



U.S. Department
of Transportation

Pipeline and
Hazardous Materials
Safety Administration

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

**COMPETENT AUTHORITY CERTIFICATION FOR A
TYPE B(U)
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0825/B(U)-96, REVISION 2
REVALIDATION OF FRENCH COMPETENT AUTHORITY
CERTIFICATE F/410/B(U)-96**

The Competent Authority of the United States certifies that the radioactive material package design described in this certificate satisfies the regulatory requirements for a Type B(U) package as prescribed in the regulations of the International Atomic Energy Agency¹ and the United States of America². The package design is approved for use within the United States for import and export shipments made in accordance with applicable international and domestic transport regulations.

1. Package Identification - MANON.
2. Package Description and Authorized Radioactive Contents - as described in French Certificate of Competent Authority F/410/B(U)-96, Revision Bi (attached).
3. 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 Engineering and Research, (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, 2012 Edition, No. SSR-6" 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/0825/B(U)-96, REVISION 2

- 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 Management System activities required by Paragraph 306 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 in the United States exporting shipments under this certificate shall satisfy the applicable requirements of Subpart H of 10 CFR 71.
4. Marking and Labeling - The package shall bear the marking USA/0825/B(U)-96 in addition to other required markings and labeling.
5. Expiration Date - This certificate expires on November 30, 2027. Previous revisions may be used until February 25, 2025.

This certificate is issued in accordance with paragraph(s) 810 of the IAEA Regulations and Section 173.473 of Title 49 of the Code of Federal Regulations, in response to the March 30, 2023 petition by TN Americas LLC, Columbia, MD, and in consideration of other information on file in this Office.

Certified By:



William Schoonover
Associate Administrator for Hazardous
Materials Safety

November 15, 2024
(DATE)

Revision 2 - Issued to endorse the French Certificate of Approval
F/410/B(U)-96, Revision Bi.

**CERTIFICATE OF APPROVAL
OF PACKAGE DESIGN**

The Competent French Authority,

In view of the Article R. 595-1 of the Environmental Code;

In view of the request presented by the company **Commissariat à l'énergie atomique et aux énergies alternatives** (Atomic energy and alternative energy commission), by letter DSSN DIR 2019-216 dated 10 April 2019;

In view of the safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019;

In view of the results of the public consultation conducted from 9 July 2020 to 24 July 2020,

Hereby certifies that the package model constituted by the **MANON** casing described in Appendix 0 rev. i and:

- loaded with:
 - a modified SV 34 container containing cobalt 60 or caesium 137 radioactive sources, as described in Appendix 1 rev. i;
 - a modified SV 69 container containing cobalt 60 or caesium 137 radioactive sources, as described in Appendix 2 rev. i;
 - an external enclosure (EDCE), containing non-removable equipment (AI) holding strontium 90 radioactive sources, as described in Appendix 3 rev. i;
 - an external enclosure (EDCE), containing a CC33 overpack holding a strontium 90 radioactive source, as described in Appendix 4 rev. i,
- emptied, contaminated or not, equipped or not with its internal fittings,

is compliant, as a type B(U) package model, with the requirements of the regulations and agreements listed below:

- International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, Safety Standards Series No. SSR-6, 2012 edition;
- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- International Maritime Dangerous Goods Code (IMDG code of the IMO);
- French Order of 23 November 1987, as amended, on the safety of ships;
- French Order of 29 May 2009, as amended, on the carriage of dangerous goods by road ("TMD order").

This certificate does not exempt the consignor from compliance with the requirements laid down by the authorities of the countries through or to which the package will be transported.

This certificate expires on **30 November 2027**.

Registration number: **CODEP-DTS-2020-045263**

Montrouge, 17 November 2020

On behalf of the President of the French Nuclear Safety Authority (ASN),
and by delegation,
the Director of Transport and Sources,

Fabien Féron

**CERTIFICAT D'AGRÉMENT
D'UN MODÈLE DE COLIS**

L'Autorité compétente française,

Vu l'article L. 595-1 du code l'environnement ;

Vu la demande présentée par la société **Commissariat à l'énergie atomique et aux énergies alternatives** par la lettre DSSN DIR 2019-216 du 10 avril 2019 ;

Vu le dossier de sûreté DSN STMR/LEPE S-MANON DSEM 5100 Ind. 02 du 22 mars 2019 ;

Vu les résultats de la consultation du public réalisée du 09 juillet 2020 au 24 juillet 2020,

Certifie que le modèle de colis constitué par la surcoque **MANON** décrite dans l'annexe 0 à l'indice i et :

- chargée :
 - d'un conteneur SV 34 modifié contenant des sources radioactives de cobalt 60 ou de césium 137, tel que décrit en annexe 1 à l'indice i ;
 - d'un conteneur SV 69 modifié contenant des sources radioactives de cobalt 60 ou de césium 137, tel que décrit en annexe 2 à l'indice i ;
 - d'une enceinte de confinement externe (EDCE) contenant un appareil indémontable (AI) dans lequel sont conditionnées des sources radioactives de strontium 90, telle que décrite en annexe 3 à l'indice i ;
 - d'une enceinte de confinement externe (EDCE) contenant une coque CC33 dans laquelle est conditionnée une source radioactive de strontium 90, telle que décrite en annexe 4 à l'indice i,
- vidée, contaminée ou non, munie ou non de ses aménagements internes,

est conforme, en tant que modèle de colis de type B(U), aux prescriptions des règlements et accords ci-après énumérés :

- règlement de transport des matières radioactives de l'Agence internationale de l'énergie atomique, collection Normes de sûreté, N° SSR-6, édition de 2012 ;
- accord européen relatif au transport international des marchandises dangereuses par route (ADR) ;
- code maritime international des marchandises dangereuses (code IMDG de l'OMI) ;
- arrêté du 23 novembre 1987 modifié relatif à la sécurité des navires ;
- arrêté du 29 mai 2009 modifié relatif aux transports de marchandises dangereuses par voies terrestres (dit « arrêté TMD »).

Le présent certificat ne dispense pas l'expéditeur d'observer les prescriptions établies par les autorités des pays à travers ou vers le territoire desquels le colis sera transporté.

La validité du présent certificat expire le **30 novembre 2027**.

Numéro d'enregistrement : **CODEP-DTS-2020-045263**

Fait à Montrouge, le 17 novembre 2020

Pour le Président de l'Autorité de sûreté nucléaire
et par délégation,
le directeur des transports et des sources,

A handwritten signature in black ink, consisting of a stylized 'F' followed by a horizontal stroke and a vertical stroke, representing the name Fabien Féron.

Fabien FÉRON

SUMMARY OF CERTIFICATE ISSUES

Issued on	Expiry date	Issue type and amendments	Authority	Certificate number	Revision index							
					body	t	0	1	2	3	4	5
24/03/2015	31/03/2020	New approval	ASN	F/410/B(U)-96	Aa	-	a	a	a	a	-	-
06/10/2017	31/03/2020	Extension to approval (content 4)	ASN	F/410/B(U)-96	Ab	-	b	-	-	-	b	-
06/10/2017	31/03/2020	Extension to approval for maritime transport	ASN	F/410/B(U)-96	Ac	-	c	c	c	c	-	-
06/11/2017	31/03/2020	Extension to approval	ASN	F/410/B(U)-96	Ad	-	d	c	d	c	-	-
04/11/2019	31/03/2020	Extension to approval Combination of revisions (Ab) and (Ad) and discontinuation of the EDCI dip tube	ASN	F/410/B(U)-96	Ae	-	e	e	d	e	e	-
18/02/2020	31/03/2020	Extension to approval (content 5)	ASN	F/410/B(U)F-96	Af	-	f	-	-	-	-	f
25/03/2020	30/11/2020	Administrative renewal of the certificate, revision (Ad)	ASN	F/410/B(U)-96	Ag	-	d	c	d	c	-	-
17/11/2020	30/11/2027	Renewal	ASN	F/410/B(U)F-96	Bh	-	h	-	-	-	-	h
17/11/2020	30/11/2027	Renewal	ASN	F/410/B(U)-96	Bi	-	i	i	i	i	i	-

APPENDIX 0 MANON CASING

1. DESCRIPTION OF THE CASING

The casing is designed, manufactured, inspected, tested, maintained and used in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The casing, of a generally cylindrical form, is shown in Figure 0.1.

The directory of design drawings for the casing and the associated shimming systems has the reference DSN STMR/LEPE S-MANON LST 0003 Rev. 02 dated 25 March 2019.

Casing dimensions	Overall external	Useful
Height	2570 mm	1704 mm
Diameter	2550 mm	1800 mm

The maximum permissible weight of the casing during transport is:

- 5,487 kg empty;
- 13,385 kg when loaded with the modified SV 34 container plus EDCI and its shimming system (see Figure 0.2);
- 15,597 kg when loaded with the modified SV 69 container and its shimming system (see Figure 0.3);
- 7,635 kg when loaded with the empty EDCE (see Figure 0.4);
- 11,925 kg when loaded with an EDCE with contents.

The casing is made up of the main sub-assemblies described below.

1.1 Body and closure system

The casing is composed of a cylindrical external mechanical protection, including two half-shells, an upper and a lower one, made of stainless steel plating and each composed of a shell welded to a disc forming the bottom.

The flange of the upper shell is attached to the flange of the lower shell by thirty M30x120 class 10.9 H screws tightened to a torque of 850 N.m with accuracy class A as per NF E25-030 standard. Each end of the external protection has a shock absorbing system.

Cut-outs are created in the bottoms, to allow air to flow.

1.2 Shock absorbing system

The shock absorbing systems of both half-shells are identical. They are made up of phenolic foam DL NU280h protected by stainless steel plating welded to the half-shells. Their outer shell is cylindrical.

The shock absorbers have the general shape of a ring, into which a recess is machined in order to create an overlapping zone for the protective shell. Passages are made in the covers to allow air to flow. An additional block of foam, independent of the ring, is located within the central axial section. This block is welded to a stainless steel puncture protection plate, which covers the cut-outs in the bottom of the half-shells.

1.3 Handling and tie-down elements

The casing is handled by attaching slings to three studs to which M36 rings are screwed, with a unit capacity of 7500 kg.

The packaging is tied down in a vertical position on its means of transport using straps and flexible turnbuckles attached to the four tie-down lugs welded to the external surface of the package. The frame structure potentially

used for transport consists of a steel frame made of metal beams on which there is a steel plate (platform) that supports the package.

A schematic diagram of the tie-down system is shown in Figure 0.5. The tie-down system dimensions are in accordance with NF EN 12195-1 or equivalent for a package weight of 16 tonnes.

An anti-slip mat, with a coefficient of friction of 0.6, is placed on the vehicle platform, and under the packaging for maritime transport.

2. MANUFACTURING SPECIFICATIONS

For the screws of the MANON casing, EDCI, EDCE and SV 69, as described in Appendix 6 of Chapter DSEM 5103 rev. 02 of the safety analysis report, prior to the application of the surface treatment, acid cleaning of the screws is prohibited for class 12.9. Cleaning with inhibited alkaline or acid solutions is permitted for class 10.9.

Screws of class 10.9 and higher are surface treated in accordance with ISO 2081 and ISO 4520.

Screws of class 10.9 and higher are subject to a degassing treatment in accordance with ISO 9588 or equivalent after the surface coating has been applied, in order to prevent the risk of brittle fracture of the screws due to the presence of hydrogen in the steel.

In addition to degassing, the detection of any hydrogen embrittlement is carried out by testing the mechanical characteristics required for the screws according to their class (tensile strength, yield strength, elongation at break, toughness, HRC hardness). These tests are carried out in accordance with the current standards (EN ISO 6892-1, EN ISO 148-1, EN ISO 6508-1 or equivalent).

3. SAFETY FUNCTIONS

The **Containment** is provided by the enclosure of the contents.

The **Radiological protection** is provided by the shielding of the contents.

The **Internal power dissipation** is provided by the ventilation openings.

The **protection against impact** is mainly provided by the shielding on the casing and the phenolic foam blocks in the casing.

The **protection against fire** is mainly provided by the phenolic foam blocks in the casing, and the materials insulating the contents.

4. ACTIONS TO BE TAKEN BY THE CONSIGNOR PRIOR TO SHIPPING THE PACKAGE

The packaging is used in accordance with the procedures in the instructions for use, in Chapter 05-01 of the safety analysis report. This is combined with:

- a visual inspection to ensure that there are no foreign objects in the content cavity;
- a check that the anti-slip mat is not worn.

5. MAINTENANCE PROGRAMME

The packaging is maintained in accordance with the procedures in the instructions in chapter 05-01 of the safety analysis report.

The screws of the MANON casing, EDCI and EDCE are lubricated on the threads and under the screw head with graphite grease.

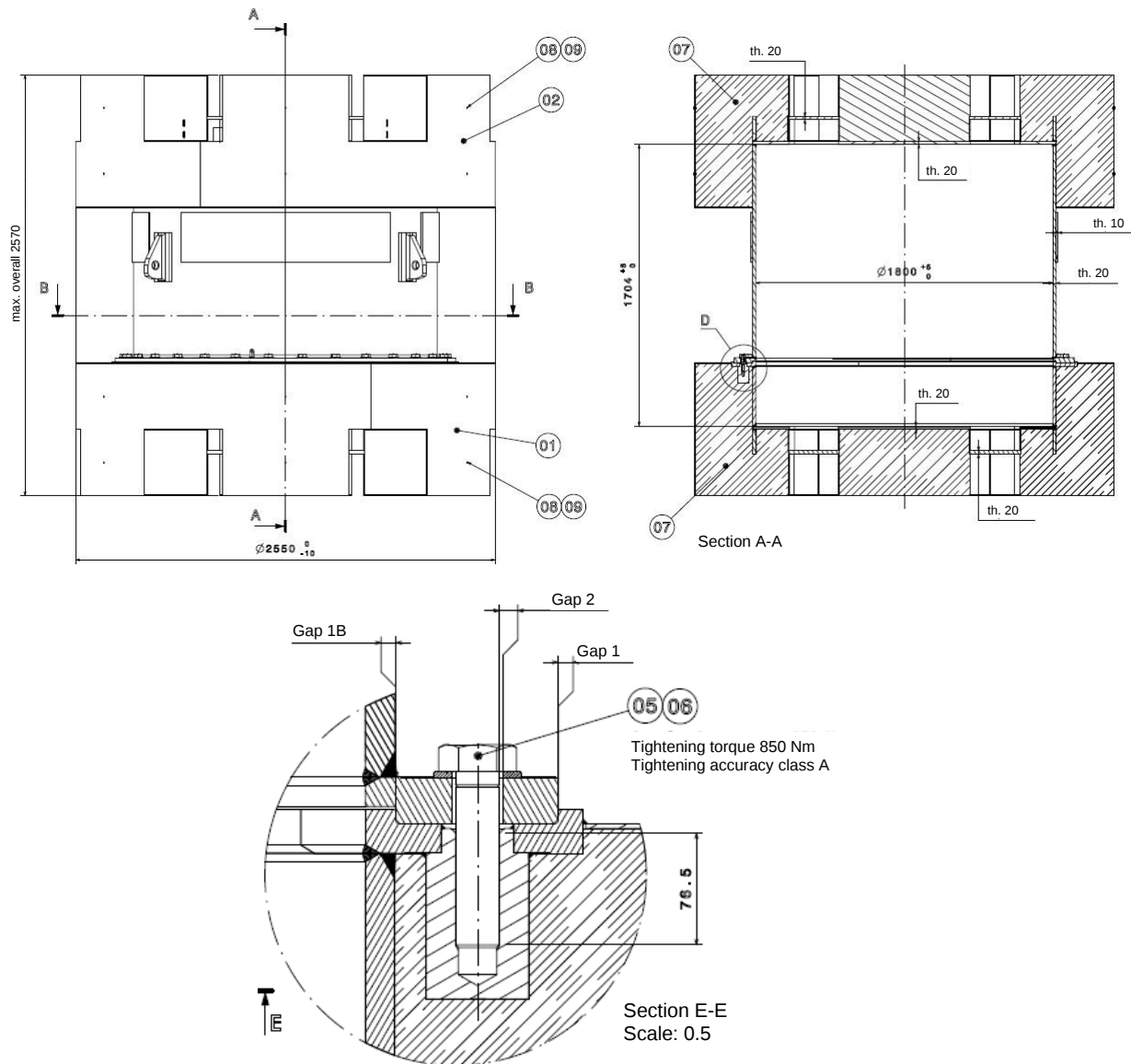
6. NOTIFICATION AND RECORDING OF SERIAL NUMBERS

The relevant authorities are kept informed of any packaging that is taken out of service or transferred to another owner. To achieve this, an owner who transfers a packaging provides the name of the new owner.

7. QUALITY MANAGEMENT SYSTEM

The quality management system principles applied during the design, manufacture, inspection, testing, maintenance and use of the package comply with those described in Chapter 05-02 of the safety analysis report.

FIGURE 0.1
DIAGRAM OF THE CASING



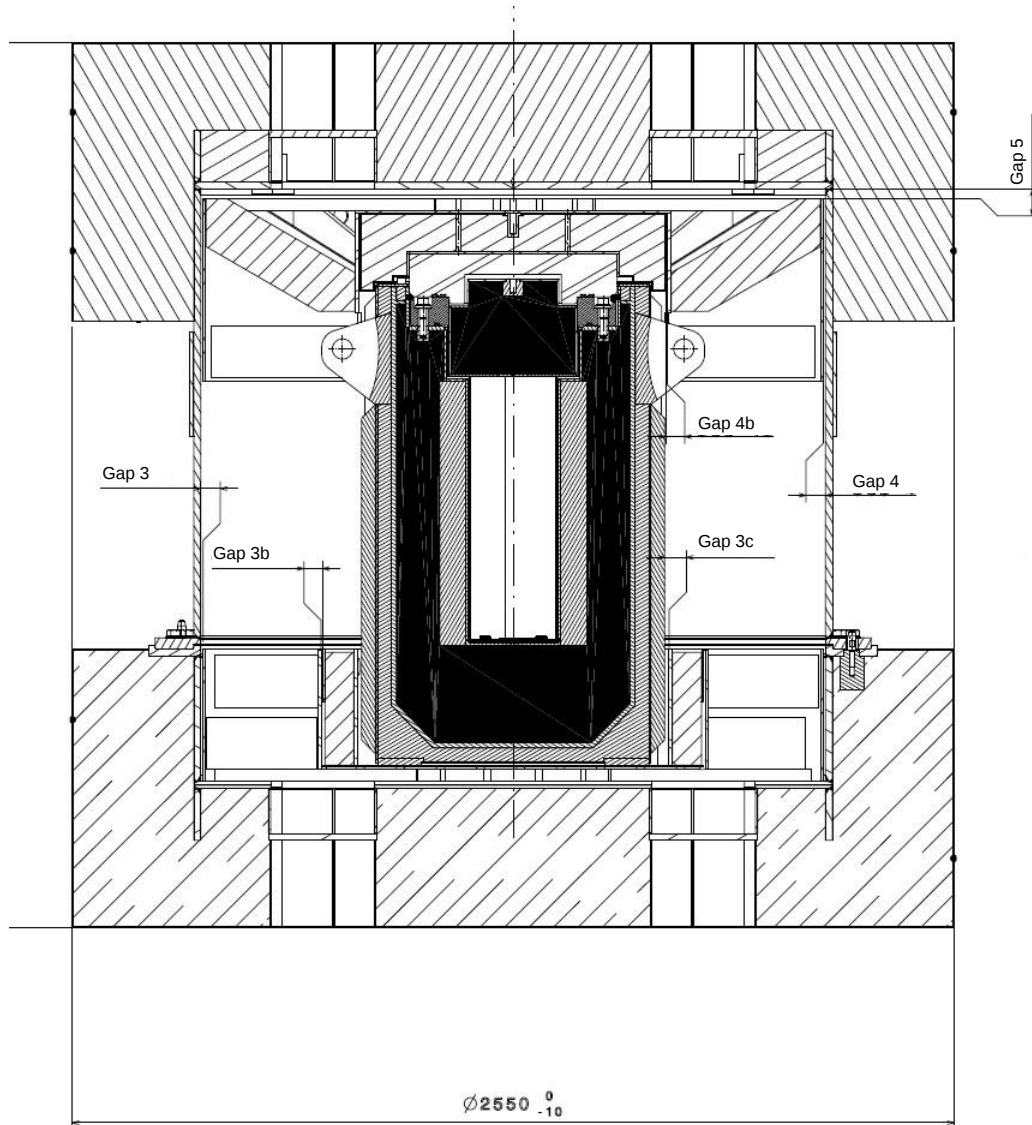
LEGEND:

- (01) Casing body - lower half-shell
- (02) Casing lid - upper half shell
- (05) M30x120 Cl.10.9 H screw
- (06) M30 washer
- (07) Phenolic foam in the casing shock absorbers
- (08) Polyethylene plug
- (09) PU mastic adhesive

Gaps 1/1B: Radial gap between the flange shoulders of the upper and lower half-shells (gaps important for safety)

Gap 2: Gap between the casing closure screws and their holes in the flange of the upper half-shell (gap important for safety)

FIGURE 0.2
DIAGRAM OF THE CASING LOADED WITH A MODIFIED SV 34 CONTAINER

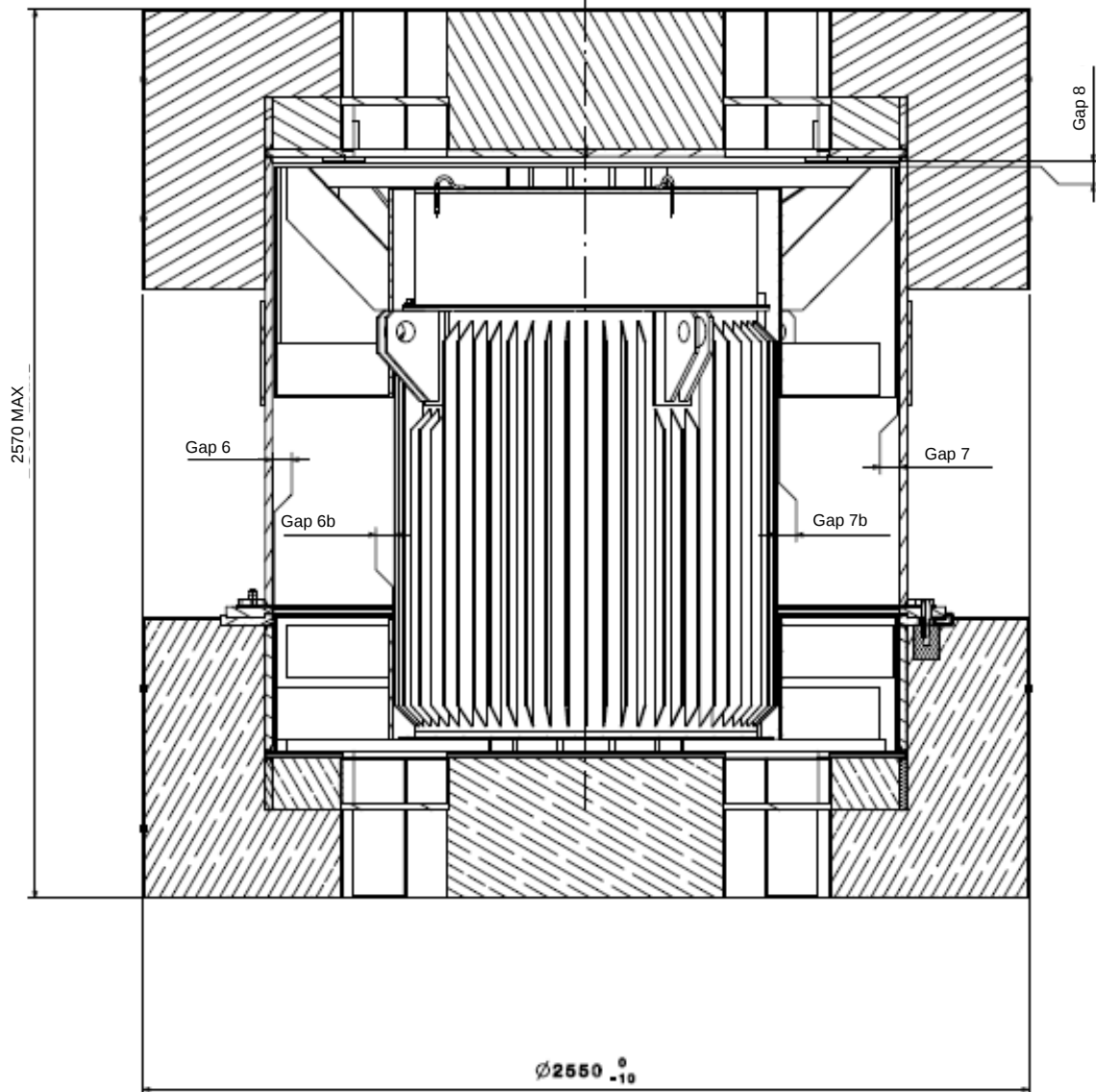


LEGEND:

- Gap 3: Radial gap between the lower shimming system of the SV 69 container and the lower half-shell (functional gap)
- Gap 3b: Radial gap between the lower shimming system C1 of the SV 34 container and the lower shimming system C2 of the SV 69 container (functional gap)
- Gap 3c: Radial gap between the lower shimming system C1 and the SV 34 container (functional gap)
- Gap 4: Radial gap between the upper shimming system of the SV 34 container and the upper half-shell (functional gap)
- Gap 4b: Radial gap between the upper shimming system and the SV 34 container (functional gap)
- Gap 5: Axial gap between the shimming system and SV 34 container stack and the casing cavity (functional gap)

Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 0.3
DIAGRAM OF THE CASING LOADED WITH A MODIFIED SV 69 CONTAINER



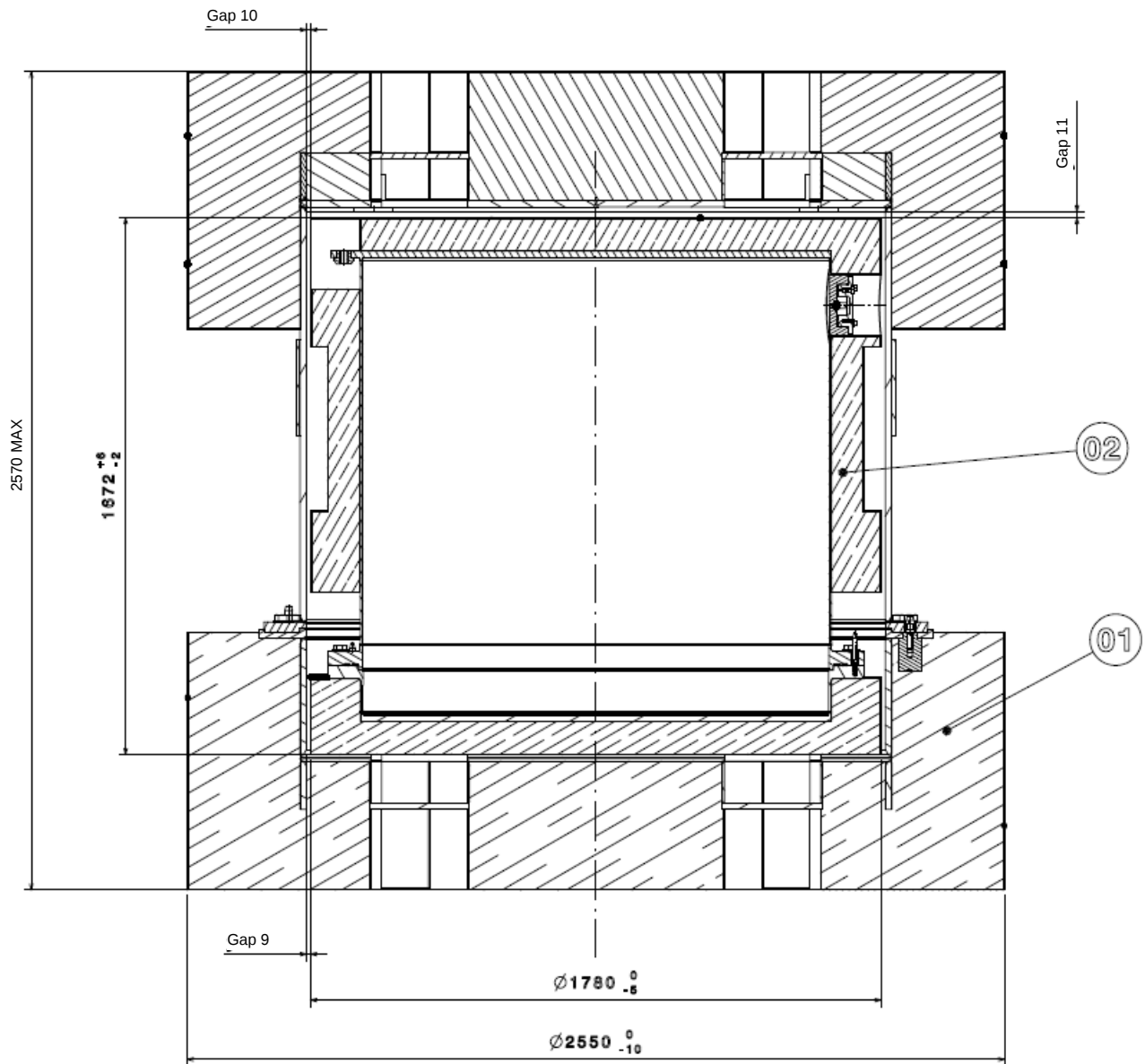
LEGEND:

- Gap 6: Radial gap between the lower shimming system C2 and the lower half-shell (functional gap)
- Gap 6b: Radial gap between the lower shimming system C2 and the SV 69 container (functional gap)
- Gap 7: Radial gap between the upper shimming system C2 and the upper half-shell (functional gap)
- Gap 7b: Radial gap between the lower shimming system C2 and the SV 69 container (functional gap)
- Gap 8: Axial gap between the shimming system and SV 69 container stack and the casing cavity (functional gap)

Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 0.4
DIAGRAM OF THE CASING LOADED WITH AN EMPTY EDCE

Section A-A

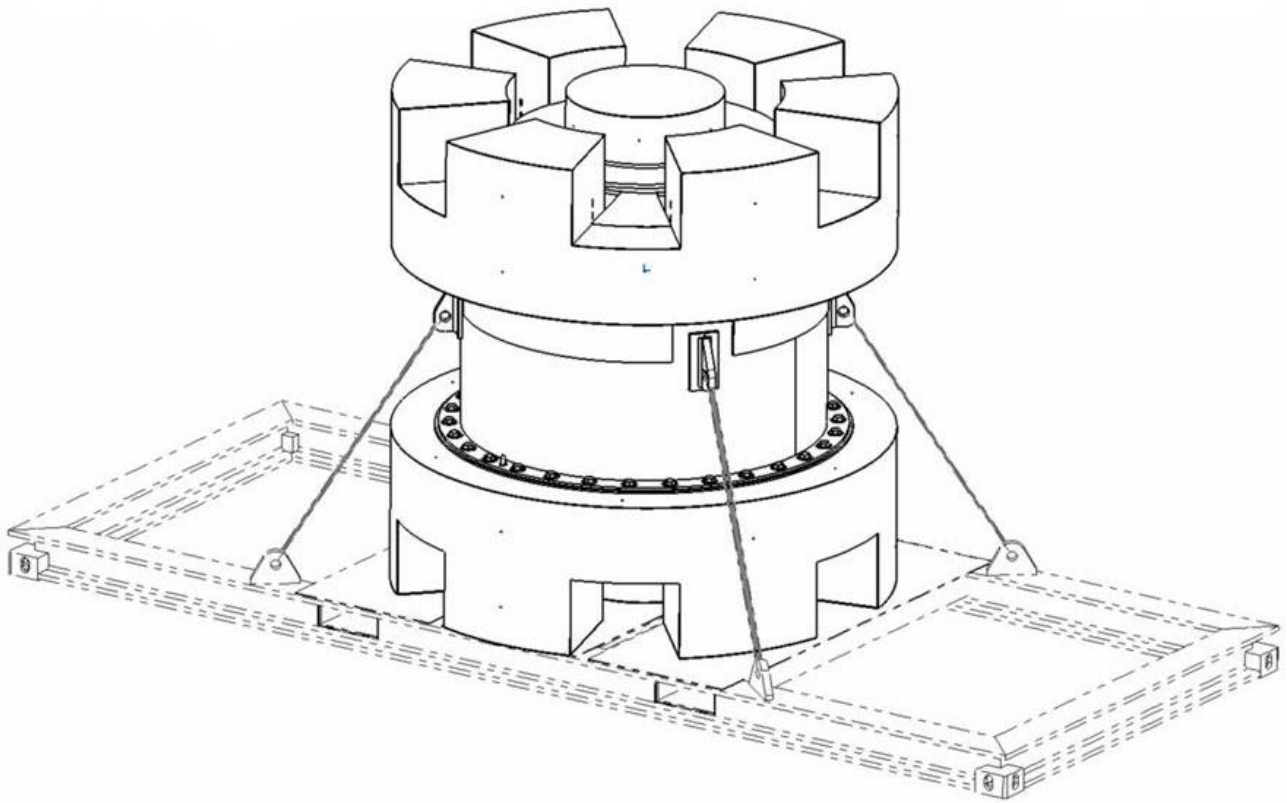


LEGEND:

- (01) Phenolic foam in the casing shock absorbers
- (02) Phenolic foam in the radial part of the EDCE
- Gap 9: Radial gap between the EDCE and the lower half-shell of the casing (functional gap)
- Gap 10: Radial gap between the EDCE and the upper half-shell of the casing (functional gap)
- Gap 11: Axial gap between the EDCE and the casing cavity (functional gap)

Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 0.5
TIE-DOWN DIAGRAM FOR THE CASING



(Optional frame)

APPENDIX 1

MODIFIED SV 34 CONTAINER LOADED WITH COBALT 60 OR CAESIUM 137 RADIOACTIVE SOURCES

The safety analysis report justifying the authorised contents has the reference DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

1. DESCRIPTION OF AUTHORISED CONTENTS

The authorised radioactive content, as described in Chapter 2 of the safety analysis report, comprises a modified SV 34 container with an internal enclosure (EDCI), loaded with cobalt 60 or caesium 137 radioactive sources.

1.1 Description of modified SV 34 container fitted with an EDCI

1.1.1 Modified SV 34 container

The modified SV 34 container is designed and manufactured in accordance with safety analysis report 05V/R/000/A of 10 August 2001. It is inspected, tested and maintained in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The design drawing for the modified SV 34 container has the reference PRK163-0000 Rev. D.

The SV 34 container is composed of a cylindrical body made up of a stainless steel outer shell with sixty vertical cooling fins, a thermal protection made of damp plaster (with stainless steel shavings), a separating shell made of mild steel, a protection against radiation, and a stainless steel inner shell. Four lugs are welded to the body for handling purposes.

The bottom of the container is made of a stainless steel plate, a protection against radiation, a stainless steel separating plate, a thermal protection made of damp plaster and a stainless steel plate.

The inner shell has a flange to hold the EDCI.

1.1.2 Internal Enclosure Assembly

The EDCI is designed, manufactured, inspected, tested, maintained and used in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The design drawings for the EDCI (with and without dip tube) have the references EMB/MANON/AMINT/DSS/PD 0402 Rev. A and EMB/MANON/AMINT/DSS/PD 0412 Rev. A. A diagram of the EDCI is shown in Figure 1.1.

The stainless steel body of the EDCI consists of a plate metal enclosure connected to a flange. It is fastened to the modified SV 34 container by fourteen screws. On some EDCIs, a tube welded to the internal cavity and connected to the flange, descends into the base of the enclosure. It is used to drain the device and helps with drying the EDCI cavity.

The closure system is made up of a stainless steel lid. It is attached to the EDCI body by fifteen screws. It has a recess on its outer surface for the closure plate of an orifice used to vent, drain and dry the cavity. Two trapezoidal grooves are machined into the lid to hold two ethylene propylene diene monomer (EPDM) O-ring gaskets. The drying orifice, to which is screwed a non-closing coupling, is protected by a leak-proof closure plate screwed onto the lid. The closure plate is stainless steel and is fixed to the EDCI lid by four screws.

The EDCI's radiological protection plug is made up of a stainless steel casing, filled with lead with 4% antimony. A stud is attached to the upper surface and is used to screw on a lifting ring. The lead plug is positioned on the shoulder of the EDCI flange.

1.1.3 Shock absorbing system

The shock absorbing cover is composed of phenolic foam enclosed in stainless steel plates. It is fixed to the EDCI lid by four screws.

At the centre is a stud used to attach a handling ring.

1.1.4 Modified SV 34 container with an EDCI

The design drawings for the modified SV 34 container with the EDCI have the references EMB/MANON/AMINT/DSS/PE 0400 Rev. A and EMB/MANON/AMINT/DSS/PE 0410 Rev. A.

A diagram of the modified SV 34 container fitted with the EDCI is shown in Figure 1.2.

Dimensions of the modified SV 34 container fitted with the EDCI	Overall	Useful
Height	1611 mm	752 mm
Diameter	1105 mm	248 mm

The maximum weight of the modified SV 34 container when loaded is 6344 kg.

The containment of the modified SV 34 container is provided by the EDCI enclosure, which comprises:

- the body of the EDCI and its welds;
- the closure plate of the drying orifice and its internal gasket;
- the lid and its internal gasket.

The radiological protection of the modified SV 34 container is provided by:

- the radial thickness and the thickness of the bottom, made of lead and steel, of the modified SV 34 container body;
- the thickness of the lead in the EDCI plug;
- the steel lid of the EDCI.

1.2 Description of radioactive sources

The radioactive sources loaded in the EDCI of the modified SV 34 container are described in Chapter 2 of the safety analysis report and meet the specifications given in the table below:

Radionuclide	Cobalt 60	Caesium 137
Physical state	Solid	
Chemical form	Metal	Caesium chloride (ClCs) Pollucite (Cs ₂ O, Al ₂ O ₃ , 4SiO ₂) Caesium nitrate (CsNO ₃)
Packaging of the source	Welded double stainless steel capsule	
Type of radiation	Beta, gamma and X	
Maximum package activity	980 TBq	3150 TBq
Maximum heat output of the package	410 W	

The two types of sources can be mixed as long as the total heat output does not exceed 410 W and the total activity does not exceed 3150 TBq.

1.3 Internal fittings

The internal fittings are described in Chapter 2 of the safety analysis report.

1.3.1 Basket

The basket is made up of a mast onto which disks are welded concentrically, at appropriate heights to spread the transport loads. The intermediate and upper disks have circular holes for the sources or tubular source recesses. The lower disks act as lower stops for the positioning of the sources.

1.3.2 Shims

The modified SV 34 container has a shimming system for positioning it in the casing. The design drawings of the different parts of this shimming system have the references:

- EMB/MANON/AMINT/DSS/PE 0120 Rev. A for the whole assembly;
- EMB/MANON/AMINT/DSS/PD 0122 Rev. A for the upper half-shell of the casing;
- EMB/MANON/AMINT/DSS/PD 0123 Rev. A for the lower half-shell of the casing;
- EMB/MANON/AMINT/DSS/PD 0121 Rev. A for the bottom and around the body of the modified SV 34 container.

A diagram of the shimming system for the modified SV 34 container in the casing is shown in Figure 1.3.

2. LOADING CONDITIONS

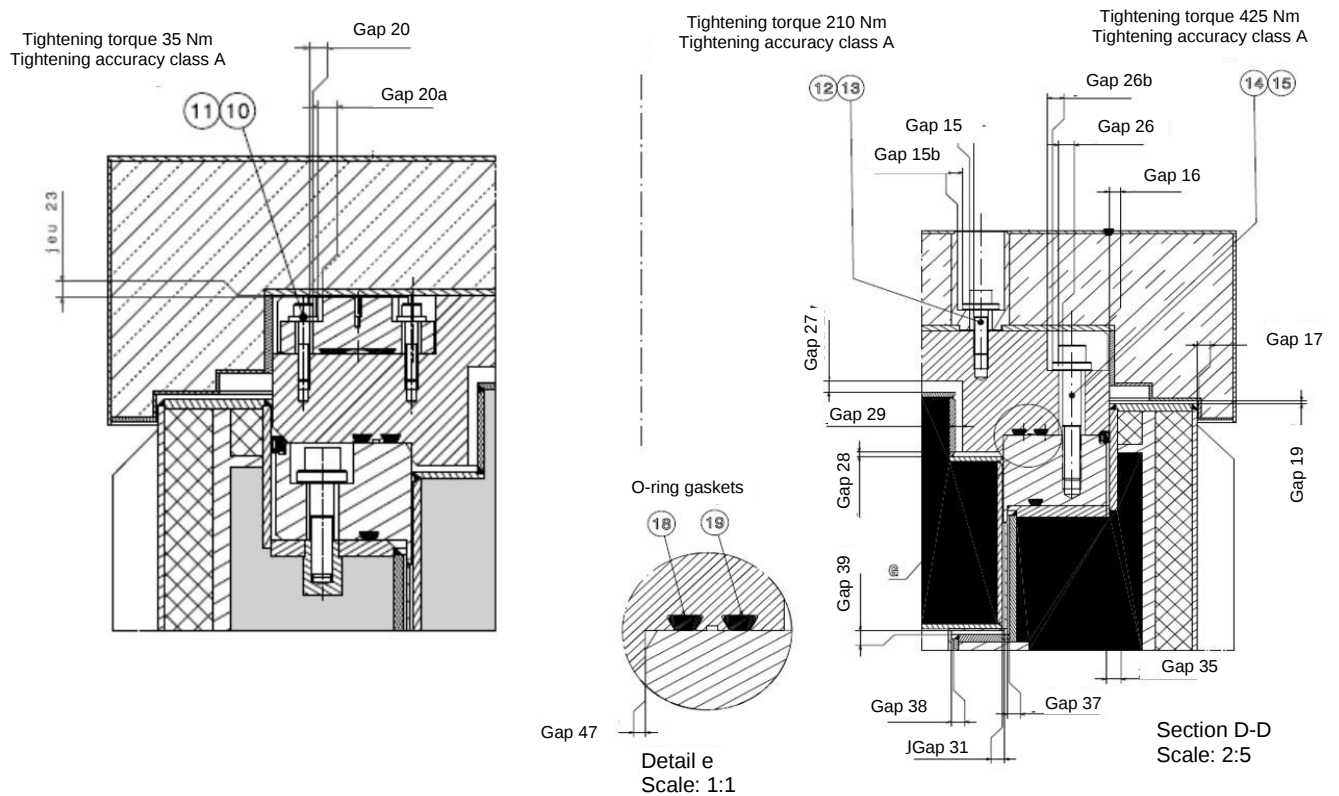
Loading is carried out in accordance with the instructions in Chapter 05-01 of the safety analysis report. The modified SV 34 container is designed to be handled, loaded and transported in a vertical position.

Underwater loading of the modified SV 34 container is not permitted.

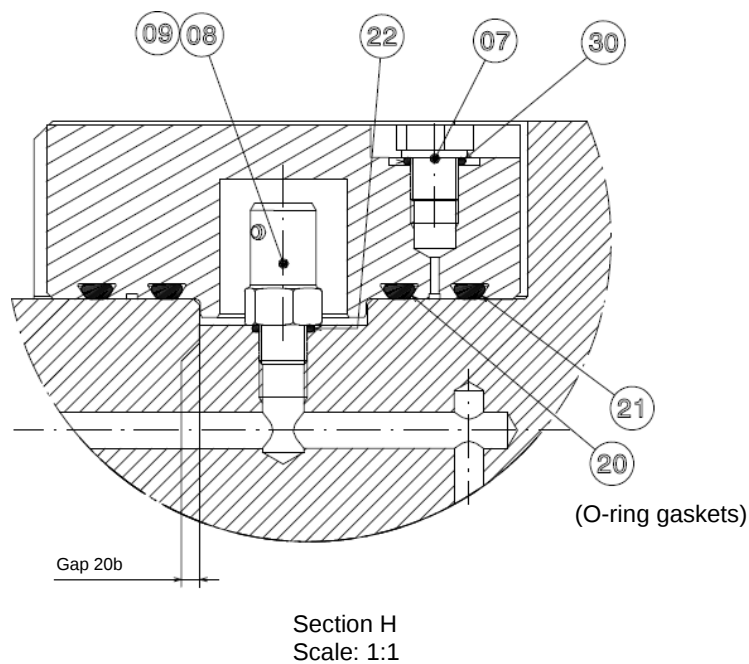
The leak-tightness of the EDCI is checked before departure by decreasing or increasing the pressure in the inter-gasket space (standard permissible leak rate 1.68×10^{-4} Pa.m³.s⁻¹ SLR).

FIGURE 1.1
DIAGRAMS OF THE EDCI CONTAINMENT SYSTEM

EDCI flange



EDCI Closure Plate

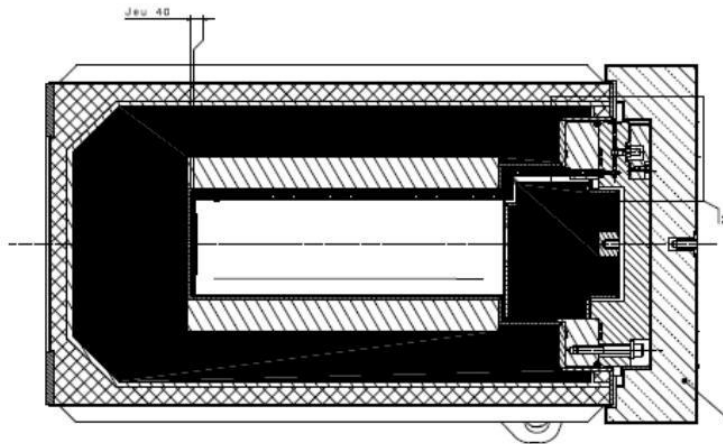
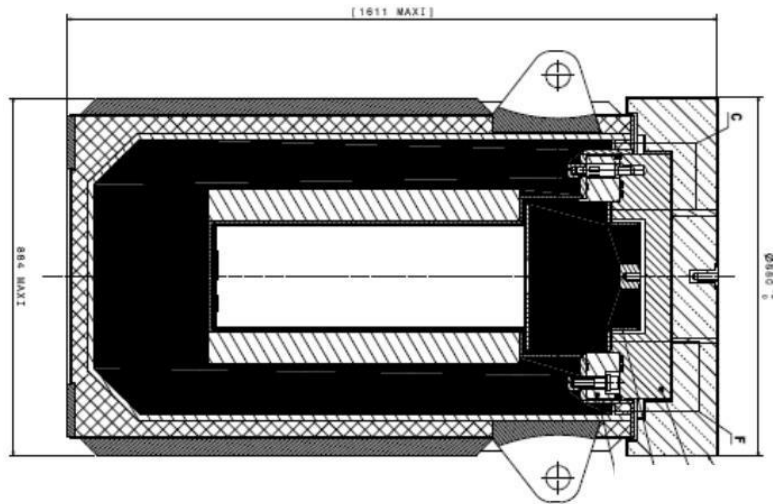


LEGEND:

- (07) : Hex plug, G1/4 male (EDCI lid and closure plate inter-gasket space)
- (08) : Threaded connector, G1/4 male
- (09) : Threaded end-piece, G1/4 female
- (10) : M10x55 Cl.10.9 CHC screw - EDCI lid cover plate
- (11) : M10 washer
- (12) : M16x60 Cl.10.9 CHC screw - cover
- (13) : M16 washer
- (14) : M20x140 Cl.12.9 CHC screw (EDCI lid)
- (15) : M20 washer
- (18) : EPDM O-ring gasket
- (19) : EPDM O-ring gasket
- (20) : EPDM O-ring gasket
- (21) : EPDM O-ring gasket
- (22) : EPDM O-ring gasket
- Gap 15: Gap between the lid cover fixing screws and their holes in the cover (gap important for safety)
- Gap 15b: Gap between the washers of the cover fixing screws and their holes in the cover (functional gap)
- Gap 16: Radial gap between the cover centring shell and the lid (gap important for safety)
- Gap 17: Radial gap between the shell covering the cover and the SV 34 container body (functional gap)
- Gap 19: Axial gap between the cover and the SV 34 container (functional gap)
- Gap 20: Gap between the closure plate fastening screws and their holes in the EDCI flange (gap important for safety)
- Gap 20a: Gap between the closure plate screw washers and their holes in the EDCI flange (functional gap)
- Gap 20b: Radial gap between the closure plate shoulder and its flange on the lid (gap important for safety)
- Gap 23: Depth gap between the closure plate and the lid (functional gap)
- Gap 26: Gap between the lid fastening screws and their holes in the lid (gap important for safety)
- Gap 26b: Gap between the washers of the lid fastening screws and their holes in the lid (functional gap)
- Gap 27: Axial gap between the radiological plug and the central part of the lid (functional gap)
- Gap 28: Axial gap between the radiological plug and the peripheral part of the lid (functional gap)
- Gap 29: Radial gap between the radiological plug and the lid (functional gap)
- Gap 31: Radial gap between the radiological plug and the body (functional gap)
- Gap 35: Radial gap between the flange and the body of the SV 34 container (joining surface zone) (functional gap)
- Gap 37: Radial gap between the body and the SV 34 container body (intermediate zone) (functional gap)
- Gap 38: Radial gap between the body and the cavity of the SV 34 (uninterrupted zone - cavity tube)(functional gap)
- Gap 39: Axial gap between the body and the SV 34 container body (intermediate zone) (functional gap)
- Gap 47: Radial gap between the lid shoulder and the inside of the EDCI flange (gap important for safety)
- Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 1.2
DIAGRAM OF THE MODIFIED SV 34 CONTAINER FITTED WITH THE EDCI

With dip tube



Without dip tube

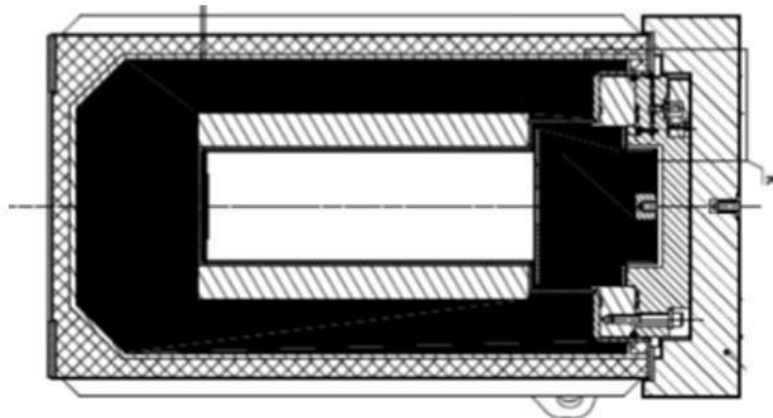
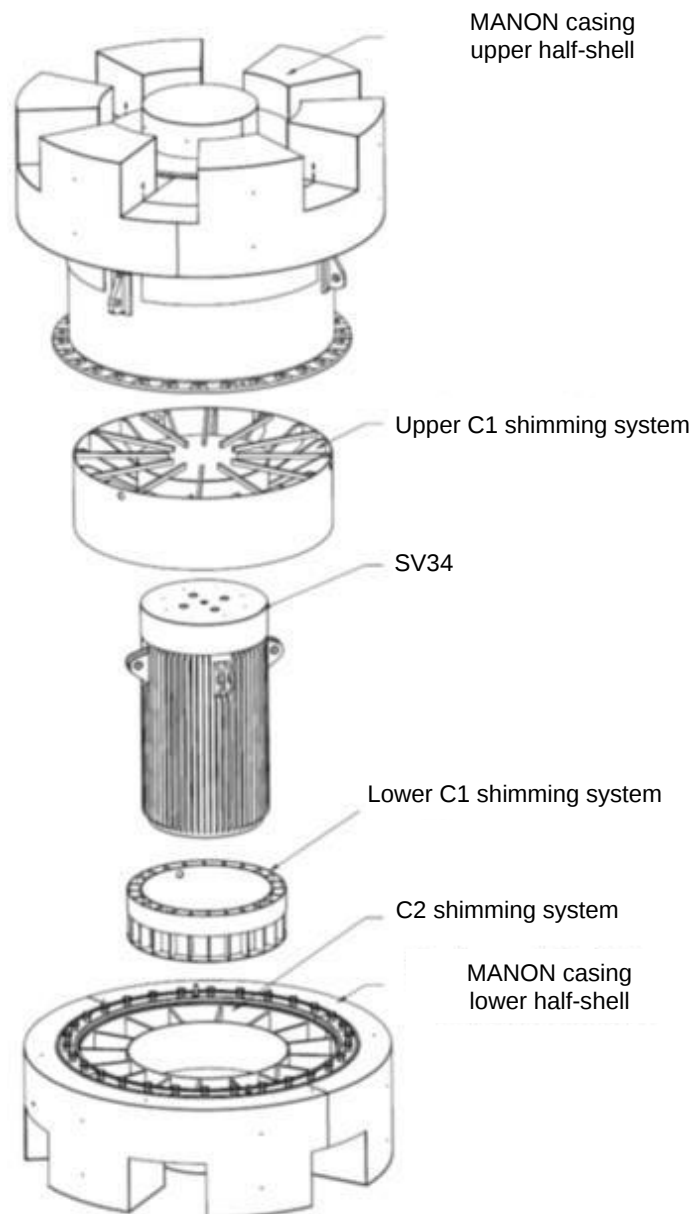


FIGURE 1.3
DIAGRAM OF THE SHIMMING SYSTEM FOR THE MODIFIED SV 34 CONTAINER IN THE CASING



APPENDIX 2

MODIFIED SV 69 CONTAINER LOADED WITH COBALT 60 OR CAESIUM 137 RADIOACTIVE SOURCES

The safety analysis report justifying the authorised contents has the reference DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

1. DESCRIPTION OF AUTHORISED CONTENTS

The authorised radioactive content, detailed in Chapter 2 of the safety analysis report, comprises a modified SV 69 container loaded with cobalt 60 or caesium 137 radioactive sources.

1.1 Description of modified SV 69 container

1.1.1 Modified SV 69 container

The modified SV 69 container is designed and manufactured in accordance with safety analysis report R65 DAG 000 Revision 2 of 16 July 1996. It is inspected, tested and maintained in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The design drawing for the modified SV 69 container has the reference 0A330E00 Rev. E. A diagram of the modified SV 69 container is shown in Figure 2.1.

The design drawing for the new lid on the modified SV 69 container has the reference EMB/MANON/AMINT/DSS/PE 0300.

Dimensions of the modified SV 69 container	Overall	Useful
Height	1612 mm	575 mm
Diameter	1100 mm	335 mm

The maximum weight of the modified SV 69 container when loaded is 8800 kg.

The modified SV 69 container comprises a cylindrical body made up of a stainless steel outer shell, fitted with vertical cooling fins, a thermal protection made of compound PNT7, a protection against radiation, and a stainless steel inner shell. Four lugs are welded to the body for handling purposes.

The bottom of the container is made of a stainless steel plate, protection against radiation, thermal protection made of compound PNT7 and a stainless steel plate.

The inner shell has a flange to accommodate a plug made of lead with 4% antimony. The closure system is made up of a stainless steel lid fastened to the body by twenty-eight M24x60 class 10.9 H screws tightened to a torque of 230 Nm.

1.1.2 Shock absorbing system

The modified SV 69 container is fitted at the top with a shock absorbing cover made of wood enclosed in stainless steel cladding, attached to the body by sixteen M12 class A4-80 CHc screws, tightened to a torque of 27 Nm.

1.1.3 Containment enclosure

The enclosure of the modified SV 69 container consists of:

- the modified SV 69 container body and its welds;
- the lid and its internal gasket;
- the lid plug and its internal gasket.

A diagram of the containment system of the modified SV 69 container is shown in Figure 2.2.

1.1.4 Radiological protection

The radiological protection of the modified SV 69 container is provided by:

- the radial thickness and the thickness of the bottom, made of lead and steel, of the modified SV 69 container body;

- the lead thickness of the modified SV 69 container plug;
- the steel lid of the modified SV 69 container.

1.2 Description of radioactive sources

The radioactive sources loaded in the modified SV 69 container are described in Chapter 2 of the safety analysis report and meet the specifications given in the table below:

Radionuclide	Cobalt 60	Caesium 137
Physical state	Solid	
Chemical form	Metal	Caesium chloride (ClCs) Pollucite (Cs_2O , Al_2O_3 , 4SiO_2) Caesium nitrate (CsNO_3)
Packaging of the source	Welded double stainless steel capsule	
Pressure in the inner capsule of the source	Less than or equal to atmospheric pressure at the time of packaging.	
Type of radiation	Beta, gamma and X	
Maximum package activity	980 TBq	3150 TBq
Maximum heat output of the package	410 W	

The two types of source can be mixed as long as the total heat output does not exceed 410 W and the maximum total activity does not exceed 3150 TBq.

1.3 Internal fittings

The internal fittings are described in Chapter 2 of the safety analysis report.

1.3.1 Basket

The basket is made up of a mast onto which disks are welded concentrically, at appropriate heights to spread the transport loads. The intermediate and upper disks have circular holes for the sources or tubular source recesses. The lower disks act as lower stops for the positioning of the sources.

1.3.2 Shims

The modified SV 69 container has a shimming system for positioning it in the casing.

A diagram of the shimming system for the modified SV 69 container in the casing is shown in Figure 2.3.

The design drawings of the different parts of this shimming system have the references:

- EMB/MANON/AMINT/DSS/PE 0130 Rev. A for the whole assembly;
- EMB/MANON/AMINT/DSS/PD 0131 Rev. A for the upper half-shell of the casing;
- EMB/MANON/AMINT/DSS/PD 0123 Rev. A for the lower half-shell of the casing.

2. LOADING CONDITIONS

Loading is carried out in accordance with the instructions in Chapter 05-01 of the safety analysis report. The modified SV 69 container is designed to be handled, loaded and transported in a vertical position.

The leak-tightness of the modified SV 69 container is checked before departure by decreasing or increasing the pressure in the inter-gasket space (standard permissible leak rate $1.65 \times 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}$ SLR).

FIGURE 2.1
DIAGRAM OF THE MODIFIED SV 69 CONTAINER

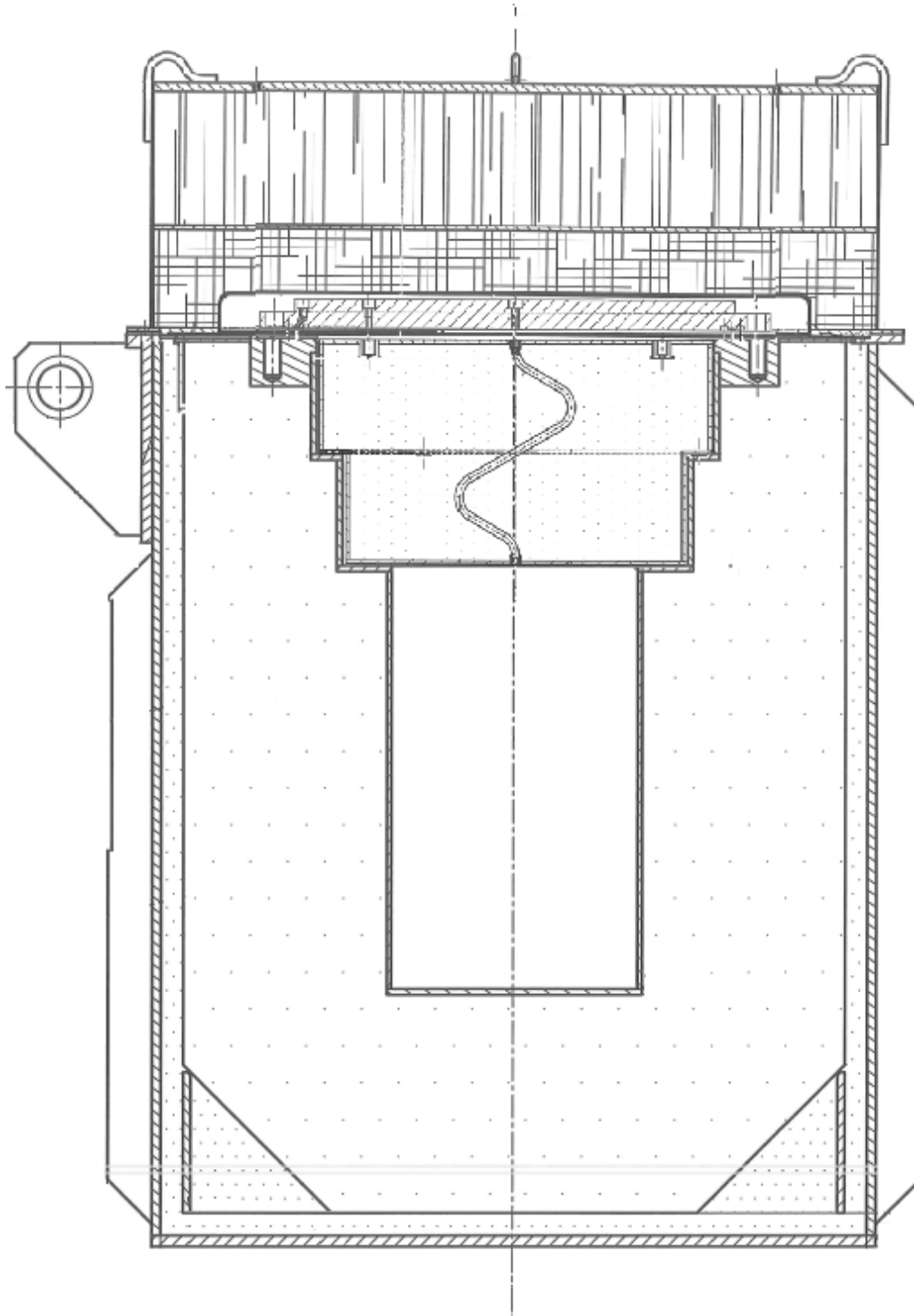
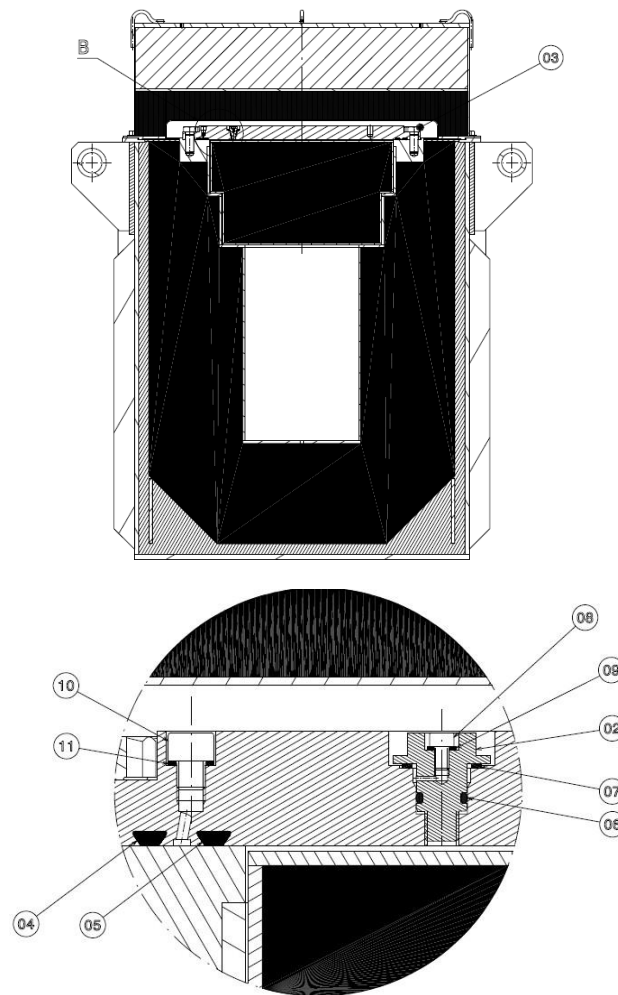


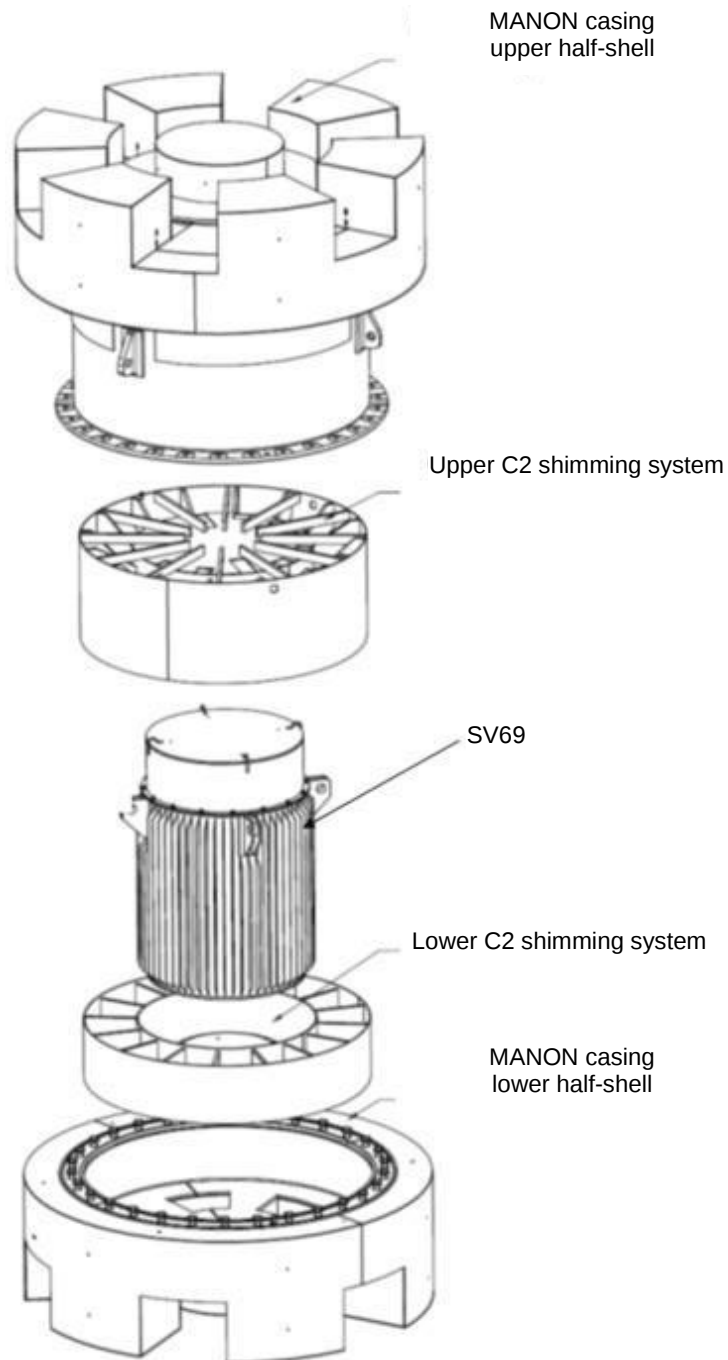
FIGURE 2.2
DIAGRAM OF THE CONTAINMENT SYSTEM OF THE MODIFIED SV 69 CONTAINER



LEGEND:

- (02) : Plug
- (03) : M24x60 H screw, Cl. 10.9
- (04) : EPDM O-ring gasket
- (05) : EPDM O-ring gasket
- (06) : EPDM O-ring gasket
- (07) : BS ring (M20)
- (08) : M5x8 CHC screw, Cl. 8.8
- (09) : BS ring (M5)
- (10) : M10x10 CHC screw - Cl. 8.8
- (11) : BS ring (M10)

FIGURE 2.3
DIAGRAM OF THE SHIMMING SYSTEM FOR THE MODIFIED SV 69 CONTAINER IN THE CASING



APPENDIX 3

EXTERNAL ENCLOSURE LOADED WITH NON-REMOVABLE EQUIPMENT

The safety analysis report justifying these contents has the reference DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

1. DESCRIPTION OF AUTHORISED CONTENTS

The authorised radioactive content, as described in Chapters 2 and 3 of the safety analysis report, comprises an external enclosure (EDCE) loaded with one of the following 'non-removable' items of equipment:

- Marguerite 20;
- Marguerite 2;
- Geter 2D;
- GSM 15;
- Gisète 4;
- Gisète 5;
- Isotaaf 1.

These non-removable items of equipment enclose strontium 90 radioactive sources.

1.1 Description of the external enclosure

The EDCE is designed, manufactured, inspected, tested, maintained and used in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The design drawing for the EDCE has the reference EMB/MANON/AMINT/DSS/PE 0500 Rev. A. A diagram of the EDCE is shown in Figure 3.1. Diagrams of its containment elements are shown in Figure 3.2.

EDCE dimensions	Overall	Useful
Height	1672 mm	1428 mm
Diameter	1780 mm	1450 mm

The cylindrical enclosure is made up of two stainless steel half-shells, an upper and a lower one. Each half-shell is composed of a cylindrical shell welded at one end to a plate and at the other to a flange. The two flanges are fastened together by eighteen screws. Two trapezoidal grooves are machined into the upper flange to hold two EPDM O-ring gaskets.

Inside each half-shell, both axially and radially, there is a layer of DL NU280h phenolic foam providing both mechanical and thermal protection. The foam is protected by stainless steel plates.

A stainless steel closure plate protects the EDCE venting self-closing coupling (radially positioned on the upper half-shell). The coupling is attached to the EDCE by four screws. Two trapezoidal grooves are machined into the closure plate to hold two EPDM O-ring gaskets.

The EDCE is handled (straight lift) by attaching slings to three handling studs (to which M24 rings are screwed, with a unit capacity of 3500 kg during handling phases) on the upper half-shell.

The maximum weight of the empty EDCE is 2148 kg.

The containment for the EDCE loaded with an item of non-removable equipment is provided by the EDCE's enclosure, which comprises:

- the two half-shells of the EDCE, their flange, welds and the internal gasket of the upper shell;
- the protective closure plate of the self-closing coupling and its internal gasket.

1.2 Description of non-removable equipment and radioactive sources

The non-removable equipment items (AI) are electric generators of various geometries comprising a steel and lead protective cask enclosing one or more strontium 90 sources (in the form of sintered pellets).

The following AIs can be loaded into the EDCE. Their characteristics are summarised in the table below:

AI	AI shown in figure	Mass (kg)	Activity as of 01/09/2006 (TBq)	Thermal power in 2006 (W)
Marguerite 20	3.3	4000	1699.4	309
Marguerite 2	3.4	450	10.4	2
Geter 2D ⁽¹⁾	3.5	1965	36.0	7
GSM 15	3.6	600	25.9	5
Gisète 4	3.7	2270	202.7	37
Gisète 5	3.8	1670	1022.3	186
Isotaaf 1	3.9	212	23.3	4
⁽¹⁾ The GETER 2D non-removable equipment is transported without its trolley, which has blunt edges.				

The radiological protection for the non-removable equipment is provided by its steel and lead radial and axial thicknesses.

1.3 Internal fittings

The internal fittings are described in Chapter 2 of the safety analysis report.

The EDCE does not have a shimming system inside the casing.

There is a different shimming system, made of stainless steel, for each type of non-removable equipment. For each type of shimming system, there is an upper part and a lower part.

AI shimming system	Maximum mass	Associated drawing
K2 shimming system (Marguerite 20)	290 kg	EMB/MANON/AMINT/DSS/PE 0520 Rev. A
K7 shimming system (Marguerite 2)	476 kg	EMB/MANON/AMINT/DSS/PE 0570 Rev. A
K4 shimming system (Geter 2D)	702 kg	EMB/MANON/AMINT/DSS/PE 0540 Rev. A
K6 shimming system (GSM 15)	670 kg	EMB/MANON/AMINT/DSS/PE 0560 Rev. A
K3 shimming system (Gisète 4)	373 kg	EMB/MANON/AMINT/DSS/PE 0530 Rev. A
K5 shimming system (Gisète 5)	537 kg	EMB/MANON/AMINT/DSS/PE 0550 Rev. A
K8 shimming system (Isotaaf 1)	763 kg	EMB/MANON/AMINT/DSS/PE 0580 Rev. A

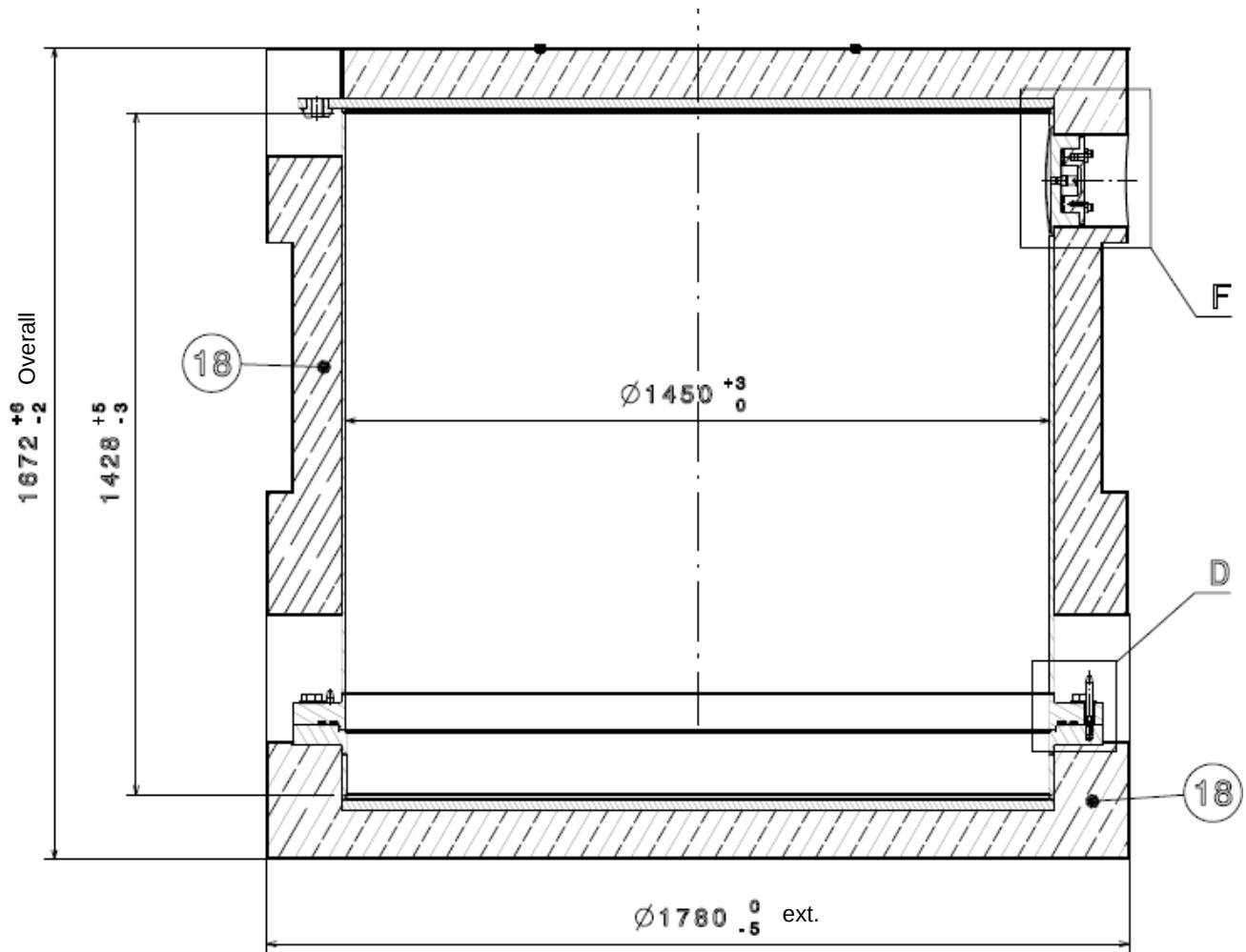
2. **LOADING CONDITIONS**

Loading is carried out in accordance with Chapter 05-01 of the safety analysis report.

The EDCE is designed to be handled, loaded and transported in a vertical position.

The leak-tightness of the EDCE is checked before departure by decreasing or increasing the pressure in the inter-gasket space (standard permissible leak rate $6.2 \times 10^{-4} \text{ Pa.m}^3.\text{s}^{-1}$ SLR).

FIGURE 3.1
EDCE DIAGRAM

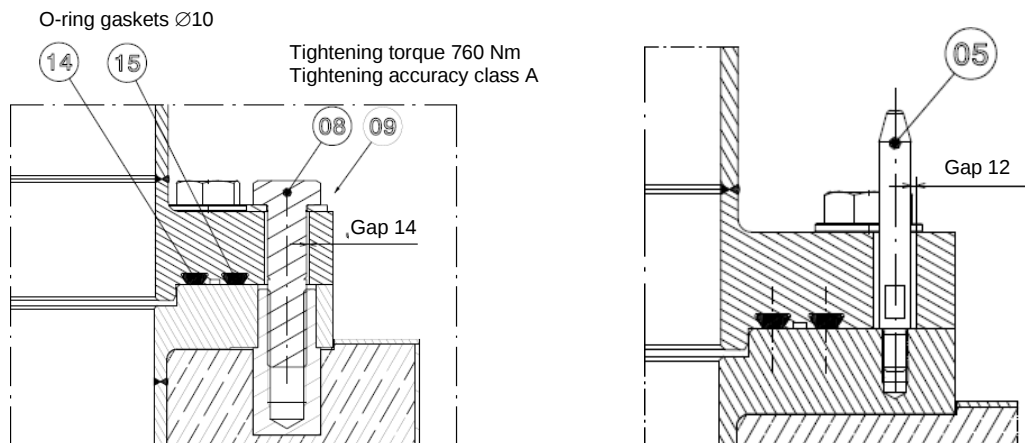


LEGEND:

(18): Phenolic foam in the radial and axial part of the EDCE

FIGURE 3.2
DIAGRAMS OF THE EDCE CONTAINMENT ELEMENTS

EDCE flange



EDCE Closure Plate

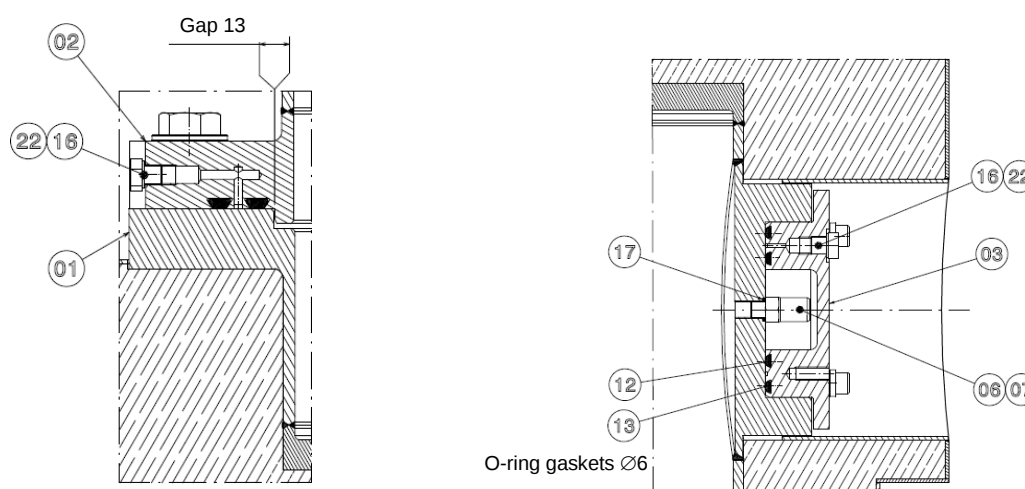


FIGURE 3.2 LEGEND:

- (01) : EDCE/lower half-shell
- (02) : EDCE/upper half-shell
- (03) : EDCE/closure plate
- (05) : EDCE/long guide pin
- (06) : Staubli threaded connector, G1/4 male
- (07) : Threaded end-piece, G1/4 female
- (08) : M24x100 Cl.12.9 H screw
- (09) : M24 washer, Ø44 thickness 4 mm
- (12) : EPDM O-ring gasket
- (13) : EPDM O-ring gasket
- (14) : EPDM O-ring gasket

- (15) : O-ring gasket
- (16) : Hex plug, G1/4 male
- (17) : EPDM Bi-material gasket washer
- (22) : BS ring (G1/4)
- Gap 12: Gap between the EDCE fool-proofing device and its hole in the flange of the upper half-shell (functional gap)
- Gap 13: Radial gap between the flange shoulders of each half-shell (gap important for safety)
- Gap 14: Gap between the EDCE closure screws and their holes in the flange of the upper half-shell (gap important for safety)
- Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 3.3
DIAGRAM OF THE MARGUERITE 20 NON-REMOVABLE EQUIPMENT

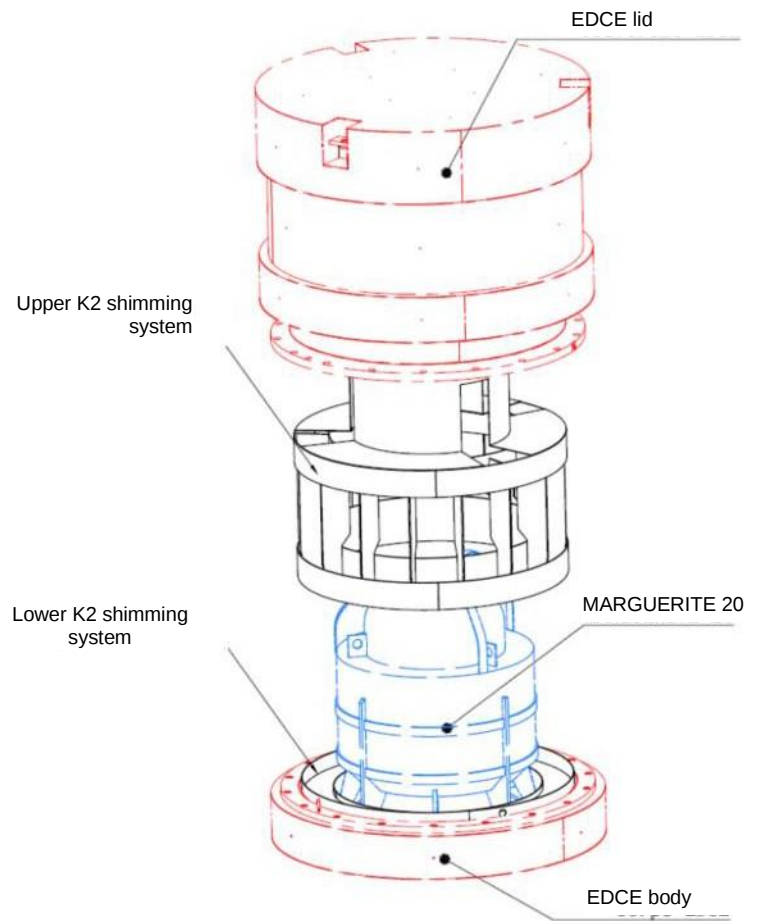
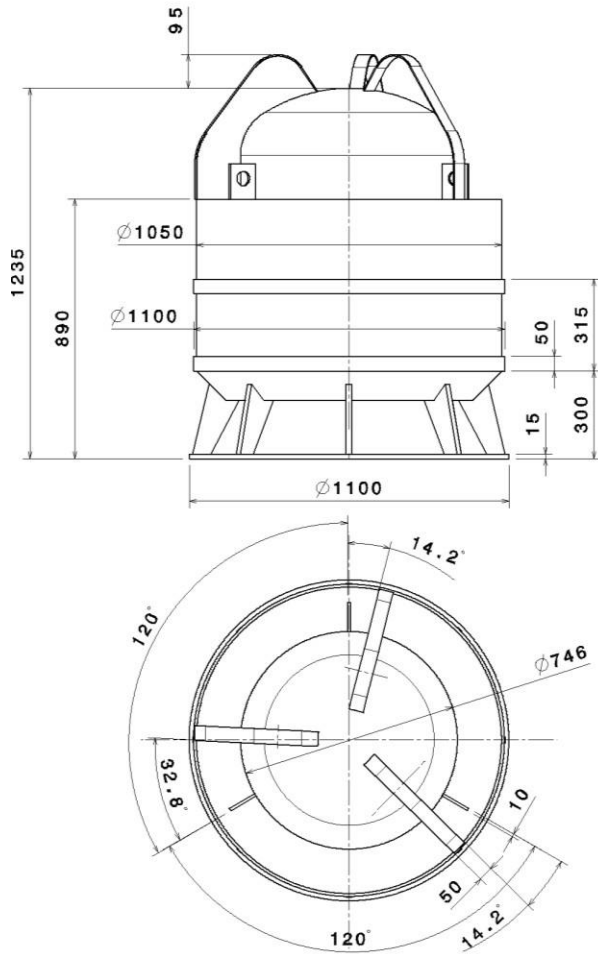


FIGURE 3.4
DIAGRAM OF THE MARGUERITE 2 NON-REMOVABLE EQUIPMENT

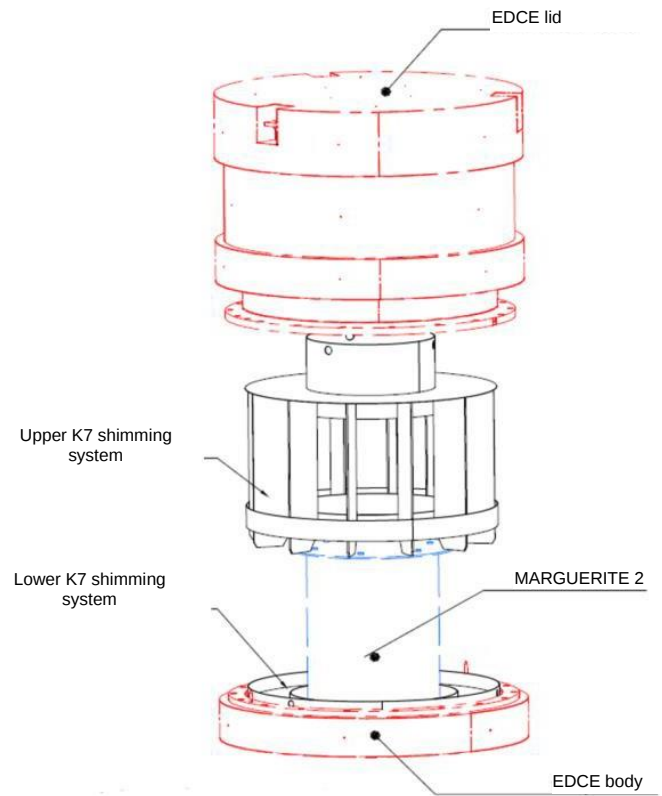
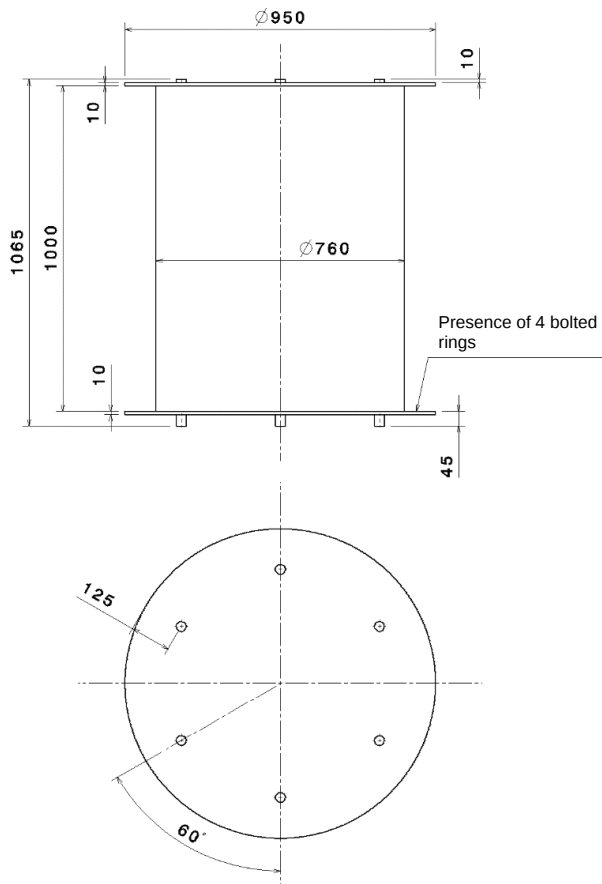


FIGURE 3.5
DIAGRAM OF THE GETER 2D NON-REMOVABLE EQUIPMENT

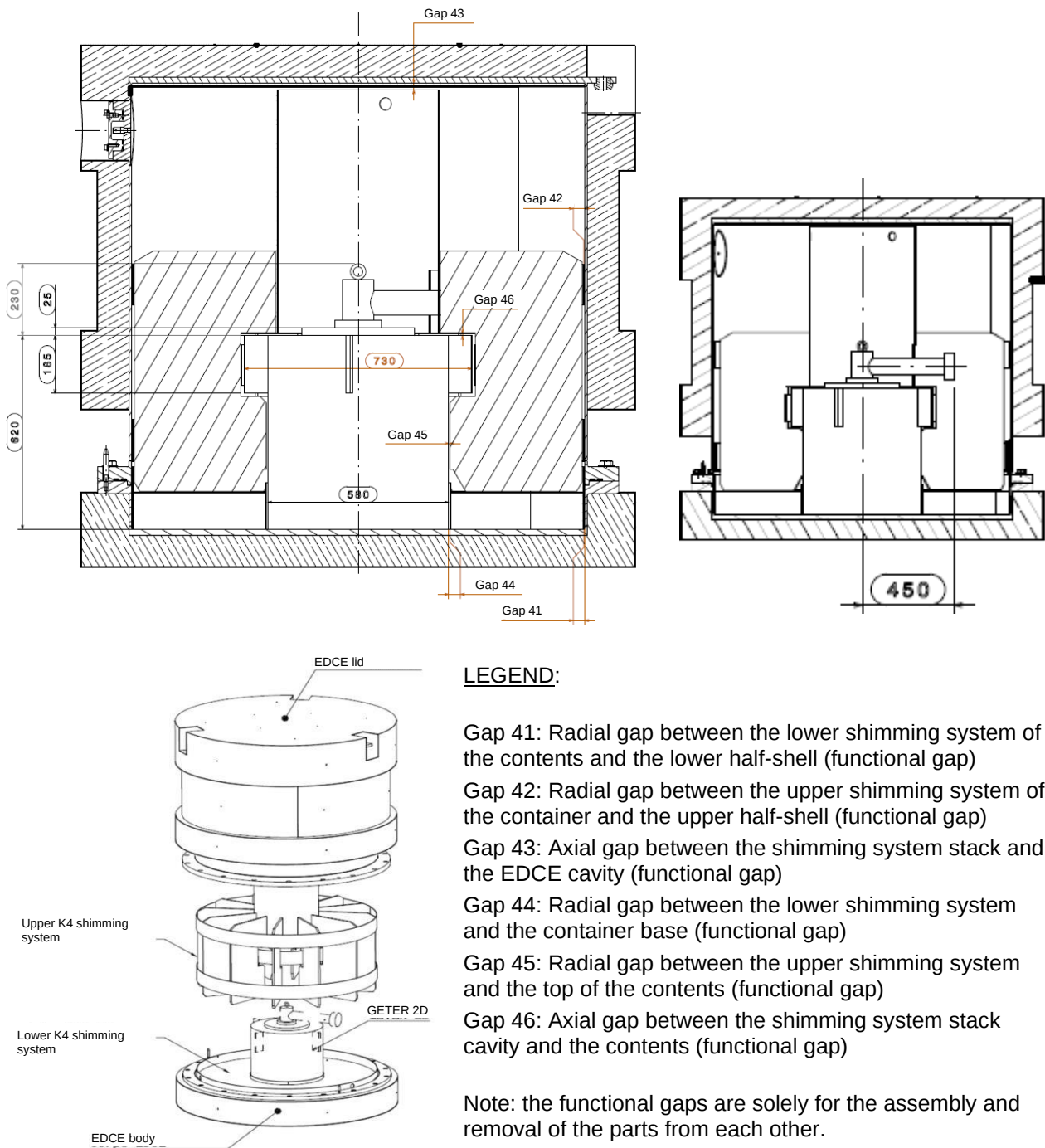


FIGURE 3.6
DIAGRAM OF THE GSM 15 NON-REMOVABLE EQUIPMENT

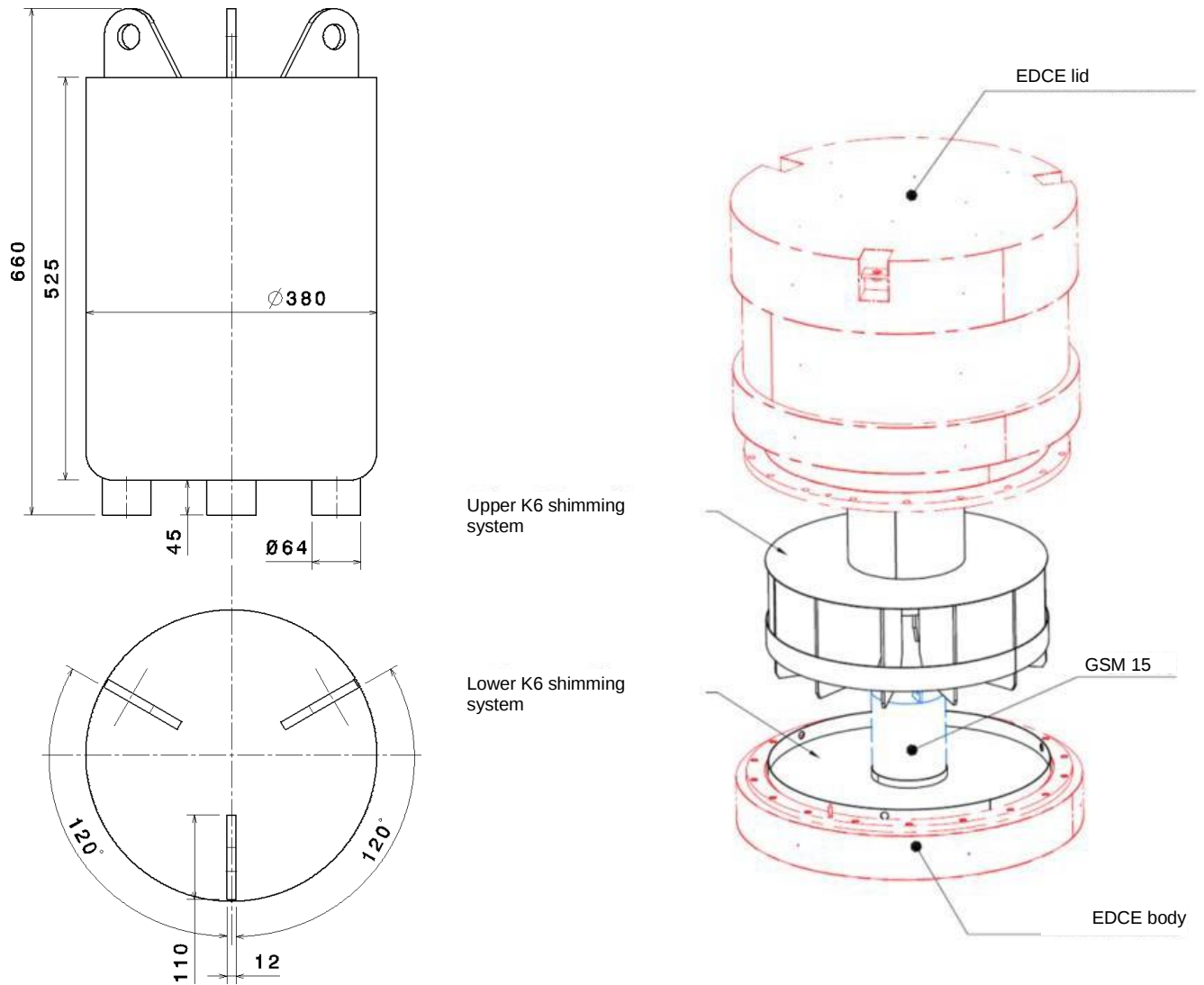


FIGURE 3.7
DIAGRAM OF THE GISETE 4 NON-REMOVABLE EQUIPMENT

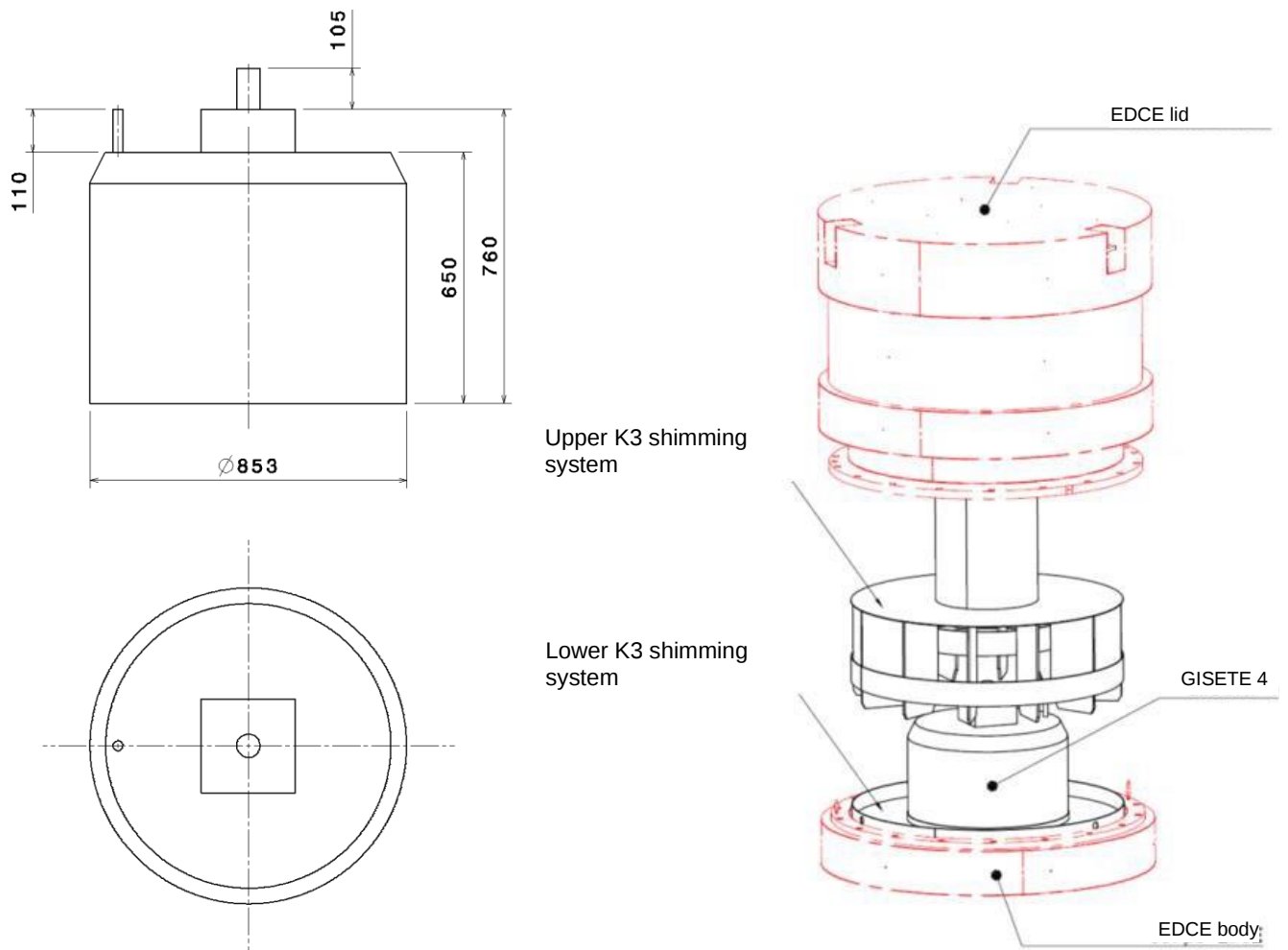


FIGURE 3.8 DIAGRAM OF THE GISETE 5 NON-REMOVABLE EQUIPMENT

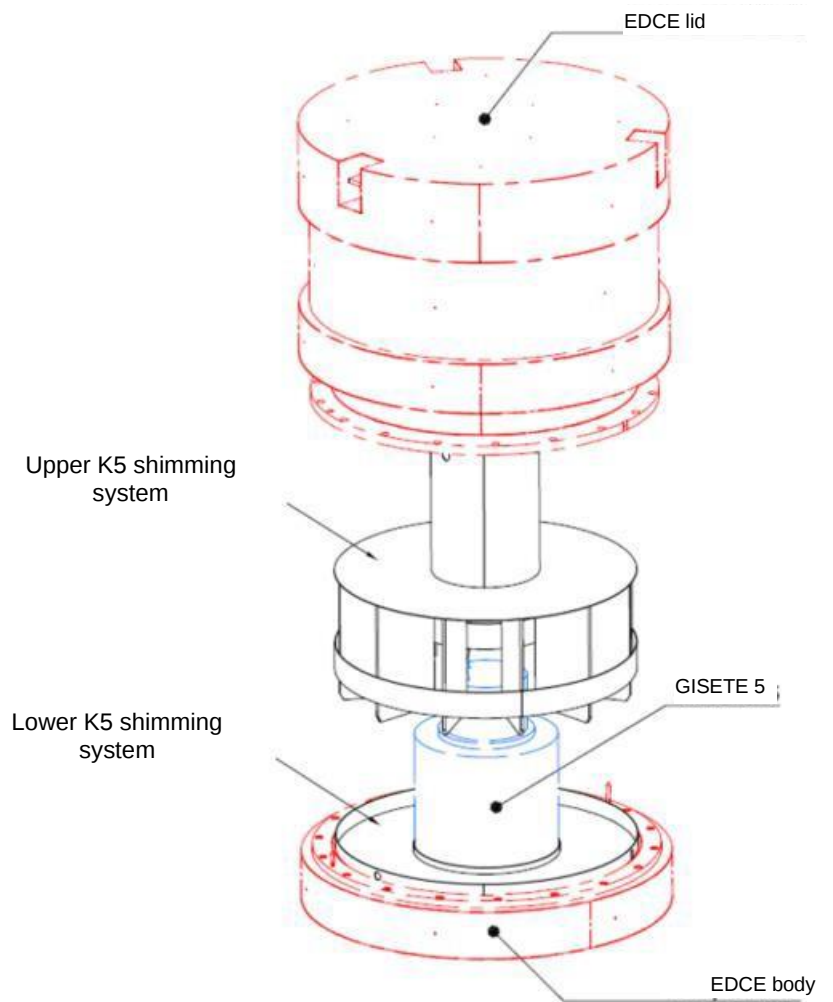
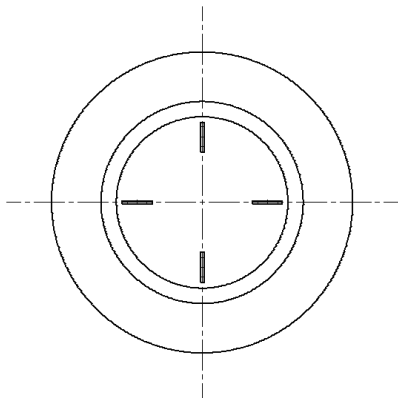
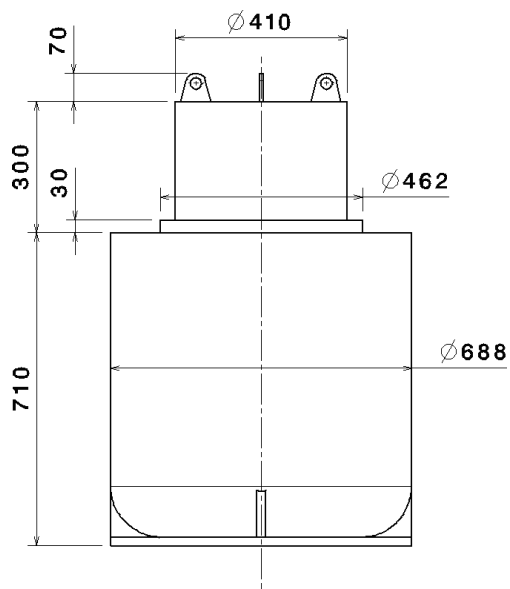
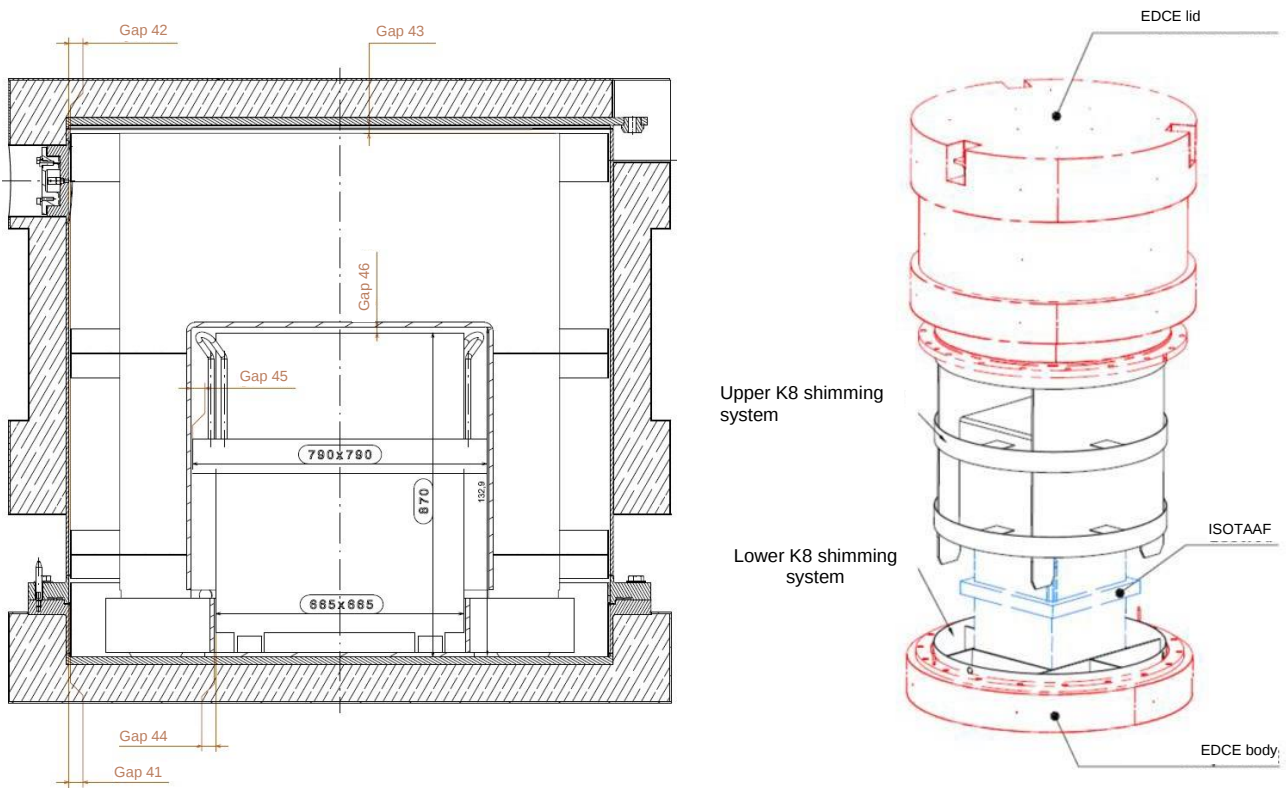


FIGURE 3.9
DIAGRAM OF THE ISOTAAF 1 NON-REMOVABLE EQUIPMENT



LEGEND:

- Gap 41: Radial gap between the lower shimming system for the contents and the lower half-shell (functional gap)
- Gap 42: Radial gap between the upper shimming system of the container and the upper half-shell (functional gap)
- Gap 43: Axial gap between the shimming system stack and the EDCE cavity (functional gap)
- Gap 44: Radial gap between the lower shimming system and the container base (functional gap)
- Gap 45: Radial gap between the upper shimming system and the top of the contents (functional gap)
- Gap 46: Axial gap between the shimming system stack cavity and the contents (functional gap)

Note: the functional gaps are solely for the assembly and removal of the parts from each other.

APPENDIX 4

EXTERNAL ENCLOSURE (EDCE) LOADED WITH A CC33 OVERPACK CONTAINING A 90SR RADIOACTIVE SOURCE

The safety analysis report justifying these contents has the reference DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

1. DESCRIPTION OF AUTHORISED CONTENTS

The authorised radioactive content comprises an external enclosure (EDCE) loaded with a CC33 overpack containing a ⁹⁰Sr radioactive source. This source is packaged in one of the following three configurations:

- S1 source in transfer nacelle DT1;
- S2 source in transfer nacelle DT2/3;
- S3 source in transfer nacelle DT2/3.

1.1 DESCRIPTION OF THE EDCE

The EDCE is designed, manufactured, inspected, tested, maintained and used in compliance with safety analysis report DSN STMR/LEPE S-MANON DSEM 5100 Rev. 02 dated 22 March 2019.

The design drawing for the EDCE has the reference EMB/MANON/AMINT/DSS/PE 0500 Rev. A. A diagram of the EDCE is shown in Figure 4.1. The diagrams of these containment systems are presented in Figure 4.2.

EDCE dimensions	Overall	Usable
Height	1672 mm	1428 mm
Diameter	1780 mm	1450 mm

The cylindrical enclosure is made up of two stainless steel half-shells, an upper and a lower one. Each half-shell is composed of a cylindrical shell welded at one end to a plate and at the other to a flange. The two flanges are fastened together by eighteen screws. Two trapezoidal grooves are machined into the upper flange to hold two EPDM O-ring gaskets.

Inside each half-shell, both axially and radially, there is a layer of DL NU280h phenolic foam providing both mechanical and thermal protection. The foam is protected by stainless steel plates.

A stainless steel closure plate protects the EDCE venting self-closing coupling (radially positioned on the upper half-shell). It is attached to the EDCE by four screws. Two trapezoidal grooves are machined into the closure plate to hold two EPDM O-ring gaskets.

The EDCE is handled (straight lift) by attaching slings to 3 handling studs (to which M24 rings are screwed, with a unit capacity of 3500 kg during handling phases) on the upper half-shell.

The maximum weight of the empty EDCE is 2148 kg.

The maximum weight of the loaded EDCE is 6438 kg.

The containment of the EDCE when loaded with the CC33 overpack containing a 90Sr radioactive source is provided by its containment enclosure, consisting of:

- the two half-shells of the EDCE, their flange, welds and the internal gasket of the upper shell;
- the protective closure plate of the self-closing coupling and its internal gasket.

1.2 Description of the 'S1', 'S2' and 'S3' sources

The packaging of the S1 source consists of (see Figure 4.3):

- a source block, consisting of a source composed of three strontium titanate (SrTiO₃) pellets clad in a double Hastelloy C capsule;
- a shielding block with an effective thickness of 65 mm of depleted uranium; it consists of a body and a lid, assembled by nuts screwed to studs installed in the body;
- a 5 mm thick stainless steel outer capsule.

The packaging of the S2 and S3 sources is cylindrical and consists (see Figure 4.4 and Figure 4.5), from

bottom to top, of:

- a source consisting of strontium titanate (SrTiO₃) pellets;
- shielding made of lead shot;
- a 4 mm thick stainless steel outer capsule.

The properties of the S1, S2 and S3 sources are set in the table below. In particular, the activities and heat outputs at the time of transport do not exceed the values shown there.

Identification of source	Overall diameter of base (mm)	Overall height (mm)	Mass (kg)	Activity (TBq)	Thermal power (W)
S1	340	320	130	1699 TBq	31
S2	110	714	15		25
S3	155	727	23		18

1.3 Description of the transfer nacelles

The S1, S2 or S3 sources are handled and loaded into the CC33 overpack by means of the transfer nacelles described below.

Transfer nacelle DT1

The transfer nacelle for source S1, known as the "DT1 nacelle" (see Figure 4.6) is made of stainless steel. Its characteristics are as follows:

Overall diameter of base	Overall height	Mass when empty	Maximum mass of source shimming system	Maximum mass when loaded
498 mm	760 mm	60 kg	60 kg	250 kg

The source is placed in the transfer nacelle under water. Drying is carried out before loading the transfer nacelle into the overpack.

After drying, the source is shimmed in the transfer nacelle using materials that do not contain hydrogen.

Transfer nacelle DT2/3

The transfer nacelle for the S2 and S3 sources, known as the "DT2/3 nacelle" (see Figure 4.7) is made of stainless steel and lead for biological protection. Its characteristics are as follows:

Overall diameter of base	Overall height	Mass when empty	Maximum mass when loaded
498 mm	995.5 mm*	1177 kg	1200 kg

* without the upper handling ring and without the lower shock absorber

The S2 and S3 sources are placed in the transfer nacelle under water.

The nacelle has a handling ring at the top and a shock absorber at the bottom. These two elements are removable and are removed before transport.

1.4 CC33 overpack and transfer nacelle shimming system

1.4.1 CC33 overpack

The CC33 overpack is shown in Figure 4.8. It comprises:

- a cylindrical stainless steel body;
- a cylindrical stainless steel lid fastened to the body by means of screw/nut systems.

The characteristics of the loaded CC33 overpack are shown in the table below:

Overall diameter of base	Overall height	Mass when empty	Maximum mass when empty of the DT1 and DT2/3 transfer nacelle shimming system	Maximum mass when loaded
1230 mm	1199 mm	526 kg	500 kg	2926 kg

The CC33 overpack is handled using four handling assemblies welded to the top of the lid.

The tie-down belt and the fork pocket system are removed before transport.

1.4.2 Shimming of the transfer nacelles in the CC33 overpack

The DT1 and DT2/3 transfer nacelles are shimmed in the CC33 overpack using a stainless steel shimming system shown in Figure 4.9 for the DT1 transfer nacelle and Figure 4.10 for the DT2/3 transfer nacelle.

The lower shimming system is common to the DT1 and DT2/3 nacelles.

The dimensions of the shimming systems allow a minimum free volume of 771 litres in the CC33 overpack.

1.4.3 Drying of the DT1 and DT2/3 transfer nacelles

Before the DT1 and DT2/3 transfer nacelles are loaded into the CC33 overpack, they are dried in a specific enclosure.

1.5 Internal fittings

The EDCE does not have a shimming system inside the casing.

The CC33 overpack is shimmed in the EDCE using a stainless steel shimming system, shown in Figure 4.11.

Shimming system	Maximum mass	Associated drawing
Shimming the CC33 overpack in the EDCE	500 kg	EMB-MANON-AMINT-DSS-PE-0601-A

The tie-down belt and the fork pocket system of the CC33 overpack are removed before transport.

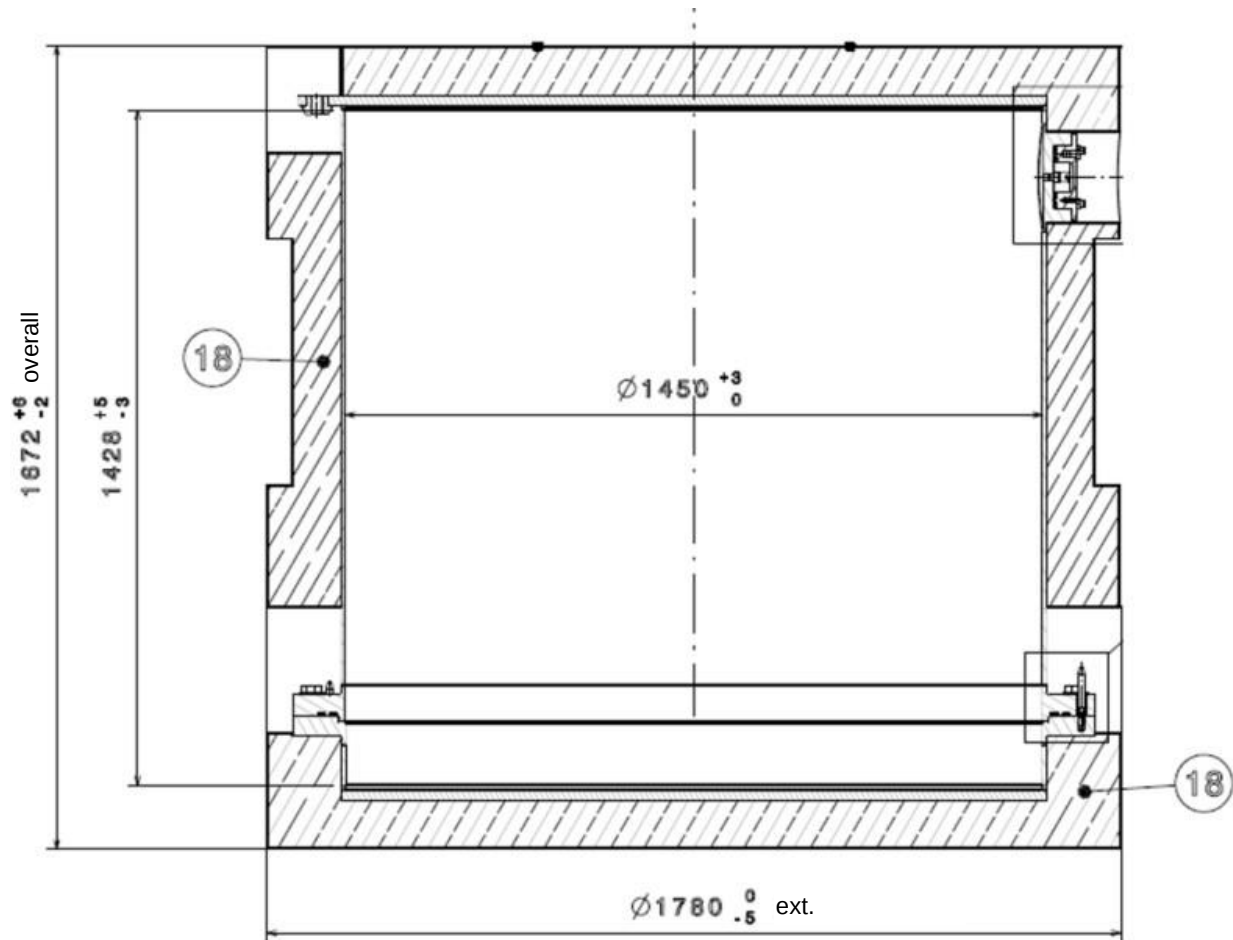
2. LOADING CONDITIONS

Loading is carried out in accordance with Chapter 05-01 of the safety analysis report.

The EDCE is designed to be handled, loaded and transported in a vertical position.

The leak-tightness of the EDCE is checked before departure by decreasing or increasing the pressure in the inter-gasket space (standard permissible leak rate 6.2×10^{-4} Pa.m³.s⁻¹ SLR).

FIGURE 4.1
EDCE DIAGRAM

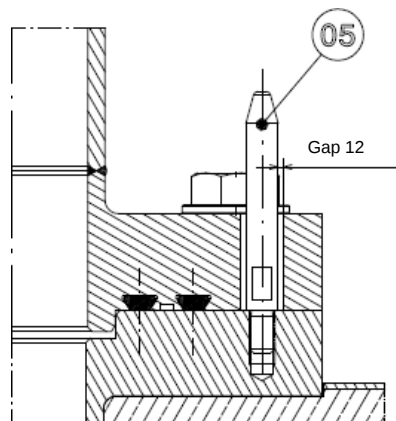
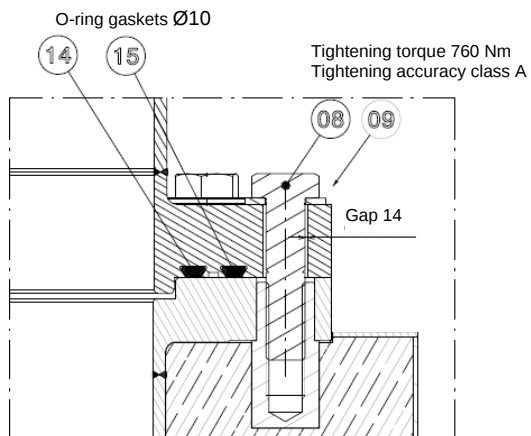


LEGEND:

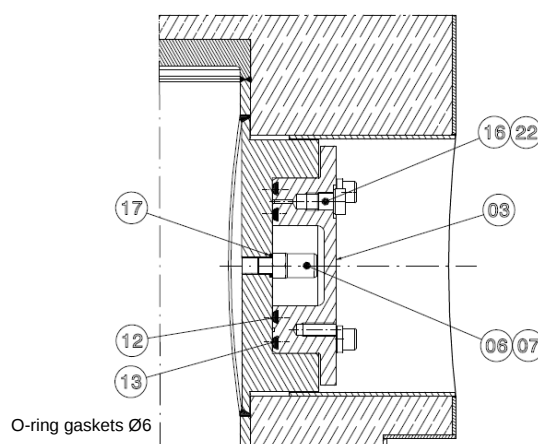
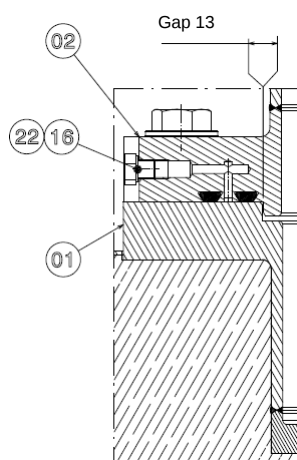
(18): Phenolic foam in the radial and axial part of the EDCE

FIGURE 4.2
DIAGRAMS OF THE EDCE CONTAINMENT ELEMENTS

EDCE flange



EDCE Closure Plate



LEGEND:

- (01) : EDCE/lower half-shell
- (02) : EDCE/upper half-shell
- (03) : EDCE/closure plate
- (05) : EDCE/long guide pin
- (06) : Staubli threaded connector, G1/4 male
- (07) : Threaded end-piece, G1/4 female
- (08) : M24x100 Cl.12.9 H screw
- (09) : M24 washer, Ø44 thickness 4 mm
- (12) : EPDM O-ring gasket
- (13) : EPDM O-ring gasket
- (14) : EPDM O-ring gasket
- (15) : EPDM O-ring gasket

- (16) : Hex plug, G1/4 male (EDCE flange and closure plate inter-gasket space)
- (17) : Bi-material gasket washer (G1/4 thread)
- (22) : BS ring (G1/4)
- Gap 12: Gap between the EDCE fool-proofing device and its hole in the flange of the upper half-shell (functional gap)
- Gap 13: Radial gap between the flange shoulders of each half-shell (gap important for safety)
- Gap 14: Gap between the EDCE closure screws and their holes in the flange of the upper half-shell (gap important for safety)
- Note: the functional gaps are solely for the assembly and removal of the parts from each other.

FIGURE 4.3
DIAGRAM OF SOURCE S1

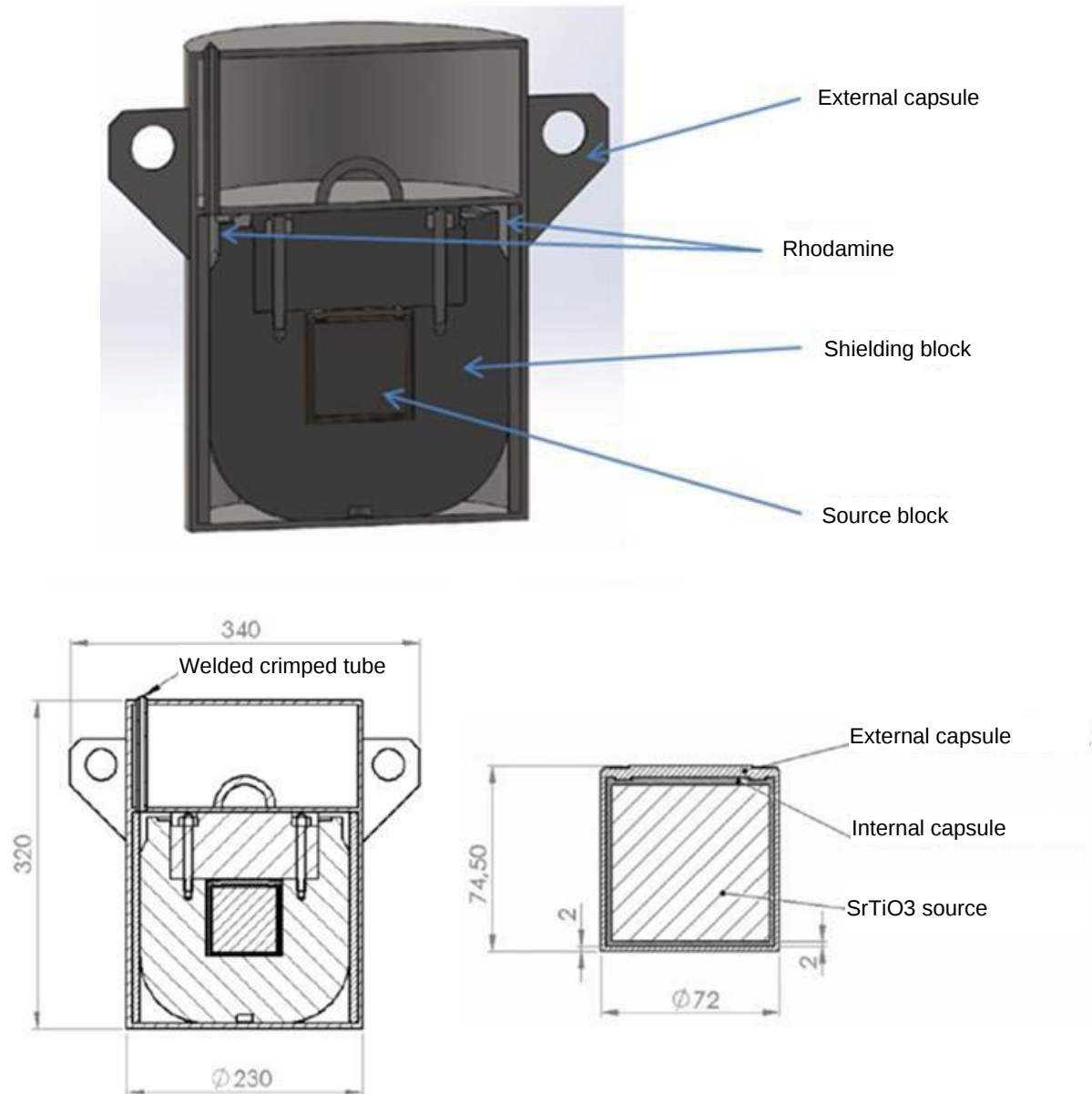


FIGURE 4.4
DIAGRAM OF SOURCE S2

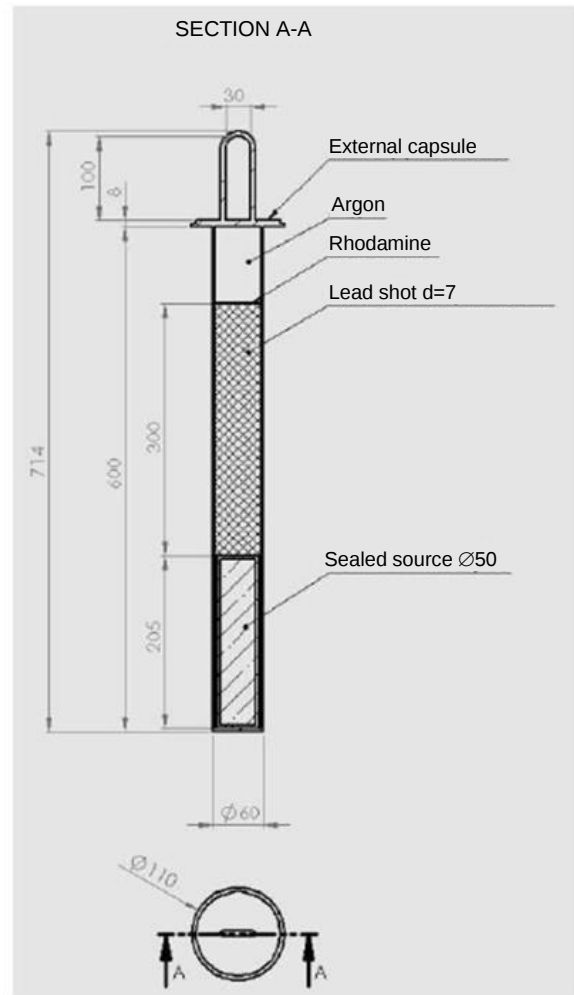


FIGURE 4.5
DIAGRAM OF SOURCE S3

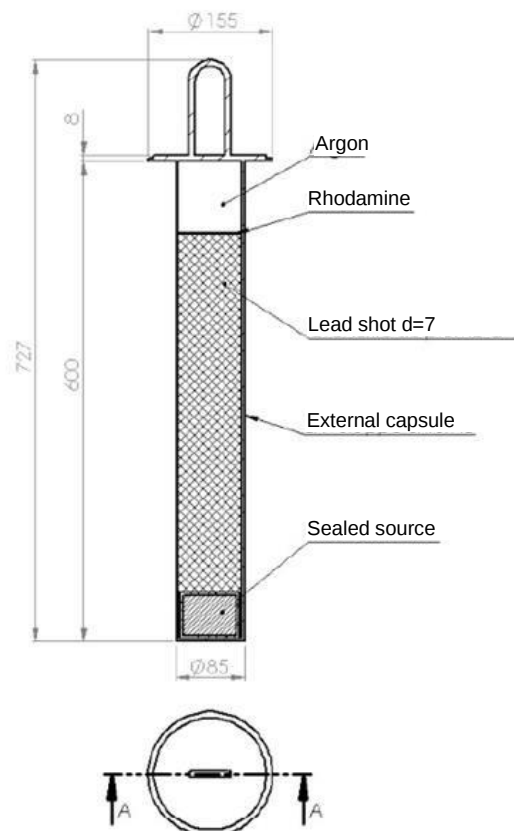
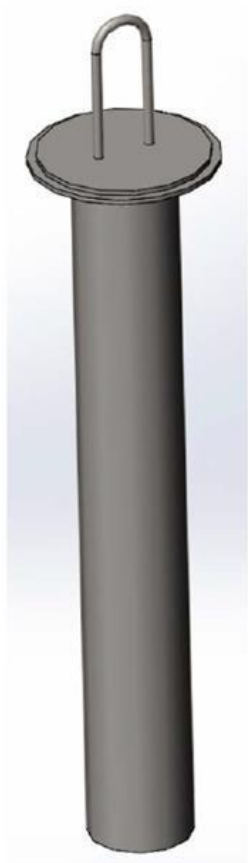


FIGURE 4.6
SCHEMATIC DIAGRAM OF THE DT1 TRANSFER NACELLE

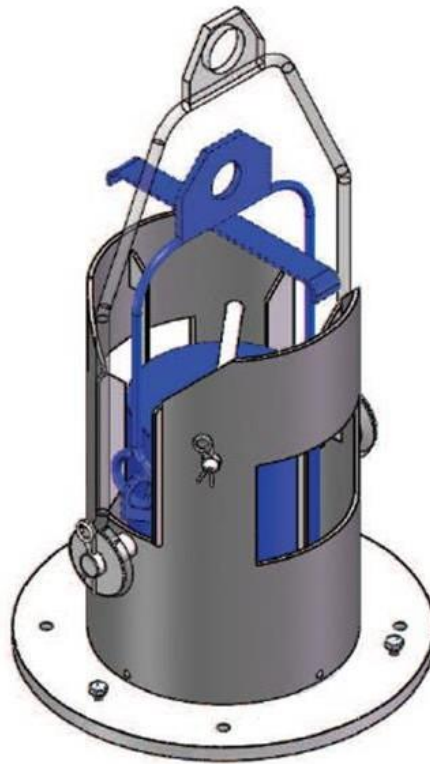


FIGURE 4.7
SCHEMATIC DIAGRAM OF THE DT2/3 TRANSFER NACELLE

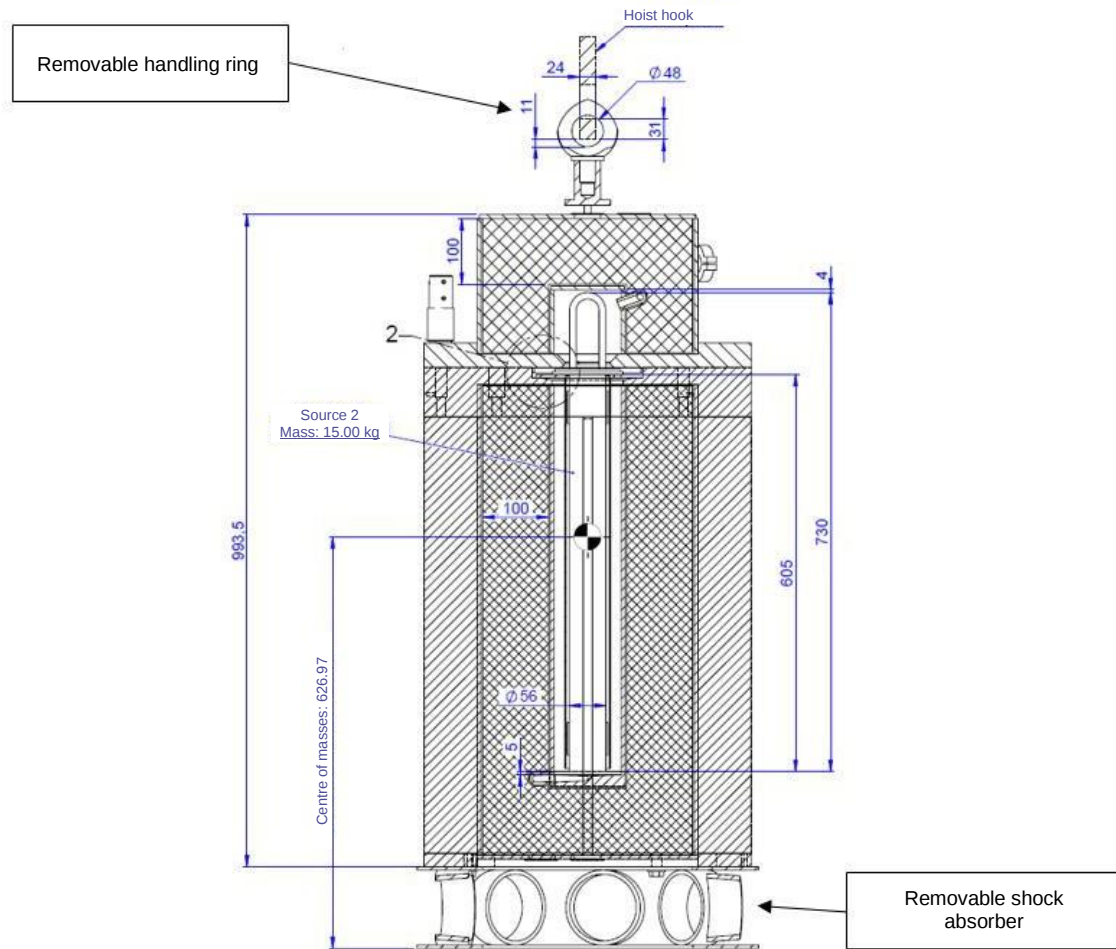


FIGURE 4.8
DIAGRAM OF CC33 OVERPACK

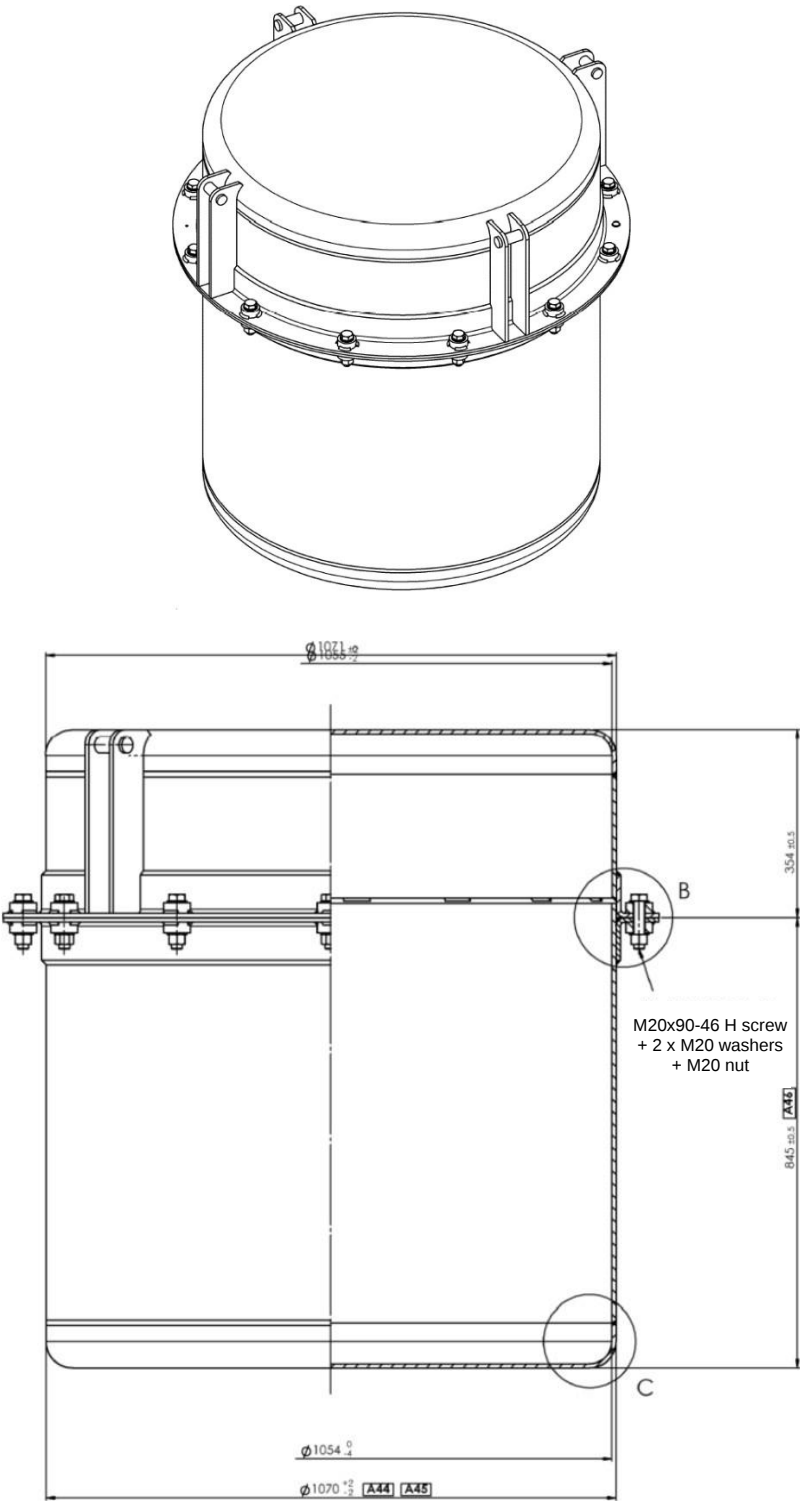


FIGURE 4.9
SCHEMATIC DIAGRAM OF THE DT1 TRANSFER NACELLE SHIMMING SYSTEM IN THE CC33 OVERPACK

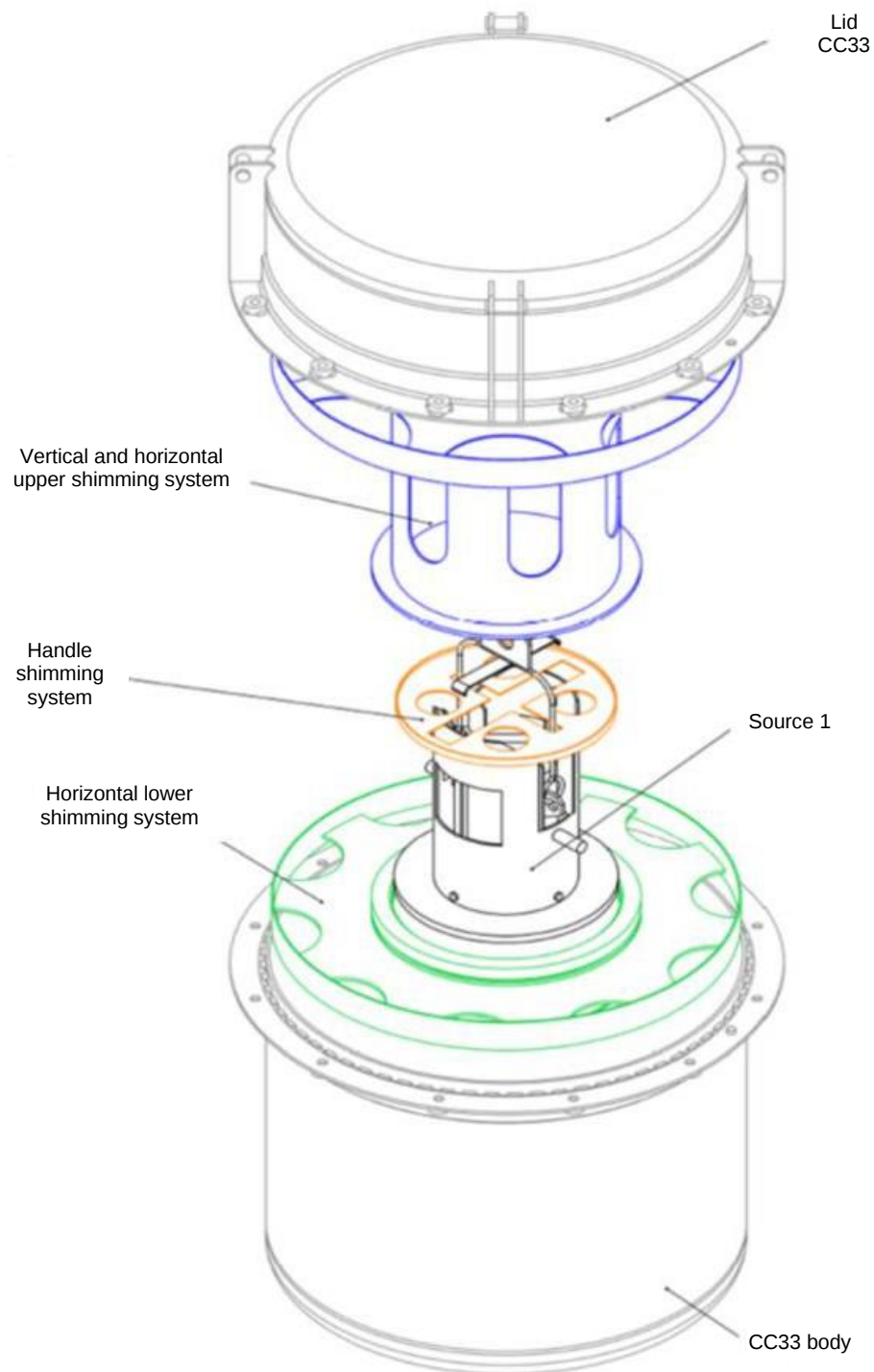


FIGURE 4.10
SCHEMATIC DIAGRAM OF THE DT2/3 TRANSFER NACELLE SHIMMING SYSTEM IN THE CC33
OVERPACK

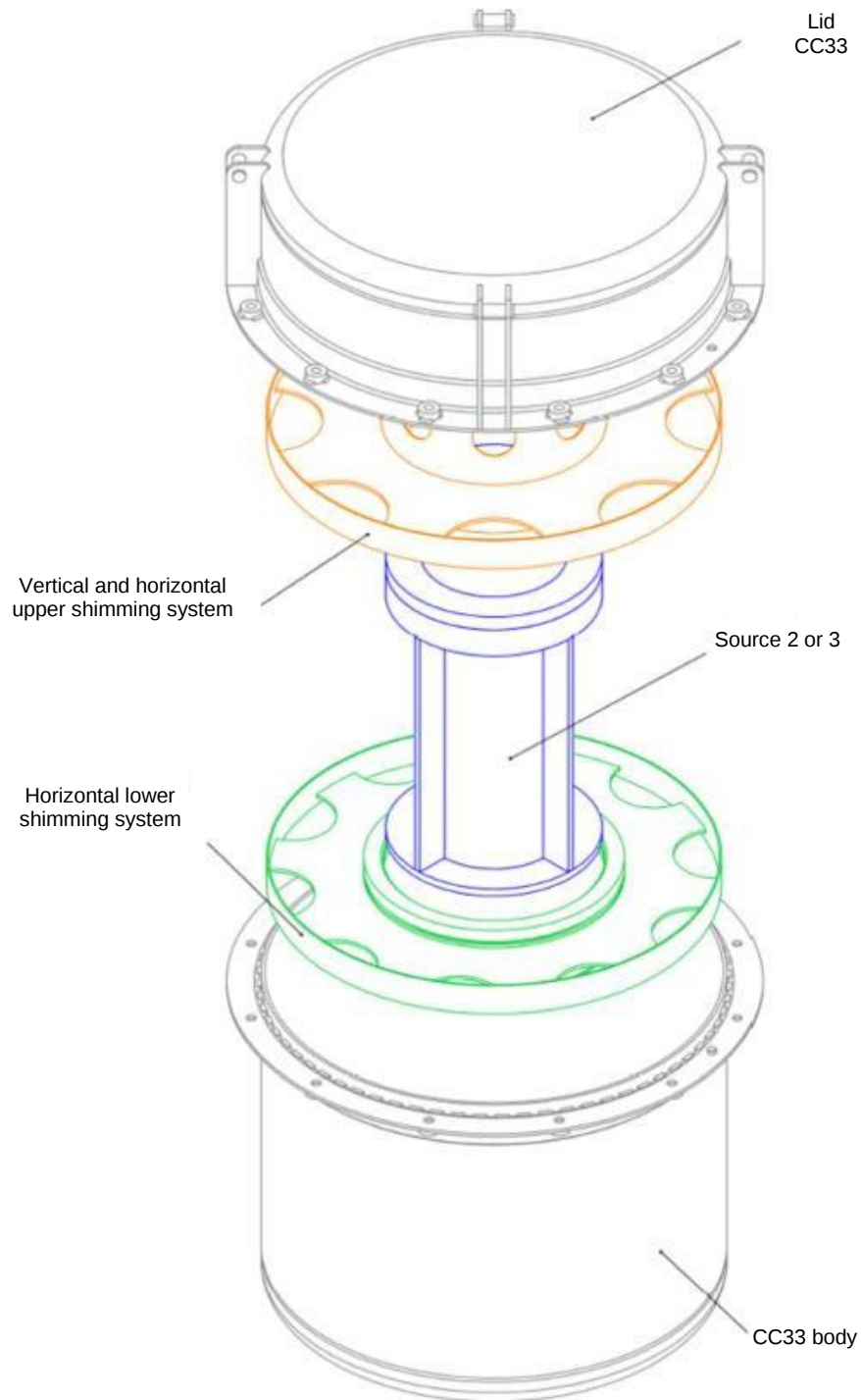
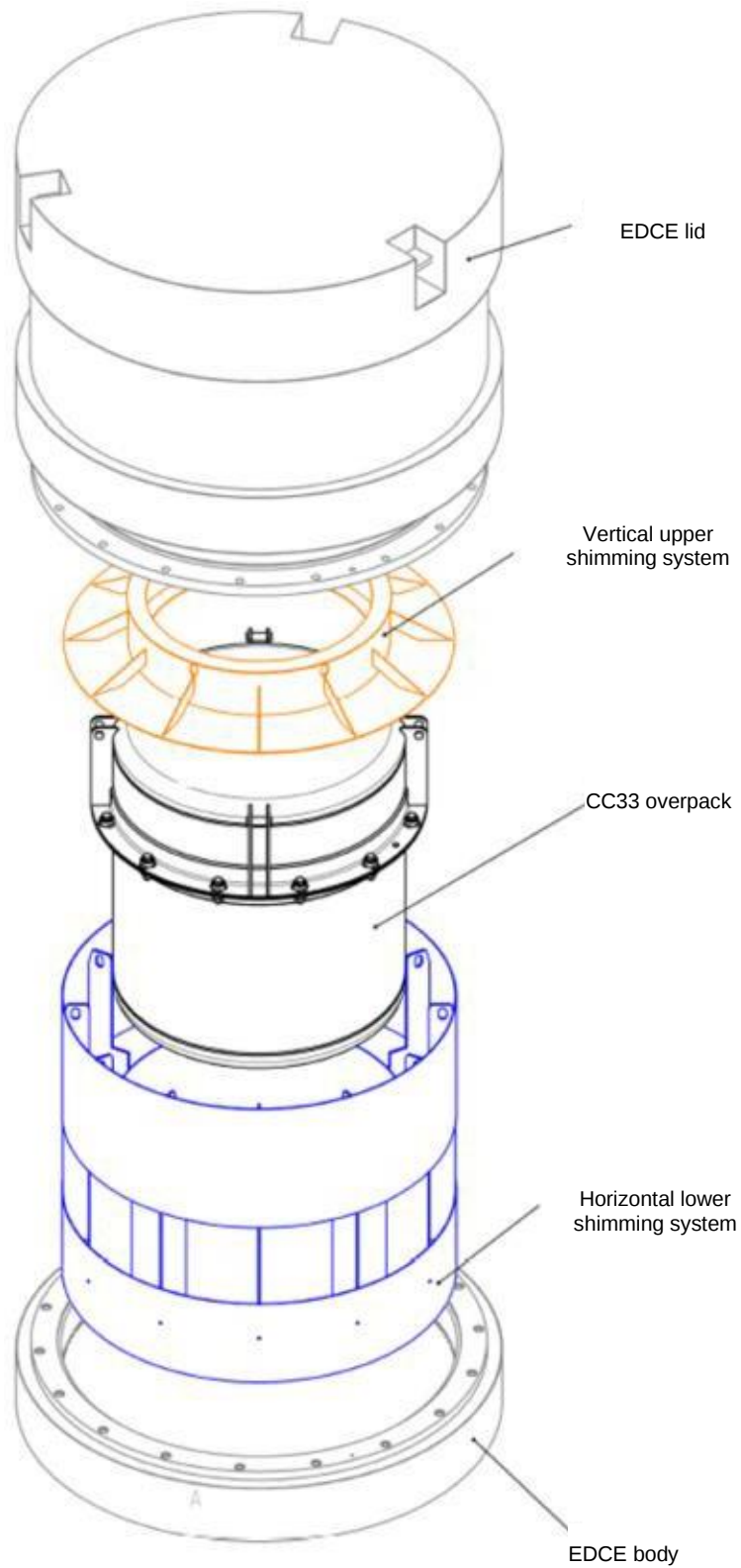


FIGURE 4.11
SCHEMATIC DIAGRAM OF THE CC33 OVERPACK SHIMMING SYSTEM IN THE EDCE





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