (150) from the lid.

5.3. Loading/unloading the cask

- Remove the lid and place it in its storage area,
- Load/unload the cask:
  - Loading:
    - Ensure the non-fixed contamination readings of the cask inner cavity and of the internal fittings conform to the following limits: (Mean limits applicable for any area of 300 cm^2 of any part of the surface):
      - the surface activity is less than 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;
      - the surface activity is less than 40 Bq/cm^2 for the other alpha emitters.
    - Load the internal fittings using the handling rings (A2).
    - Fold down the handling rings (A2) on the closure disc of the internal fittings (201).
    - Position the lid on the cask,
  - Unloading:
    - Unload the cask's internal fittings using the handling rings (A2)

5.4. Preparation before shipment

- Take off the lid lifting parts,
- Position all the lid fastening screws (150) and tighten them.
- By raising the pressure, leak-test the lid gaskets.
- Inert the cask cavity with the filling gas defined in table 6A.2 to a maximum pressure of 1.2 bars absolute. Remove the orifice A tool and install the orifice A closure plate. Tighten the orifice closure plate screws in accordance with the requirements in table 6A.1.
- Leak-test the orifice A closure plate and the orifice B closure plate by increasing the pressure. The closure plate inner gaskets must be tested by volumetric inspection (or by an equivalent method),
- Check that the leak-tightness criteria of table 6A.3 are met. The measurement uncertainties on the leakage tests must be taken into account.
- Conduct the radiological inspections on the radiation intensity and non-contamination of the cask, according to the required zones in Appendix 6A.3. Check compliance with the regulatory criteria.
- Position the cover on the cask, tighten the screws (151) according to the requirements in table 6A.1 and affix the safety seals to the cover.
- Take the lifting rings off the cover and fit the protection plugs of the M30 tapped holes and cover screw sleeves.
- Complete the radiological inspections,
- Carry out package regulatory labelling and marking.
- Position the lifting beam on the cask,
- Transfer the cask to the vehicle and deposit it.
- Stow and tie down the cask on the vehicle. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.
- Conduct the radiological inspections around the vehicle.
- Position the regulatory placards and warning signs on the vehicle.
- Complete the transport documents.

5.5. Inspection before shipment

During each transport cycle, the users will make sure to perform the following inspection operations:

- Visually inspect the overall cask condition (cover, trunnions, lids, tie-down lug welds, etc.).
- Inspect the removed screws (including the lid screws) and replace if necessary.
- Inspect the lid and closure plate gasket bearing surfaces; inspect the gaskets and replace if necessary.
- Check that the test plugs are not damaged and replace if necessary.

6. USING THE CASK WITH THE GISETE CONTENT

For this package design, the TN-MTR cask is equipped with the standard lid. The gisete content can only be loaded or unloaded in dry condition.

The gisete content is described in chapter 0A-14 of this file.

Only the following loading configurations are authorised:

- Gisete 4 content with gisete 4 internal fittings;
- Gisete 5 content with gisete 5 internal fittings;
- Gisete 8 content with gisete 8 internal fittings.

6.1. Preparing the cask before loading or unloading

Preamble:

The operations to obtain atmospheric pressure or reduce pressure can be performed via orifice B or via orifice A.

The cask is on its preparation area. The following must be done as a minimum:

- Unscrew the cover fastening screws (151), fit 4 M30 rings into the cover handling tappings and place the cover in its storage area.
- Unscrew the screws (350) and take off the orifice A closure plate,
- Position the orifice A tool if necessary,
- Restore the atmospheric pressure in the cavity.
- Position the lid lifting parts on the lid,
- Remove all the screws (150) from the lid.
- Remove the lid and place it in its storage area,

6.2. Loading/unloading the cask

- Load/unload the cask:
  - Loading:
    - Ensure the non-fixed contamination readings for the cask's internal cavity, the internal fittings and the external surfaces of the isotope generator body are within the following limits: (Mean limits applicable for any area of 300 cm^2 of any part of the surface):
      - the surface activity is less than 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters;
      - the surface activity is less than 40 Bq/cm^2 for the other alpha emitters.
    - If the cask must be loaded with the gisete 4 type content:
      - If it is not already present, position the radial wedge for the gisete 4 internal fittings at the bottom of the cavity. Check there are no foreign objects within the radial wedge housing.

- Load the gisete content using the handling system (rings, lifting beam, etc.), remove these handling systems once the content has been positioned.

– If the cask must be loaded with gisete 5 or gisete 8 content:

- If it is not already present, position the radial wedge for the gisete 5 or 8 internal fittings at the bottom of the cavity using the lifting system (10). Check there are no foreign objects within the radial wedge housing.
- Load the gisete content using the handling system (rings, lifting beam, etc.), respecting the indexing mentioned in Chapter 0A-14 in the case of gisete 8 content, and remove these handling devices once the content has been put in place.

Remark: the radial wedge for the gisete 5 or gisete 8 internal fittings can be loaded with the gisete 5 or gisete 8 content first, before being loaded in the cask.

– Position the axial wedge using the handling rings, and remove these handling devices once the wedge is in place.

– Position the lid on the cask.

– Unloading:

– Unload the axial wedge using the handling rings.

– If the cask is loaded with the gisete 4 type content:

- Unload the gisete content using a handling system (rings, lifting beam, etc.).
- Unload the radial wedge (if necessary).

– In the case of gisete 5 or gisete 8 content:

- Unload the radial wedge loaded with the gisete content using the lifting system (10)

Or

- Unload the gisete content using a handling system (rings, lifting beam, etc.).
- Unload the radial wedge (if necessary) using the lifting system (10)

6.3. Preparation before shipment

– Take off the lid lifting parts,

– Position all the lid fastening screws (150) and tighten them.

– By raising the pressure, leak-test the lid gaskets.

- The cavity is left at atmospheric pressure. The choice of cavity fill gas must be in agreement with table 6A.2. Remove the orifice A tool and install the orifice A closure plate. Tighten the orifice closure plate screws in accordance with the requirements in table 6A.1.
- Leak-test the orifice A closure plate and the orifice B closure plate by increasing the pressure. The closure plate inner gaskets must be tested by volumetric inspection (or by an equivalent method),
- Check that the leak-tightness criteria of table 6A.3 are met. The measurement uncertainties on the leakage tests must be taken into account.
- Conduct the radiological inspections on the radiation intensity and non-contamination of the cask, according to the required zones in Appendix 6A.3. Check compliance with the regulatory criteria.
- Position the cover on the cask, tighten the screws (151) according to the requirements in table 6A.1 and affix the safety seals to the cover.
- Take the lifting rings off the cover and fit the protection plugs of the M30 tapped holes and cover screw sleeves.
- Complete the radiological inspections,
- Carry out package regulatory labelling and marking.
- Position the lifting beam on the cask,
- Transfer the cask to the vehicle and deposit it.
- Stow and tie down the cask on the vehicle. The tie-down straps must be aligned with the tie-down lugs and their anchor points on the floor must be about 900 mm, or more, from the outer shell of the cask.
- Conduct the radiological inspections around the vehicle.
- Position the regulatory placards and warning signs on the vehicle.
- Complete the transport documents.

6.4. Inspection before shipment

During each transport cycle, the users will make sure to perform the following inspection operations:

- Visually inspect the overall cask condition (cover, trunnions, lids, tie-down lug welds, etc.).
- Inspect the removed screws (including the lid screws) and replace if necessary.
- Inspect the lid and closure plate gasket bearing surfaces; inspect the gaskets and replace if necessary.
- Check that the test plugs are not damaged and replace if necessary.

7. USING THE CASK WITH A TRANSFER SYSTEM

When interfacing problems between the cask and the facility exist (crane undersized or pool too small for example), it is possible to use a transfer system to load the cask.

7.1. Receiving and preparing the cask

These operations are described in sections 2.1 and 2.2 of this document. However, the poral pellet plugs will not be fitted.

7.2. Preparing the transfer system

- Put the biological shield on the skirt
- Put the skirt on the cask
- Flood the skirt
- Remove the lid from the cask
- If required, plug the housings to be left empty in accordance with the requirements indicated on the loading plan.
- Position the stool for placing the transfer hood

7.3. Loading

- In the fuel storage pool, immerse the transfer hood for gripping a fuel element
- Open the transfer hood
- Secure the fuel element
- Place the element in the hood
- Close the hood
- Take the hood out of the pool then plunge it into the skirt filled with water
- Place the hood in the stool then open it
- Place the fuel element in the stool
- Close the hood then take it out of the skirt
- The fuel element (or BR2 can) is placed in the basket:

  Loading, when fuel elements must be loaded into canisters:
  - load the canisters into the cask if they have not been previously positioned during cask configuring, as per the pre-defined loading plan

  - unlock the canister
  - load the fuel element
  - lock the canister with the transport plug

- The hood is then decontaminated or taken back to the pool for reloading of fuel elements.

7.4. Taking off the transfer system

- Remove and decontaminate the stool
- If necessary remove the housing plugging devices.
- Put back the lid
- Drain the skirt

– Remove and decontaminate the skirt

7.5. Preparing and inspecting the cask before shipment

These operations are described in sections 2.4 and 2.5 of this document (except taking off the poral pellet plugs).

8. USING THE CASK AS AN EXCEPTED PACKAGE

The TN-MTR emptied of its content and possibly equipped with internal fittings (baskets, cans, canisters or wedges) can be transported as an empty cask as an excepted package. The standard and SEC lids are authorised. The applicable criteria and the minimum instructions for use of the excepted package design are presented below.

8.1. Criteria for shipment as an excepted package

– Contamination criterion

The level of non-fixed contamination on the cask's internal surfaces, and on the surfaces of the internal fittings must not exceed the following limits:

- 400 Bq/cm^2 for beta radiation emitters and low-toxicity alpha emitters,
- 40 Bq/cm^2 for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm² of any part of the surface.

The level of non-fixed contamination of the cask’s external surfaces must not exceed:

- 4 Bq/cm^2 for beta radiation emitters and low-toxicity alpha emitters,
- 0.4 Bq/cm^2 for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm² of any part of the surface.

– Dose equivalent rate criteria:

The radiation intensity at any point on the outer surface of the package must not exceed the limit of 5 µSv/h.

The inspection zones are indicated in Appendix 6A3.

If necessary, the cask’s cavity must first be dried in accordance with the instructions in section 2.4.

8.2. Minimum instructions for use of the excepted package design

This section contains the minimum instructions for preparation and inspections prior to shipment when using the excepted package design.

– Check the cleanliness of the gasket seating surfaces and the lid gaskets, and clean them if necessary.

– Check for compliance with the internal contamination criteria in section 8.1

- Verify satisfactory condition of the screws equipping the removed elements (cleanliness and no material torn off)
- Close the package and tighten the screws on the enclosure's components to the torques indicated in table 6A.1
- Position the shock absorbing cover. Tighten the cover's screws to the torque indicated in Table 6A.1.
- Attach the safety seals to the cover.
- Check for compliance with the external contamination and radiation intensity criteria in section 8.1

9. QUALITY ASSURANCE PROVISIONS

The provisions common to all activities and applicable to the operating activities of the cask are described in chapter 8A of this report. The arrangements defined below are applicable to activities starting after 31 December 2010. For activities starting before December 31, 2010, the rules and classifications laid out in Rev. 2 of chapter 4466-Z-8A are applicable.

Conformity between all cask operation documents (documents produced by the designer and/or the users) and the instructions for use of the package design given in the safety analysis report must be verified.

The designer must ensure that the user manual it issues complies with the requirements of the safety analysis report. For package operation, the project manager of the operation (plant operator, carrier, etc.) is responsible for the compliance of the issued documents (process outlines, etc.) with the requirements of the safety analysis report that are communicated via the documents drafted by the designer.

Upon issue of each new approval certificate (renewal or extension), the compliance of the cask user manual must be certified once any changes have been taken into account.

These verifications must be recorded.

10. REFERENCES

<1> Applicable RID regulations, see chapter 00.

LIST OF TABLES

LIST OF APPENDICES

TABLE 6A.1

TN-MTR CASK SCREW TORQUES

Reference	Description	Nominal Diameter	Torque (1) (3)
150	Lid to body attachment screw(2)	M30	660 N.m
151	Shock absorbing cover to body attachment screw(2)	M42	660 N.m
312	M20 plugs	M20	20 N.m (indicative value)
350	Orifice closure plate to lid attachment screws(2)	M12	40 N.m

(1) All these torque requirements are met with an uncertainty of ± 10%

(2) Light lubrication must be applied to the screws using a "NEVER SEEZ High Temperature Stainless Nuclear Grade" lubricant (or similar regarding the friction coefficient) in order to ensure there is a thin film of grease on all the threads right around the screws and over the entire surface under the screw heads.

(3) The closure of all the cask screwed elements must preferentially be performed according to a "criss-cross or star" torquing method; another method may be used subject to prior approval by the designer.

Note: this table is taken from table 0.6 of chapter 0.

TABLE 6A.2 (1/2)

PERMISSIBLE THERMAL POWER LEVELS IN THE TN-MTR CASK

The table below indicates the permissible thermal power levels in the TN-MTR Cask for each type of content as well as the authorised cavity filling gases:

		Maximum power of the content	Cavity inerting
RHF Basket		5,000 W	Helium
		4,360 W	Air, helium or any other inert gas (nitrogen, etc)
MTR-68 Basket	General case	5,000 W	Air, helium or any other inert gas (nitrogen, etc)
	OSIRIS 42 W	2,856 W	Air, helium or any other inert gas (nitrogen, etc)
	BR2 S5 and S6 25 W	1,700 W	Air, helium or any other inert gas (nitrogen, etc)
	ANSTO 42 W	2,856 W	Air, helium or any other inert gas (nitrogen, etc)
MTR-52 Basket	General case (without can or with can 1)	5,000 W	Air, helium or any other inert gas (nitrogen, etc)
	OSIRIS 42 W	2,184 W	Air, helium or any other inert gas (nitrogen, etc)
	with can 2 or 3	4,500 W	Air, helium or any other inert gas (nitrogen, etc)
	Failed or disassembled BR2	900 W	Helium
MTR-52S and MTR-52SV2 baskets	General case (without canister) 42 W per housing	2,200 W	Air, helium or any other inert gas (nitrogen, etc)
	With 15W canisters per housing	780 W	Air, helium or any other inert gas (nitrogen, etc)
MTR-44 Basket	General case	5,000 W	Helium
		3,430 W	Air, helium or any other inert gas (nitrogen, etc)
	OSIRIS 42 W	1,848 W	Air, helium or any other inert gas (nitrogen, etc)
	Beryllium elements	-	Air only
FRMII basket		420 W	Air, helium or any other inert gas (nitrogen, etc)
CESOX		1,200 W	Air only
Caesium trap		0.5 W	Argon

TABLE 6A.2 (2/2)

PERMISSIBLE THERMAL POWER LEVELS IN THE TN-MTR CASK

	Maximum power of the content	Cavity inerting
Gisete content	160 W	Air, helium or any other inert gas (nitrogen, etc)

TABLE 6A.3

LEAK-TIGHTNESS CRITERIA OF THE TN-MTR CASK

The leak tests must comply with ISO standard 12807 “Safety of radioactive material transports – leak testing of packages” at the latest applicable edition and conducted by qualified personnel in accordance with the quality assurance system (type COFREND II).

- For transport of elements other than beryllium elements, the sum of the leakage rates from the lid and the two closure plates in the inter-gasket spaces must not exceed the following criteria (taking into account all uncertainties):

Leak-tightness criteria	Content comprising failed elements before transport	Content not comprising any failed elements before transport
Q ($Pa.m^3.s^{-1}$) SLR	1.33×10^{-4}	4.7×10^{-4}

The applicable leak-tightness criterion in the case of failed or disassembled BR2 content is $1.33.10^{-4}$.

- For transport of beryllium elements, the sum of the leakage rates from the lid, the two closure plates in the inter-gasket spaces and the M20 plugs of the test orifices of the lid and the two closure plates must not exceed the following criteria (taking into account all uncertainties):

Leak-tightness criteria	Beryllium elements
Q ($Pa.m^3.s^{-1}$) SLR	3.5×10^{-5}

- For transport of CESOX content, caesium trap content and gisete content, the sum of the leakage rates from the lid and the two closure plates in the inter-gasket spaces must not exceed the following criteria (taking into account all uncertainties):

Leak-tightness criteria	Content CESOX	Caesium trap content	Gisete content
Q ($Pa.m^3.s^{-1}$) SLR	1.33×10^{-4}	1.33×10^{-4}	4.7×10^{-4}

APPENDIX 6A.1

TN-MTR CASK DRYING CRITERIA

Vacuum-dry the cavity by blowing dry, hot air or by any other method enabling the reaching of a drying level equivalent to the one corresponding to the pressure rise criterion: P between 6 and 10 mbar and $\Delta P < 1$ mbar in 5 minutes,

APPENDIX 6A.2

TN-MTR CASK TEMPERATURE CRITERIA

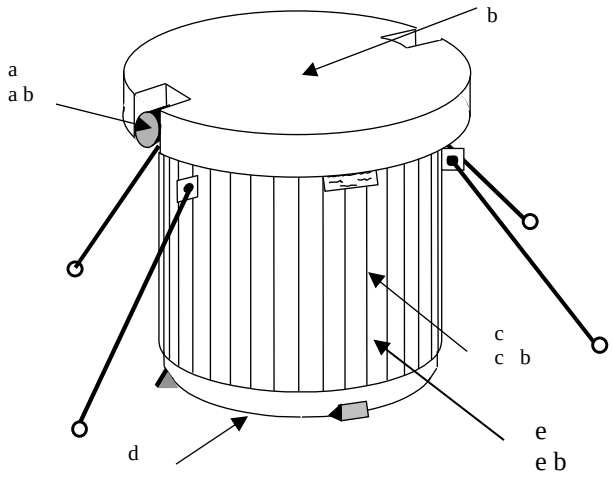
For a maximum accessible surface temperature T_S, an ambient temperature T_A measured away from the sun and a maximum ambient temperature T_{Amax} defined as follows:

- in the case of transport that does not use a ship, $T_{Amax} = 38°C$;
- in the case of transport by ship, T_{Amax} will be equal to the set temperature of the cargo hold of the ship, (maximum 55°C):

If $85°C < T_S + (T_{Amax} – T_A)$: set up of a thermal protection barrier.

APPENDIX 6A.3

REQUIRED RADIOLOGICAL INSPECTION ZONES



ITEMS	LOCATION
a / a b	Trunnions
b	Top of shock-absorbing cover
c / c b	Body / fins (measurement at mid-height)
d	Under the cask
e/e b	Body / fins (measurement at quarter height)– CESOX specific

Note: The b points are located behind the cask, diametrically opposite

APPENDIX 6A.4

JUSTIFICATION FOR THE TIME CRITERION IMPOSED PRIOR TO TIGHTENING THE SCREWED ELEMENTS OF THE CLOSURE SYSTEM.

The characteristic time for thermal diffusion at 20°C is defined by the following relation:

$$\tau = \frac{L^2}{D}$$

Where:

- $D = \frac{\lambda}{\rho \times Cp}$: the diffusivity of the material in $m^2.s^{-1}$;
- λ: the thermal conductivity of the material in $W.m^{-1}.K^{-1}$;
- ρ: the density of the material in $kg.m^{-3}$;
- Cp: the thermal capacity of the material in $J.kg^{-1}.K^{-1}$;
- L the diffusion length in m;

	Lid (1)	**Lid screws(1)**
λ ($W.m^{-1}.K^{-1}$)	16	33.7
ρ ($kg.m^{-3}$)	7,850	7,800
Cp ($J.kg^{-1}.K^{-1}$)	500	461
D ($m^2.s^{-1}$)	4.08×10^{-6}	9.37×10^{-6}
L (mm)	≤ 30	≤ 57.5 (2)
τ (s)	221	353
τ (min)	**4**	**6**

(1) Thermal properties - see Chapter 0

(2) The characteristic diffusion length for the screw corresponds to the distance under the screw head and the half-length of engagement of the screw.

So for all the components of the closure system to reach the same temperature it is necessary to wait 10 minutes.