RÉPUBLIQUE FRANÇAISE

AUTORITÉ DE SÛRETÉ NUCLÉAIRE

DIRECTION DU TRANSPORT ET DES SOURCES

APPROVAL CERTIFICATE FOR A MODEL OF PACKAGE

F/395/B(M)F-96 (Df)
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The competent French authority,

In view of the request made by the company **ROBATEL Industries** by letter Fla/jgl/102422/No. 13-039,

In view of the R72 safety dossier DAG 000 rev. E. dated 23 April 2013,

Certifies that the model of package constituted by the **R72** cask described below in annexe 0 at index f and:

- loaded
  - with irradiated fuel rods, as described in annexe 1 at index f,
  - or with irradiated fuel rods, as described in annexe 2 at index f,

  is conform as a model of package of type B(M) loaded with fissile materials,

- emptied, whether or not contaminated, whether or not equipped with internal arrangements, is conform as a model of package of type B(M),

to the requirements of the regulations, agreements or recommendations listed below:

- regulation for the transport of radioactive materials of the International Atomic Energy Agency, safety standards collection, No.TS-R-1, 2009 edition;
- regulation for the transport of radioactive materials of the International Atomic Energy Agency, safety standards collection, No. SSR-6, 2012 edition;
- European agreement concerning the international carriage of dangerous goods by road (ADR);
- international regulations concerning the carriage of dangerous goods by rail (RID);
- order dated 29 May 2009 amended concerning the carriages of dangerous goods by land (TDM order);

This decision contains the approval of the consignment procedures in annexe t at index f.

This certificate does not exempt the consignor from observing the requirements established by the authorities of the countries through or towards whose territories the packages will be transported.

The validity of this certificate expires on: **31/09/2019.**

Registration number: **CODEP-DTS-2014-042971**

Paris, 29/09/2014

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SUMMARY OF THE ISSUES OF THE CERTIFICATE

issue	expiry	type of issue and modifications made	authority	classification mark of the certificate	revision index							
					body	t	0	1	2	3	4	5
03.12.2008	31.12.2013	New approval	ASN	F/395/B(M)F-96	Aa	a	a	a	a	a	-	-
15.07.2009	31.12.2013	Extension of approval	ASN	F/395/B(M)F-96	Ab	b	b	a	a	a	b	-
03.03.2011	31.12.2013	Extension of approval: Modification of the sealing criteria of the cask Deletion of content No.4	ASN	F/395/B(M)F-96	Ac	b	c	a	a	a	-	-
29.11.2013	30.09.2014	Prorogation of the approval	ASN	F/395/B(M)F-96	Bd	b	c	a	a	a	-	-
01.10.2014	30.06.2015	Prorogation of the approval	ASN	F/395/B(M)F-96	Ce	e	c	a	a	a	-	-
29.09.2014	31.09.2019	Prorogation of the approval: Deletion of content No. 3	ASN	F/395/B(M)F-96	Df	f	f	f	f	-	-	-

ANNEXE t

CONSIGNMENT PROCEDURES

Contents concerned:

This approval authorises consignments of the R 72 package loaded with the contents described in appendices 1 and 2 whose activity is above 3000 A2 or 1000 TBq.

Limitation of the permitted ambient temperature:

No transport shall be carried out if there is a risk that the forecast ambient temperature will be below –25 °c on the route at the time of transit or warehousing of the loaded package. The proof of conformity to this measure will be given by a weather bulletin for the journey to be made.

ANNEXE 0

R72 CASK

1. DEFINITION OF THE CASK

The cask is designed, manufactured, inspected, tested, maintained and used in conformity with the ROBATEL Industries safety dossier R72 DAG 000 Rev. E.

The cask, usually cylindrical, is shown in figure 0.1.

The design plans of the cask are the following ROBATEL Industries plans.

- R72 PE 0001-1 rev. H
- R72 PE 0001-2 rev. H

The overall external dimensions of the cask are:

- length: 6,254 mm
- external diameter: 1,680 mm

The maximum permitted weight of the loaded cask during transport is 21,500 kg.

The cask is made up of the following main sub-assemblies:

1.1 Body

The body of the R72 cask is made up of an internal tube and a set of external cylindrical shells in stainless steel between which are arranged the lateral biological and thermal protections. These two assemblies (internal tube and external cylindrical shells) are connected so that they are sealed at each end. A cover closes each end.

1.2 Closure system

The closure system of the R72 package is made up of:

- the front cover (thick part in stainless steel) fixed to the body of the cask by 21 x M36 bolts,
- the rear cover (thick part in stainless steel) fixed to the body of the cask by 8 x M16 bolts,
- the depressurisation plug of the front cover (M20),
- the 4 x G½" drain plugs,
- the drain closure (thick part in stainless steel) fixed to the body of the cask by 3 x M12 bolts.

1.3 Shock absorber systems

These are two covers each fixed to the front and rear panels by 8 x M 36 bolts. They are made up of a stainless steel structure filled with wood (lime and balsa).

1.4 Handling and tie down components

The R72 cask is equipped with three pairs of trunnions (two at the front, one at the rear) fixed to its external casing and used for handling it.

The R72 cask is equipped with a tie-down unit fixed to its external casing that can be used as longitudinal stabilisation for tying down onto a chassis for transport by road or rail.

1.5 Safety functions and elements important to safety

The main safety functions and the main elements important to safety are the following:

- **the containment** provided by the containment envelope of the cask formed by:
  - the thick, seamless, stainless steel internal tube of the body of the cask,
  - the two stainless steel end parts of the tube,
  - the two full penetration circular welds of the end parts on the internal tube of the cask,
  - the solid stainless steel front cover fixed by 21 M36 bolts and :
    - its internal EPDM O-ring of the double seal system (the external seal is a check seal),
    - its depressurisation opening plugged by an M20 plug fitted with its EDPM O-ring,
  - the solid stainless steel rear cover fixed by 8 M16 bolts and its internal EPDM O-ring of the double seal system (the external seal is a check seal),
  - the four G½" drain plugs fitted with their EPDM O-ring.

  There is no containment pipework.
  However, the cask has a second sealed envelope made up by the canisters of the internal arrangements (see descriptions §§ 1.6.1.3 and 1.6.2.3 of this appendix) taken into account in the containment analysis of the safety file. The sealing of this second envelope must also be checked before transport of the cask following the instructions of its safety file (see § 2 of this appendix).

- **the radiological protection** provided by:
  - Radially:
    - 30 mm thick stainless steel (internal tube of the body),
    - 135 mm thick soft lead,
    - 210 mm thick PNT7™ ROBATEL,
    - 30 mm thick stainless steel (external envelope of the body),
  - Axially towards the rear:
    - 40 mm thick stainless steel (rear cover),
    - 50 mm thick stainless steel (rear cap),
  - Axially towards the front:
    - 70 mm thick stainless steel (front cover),
    - 50 mm thick stainless steel (front cap).

  The radiological protection must be completed, as required, by the internal arrangements used with the cask (see the description § 1.6).

- **the criticality safety** ensured by the isolation system made up of the elements described in the appendices of contents and of the following elements of the cask:
  - the internal tube in 30 mm thick stainless steel,
  - the 135 mm thickness of lead,
  - the 210 mm thickness of ROBATEL PNT7™,
  - the external envelope in 30 mm thick stainless steel,
  - the front and rear covers in 70 mm and 40 mm thick stainless steel,
  - the E1 and E2 canisters.

- **the dissipation of the internal power** provided by:
  - radiation between the contents and the internal tube of the body of the cask,
  - conduction in the internal gases in the cavity of the cask,
  - conduction in the body of the cask through the different layers that make it up (internal tube in 30 mm stainless steel, 135 mm layer of lead, 210 mm layer of PNT7™ ROBATEL and cylindrical shell in 30 mm stainless steel),
  - convection and radiation between the external surface of the cask and the ambient air.

- **the protection against impacts** provided by:
  - a thick external envelope in 30 mm thick stainless steel,
  - front and rear shock absorbing caps, fixed to both ends of the cask by 8 M36 bolts, made up of:
    - an external envelope in 4 mm and 10 mm thick stainless steel,
    - wood (balsa and lime),
    - a thick anti-perforation sheet and cylindrical shell (respectively 40 mm and 20 mm) in stainless steel.

- **the protection against fire** provided by:
  - the 210 mm thick layer of thermal protection over the length of the cask made up of PNT7™ ROBATEL, the wooden shock absorbing caps at the ends of the cask.

1.6 Internal arrangements

The contents can be placed in two internal arrangements: AI1 and AI2.

1.6.1 The AI1 internal arrangements

The internal arrangements No.1 (AI1) are described in chapter R72 ANS 120 revision C of the safety dossier. They are shown on figures 0.3 and 0.4.

The plans describing these internal arrangements are as follows:

R72 PE 0002-1 ind. H
R72 PE 0002-2 ind. G
R72 PD 0400 ind. H
R72 PD 0401 ind. H

The AI1 internal arrangements can depending on requirements be associated to the different contents described in appendices 1 and 2 in order to transport them.

These internal arrangements are made up of the following elements:

1.6.1.1 Basket

The baskets are fabricated stainless steel assemblies. They are made up of 10 sheath tubes (each able to take one rod — with or without an outer cladding — or one capsule) a base part (with holes for water circulation) and a square cross-section top part.

Two types of basket are defined (R10-I and R10-XI); they differ only in their length and weight.

1.6.1.2 Spacers

The spacers are solid stainless steel parts that may be placed at the bottom of the canister to supplement the rear axial radiological protection. They have holes for water drainage if necessary.

1.6.1.3 E1 canister

The E1 canister is made up of a body and a plug, stainless steel fabricated assemblies. It forms a sealed enclosure in which different elements can be loaded as required (basket, spacer).

It has facilities that allow the implementation, as required, of draining, rinsing, drying and inerting operations of its enclosure (pipework, unions, valves).

The canister plug and the base of the canister are composed of stainless steel, lead and HDPE 1000, forming additional axial radiological protection to that of the cask.

The plug is fitted with an FPM O-ring to seal the canister. It is fixed to the canister by 12 x M16 bolts.

The canister forms a second confinement enclosure completely independent of that of the cask. Its sealing must be tested after loading and before transport of the cask in accordance with the instructions of its safety file (see paragraph 2 of this annexe).

1.6.1.4 Sealing flange

The sealing flange is a stainless steel ring equipped with two EPDM O-rings that seal the cavity of the cask during the draining and drying operations, when the front cover has been removed. These seals are not containment seals.

1.6.1.5 Redan

The redan is a stainless steel part inserted and fixed into the rear part of the R72 cask in the internal cavity by 4 x M8 bolts. Its function is to limit the axial leakage lines towards the rear.

1.6.2 Internal arrangements AI2

The internal arrangements No.2 (AI2) are described in chapter R72 ANS 121 revision C of the safety dossier. They are shown on figures 0.5 and 0.6.

The plans describing these internal arrangements are as follows:

R72 PE 0003-1	ind. C
R72 PE 0003-2	ind. C
R72 PD 0605	ind. B.
R72 PD 0650	ind. A.

The AI2 internal arrangements can depending on requirements be associated to the different contents described in appendices 1 and 2 in order to transport them.

These internal arrangements are made up of the following elements:

1.6.2.1 Basket

The baskets are fabricated stainless steel assemblies. They are made up of 7 or 10 sheath tubes (each able to take one rod or portions of rods) a base part (with holes for water circulation) and a cylindrical top part

Two types of basket are defined (T10-XI and T7-XI); they are of similar design; the T10-XI basket has 10 sheath tubes of internal diameter 16 mm. The T7-XI basket has 7 sheath tubes (6 of internal diameter 20 mm and 1 of internal diameter 16 mm).

1.6.2.2 Spacers

The spacer is solid stainless steel part placed in the cavity of the cask (in the front part) to form the interface between the top of the E2 canister and the cavity of the cask.

1.6.2.3 E2 canister

The E2 canister is made up of a body and a plug, stainless steel fabricated assemblies. It forms a sealed enclosure in which different elements can be loaded as required (T10-XI and T7-XI basket).

It has facilities that allow the implementation, as required, of draining, rinsing, drying and inerting operations of its enclosure (pipework, unions, valves).

The canister plug and the base of the canister are composed of stainless steel, lead and HDPE 1000, forming additional axial radiological protection to that of the cask.

The plug is fitted with an FPM O-ring to seal the canister. It is fixed onto the canister by the canister flange.

The canister forms a second confinement enclosure completely independent of that of the cask. Its sealing must be tested after loading and before transport of the cask in accordance with the instructions of its safety file (see paragraph 2 of this annexe).

1.6.2.4 Canister flange

The flange of the E2 canister is a stainless steel ring, fixed onto the spacer by 16 x M16 bolts. It holds the canister plug in place on the canister.

It also forms the interface between the sealing flange and the canister plug.

1.6.2.5 Sealing flange

The sealing flange is a stainless steel ring equipped with two EPDM O-rings that seal the cavity of the cask during the draining and drying operations, when the front cover has been removed. These seals are not containment seals.

1.6.2.6 Redan

The redan is a stainless steel part inserted and fixed into the rear part of the R72 cask in the internal cavity by 4 x M8 bolts. Its function is to limit the axial leakage lines towards the rear.

2. MEASURES THE CONSIGNOR MUST TAKE BEFORE THE CONSIGNMENT OF THE PACKAGE

The cask must be used in accordance with procedures conform to the usage instructions in chapter R72 ANS 700 revision D of the safety dossier.

In addition, the following actions also have to be carried out:

- in case of loading under water, the pressure in the cavity of the cask and the canister has to be maintained between [6 mbar + ΔP, 10 mbar − ΔP] for at least one hour during the drying operations, ΔP being the uncertainty of the pressure sensor. Keep as criterion an increase of the pressure inferior to 1 mbar in 30 min, taking into account all the uncertainties of the used equipment;
- grease of type NEVER SEEZ must be applied on the threated part and under the top of the fixing screws of the package at each loading operation; the screws of the closing elements of the cavity of the cask and the canisters, as well as the screws of the caps, must be tightened crosswise;
- for transport by rail, label No. 15 of the RID must be affixed on the wagon in which the package is transported.

3. MAINTENANCE SCHEDULE

The maintenance of the cask is described in chapter R72 ANS 700 revision D of the safety file.

4. NOTIFICATION AND RECORDING OF THE SERIAL NUMBERS

Any scrapping or change of ownership of a cask must be brought to the attention of the competent authorities. For this, an owner who is disposing of a cask will transmit the name of the new owner.

5. QUALITY ASSURANCE

The Quality Assurance principles to be applied at the time of the design, manufacture, inspection, testing, maintenance and use of the package must be in conformity with those described in chapter R72 ANS 800 revision B of the safety dossier.

6. ADDITIONAL REQUIREMENTS IN THE EVENT OF CONFINED TRANSPORT

When the packages are transported in a closed means of transport (vehicle covered with a tarpaulin, transport wagon, canopy, etc.) the heat dissipation is likely to be modified.

Transport within a confined means is authorised subject to the consignor ensuring that the residual thermal power of the loading makes it possible to guarantee that the maximum temperature reached by the HDPE (high density polyethylene) of the cask, taking into account the establishment of the regulatory thermal equilibrium, the sunshine and the ambient temperature and the presence of the tie down, does not exceed 80°C.

7. GROUNDS FOR MULTILATERAL APPROVAL

The model of package has not been designed for ambient temperatures below –25°C.

FIGURE 0.1
DIAGRAM OF THE R72 CASK

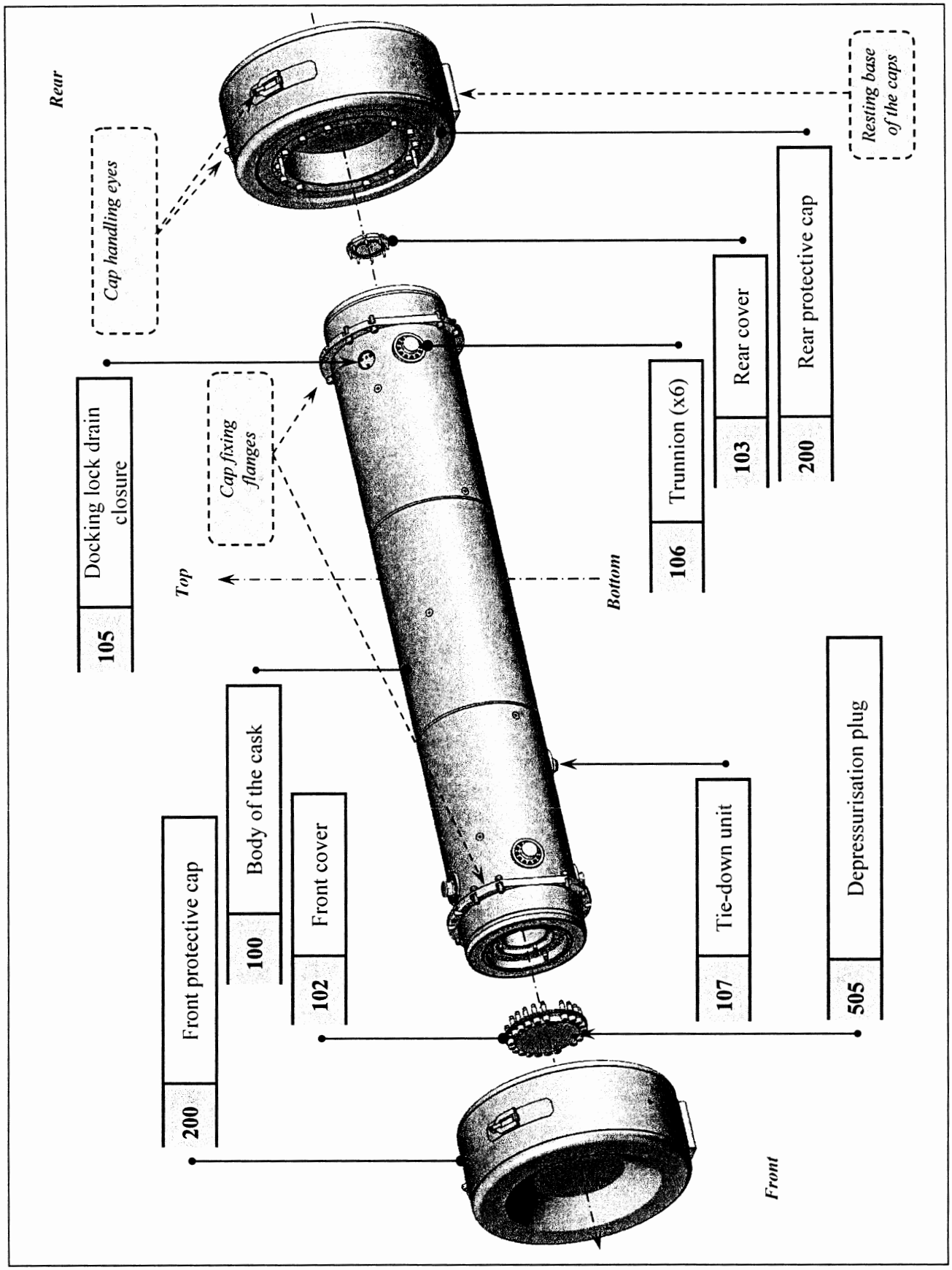


FIGURE 0.2
DIAGRAM OF THE OPENINGS OF THE CASK

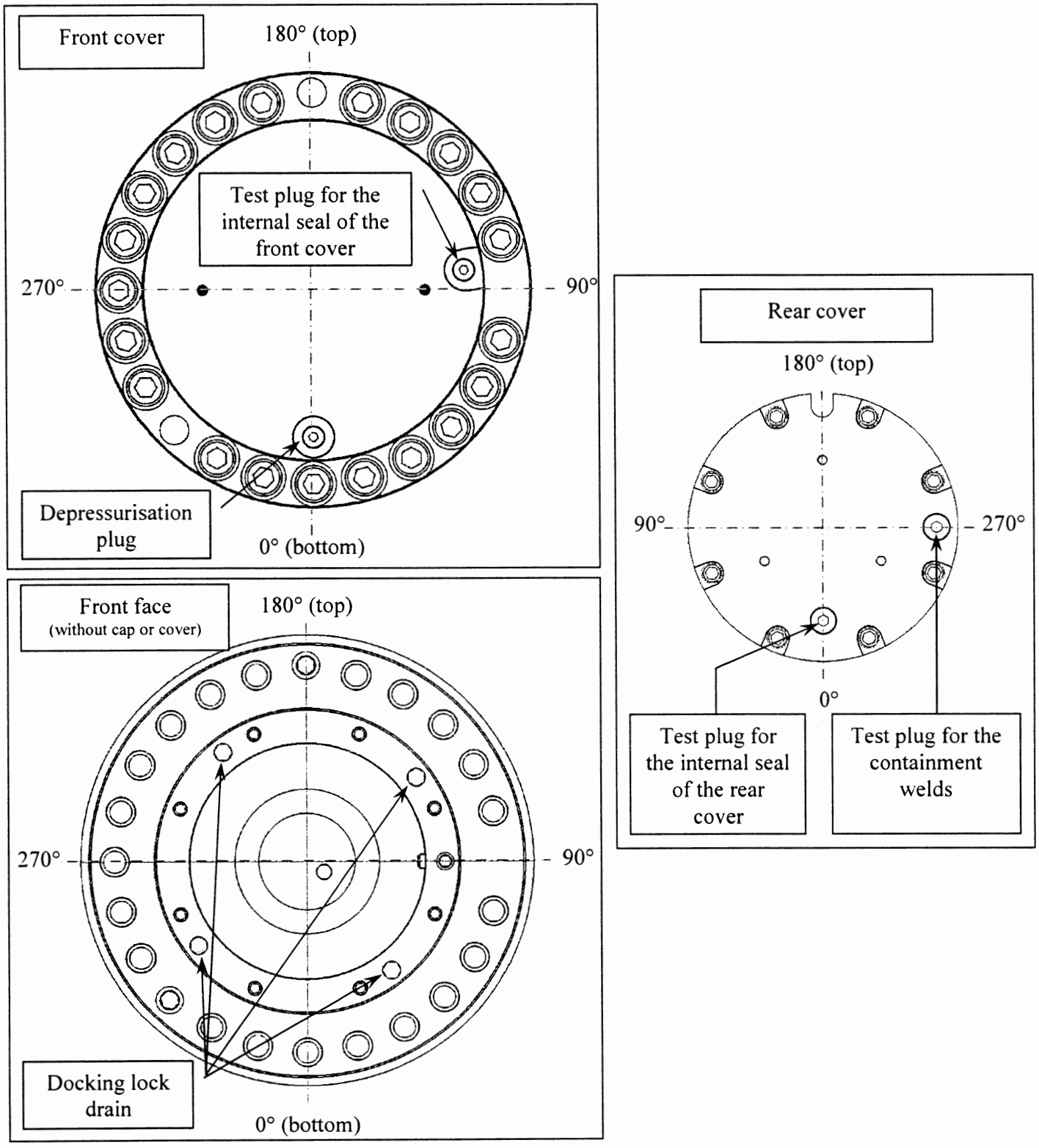


FIGURE 0.3
DIAGRAM OF THE AI1 INTERNAL ARRANGEMENTS

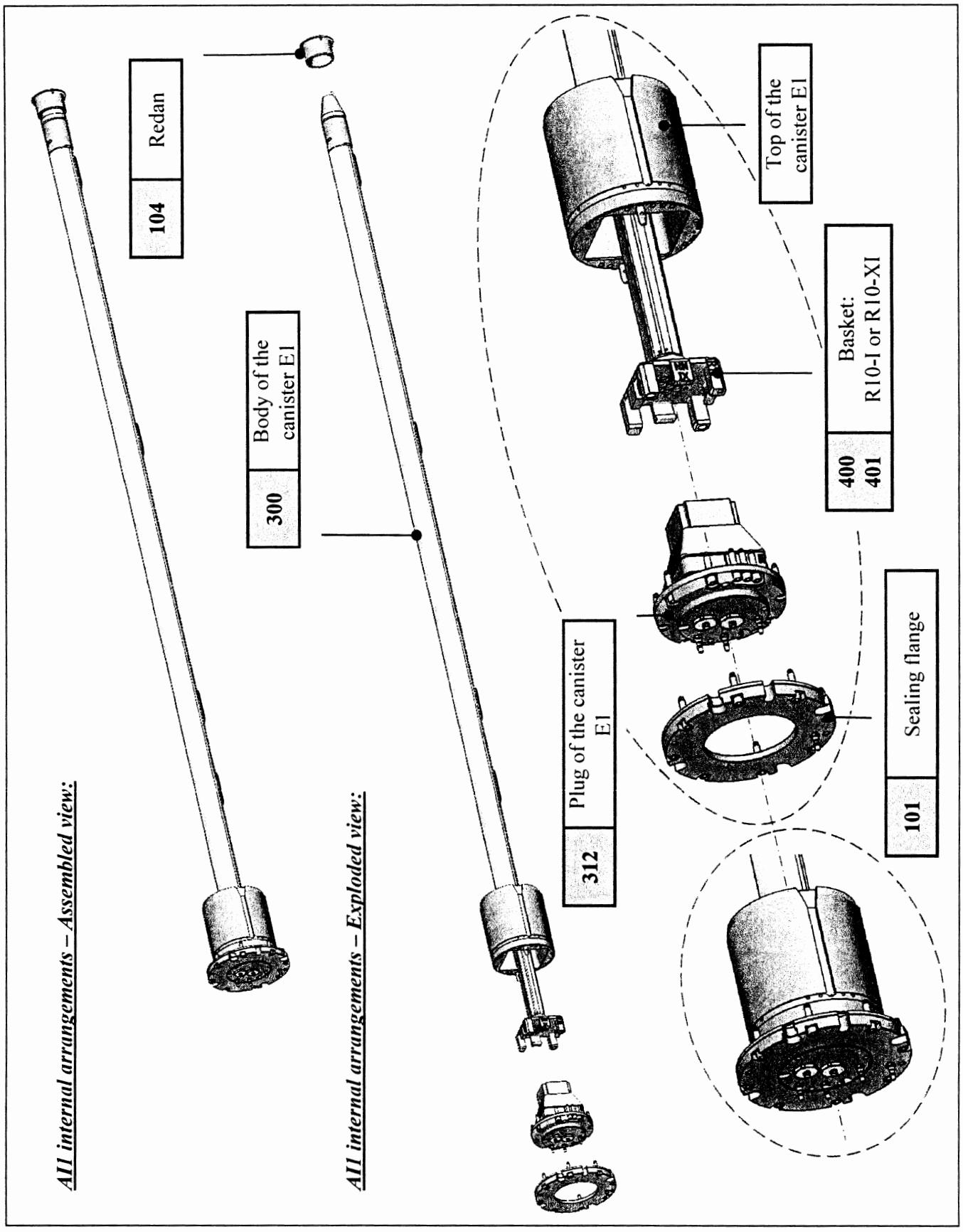


FIGURE 0.4
DIAGRAM OF THE OPENINGS OF THE AI1 INTERNAL ARRANGEMENTS

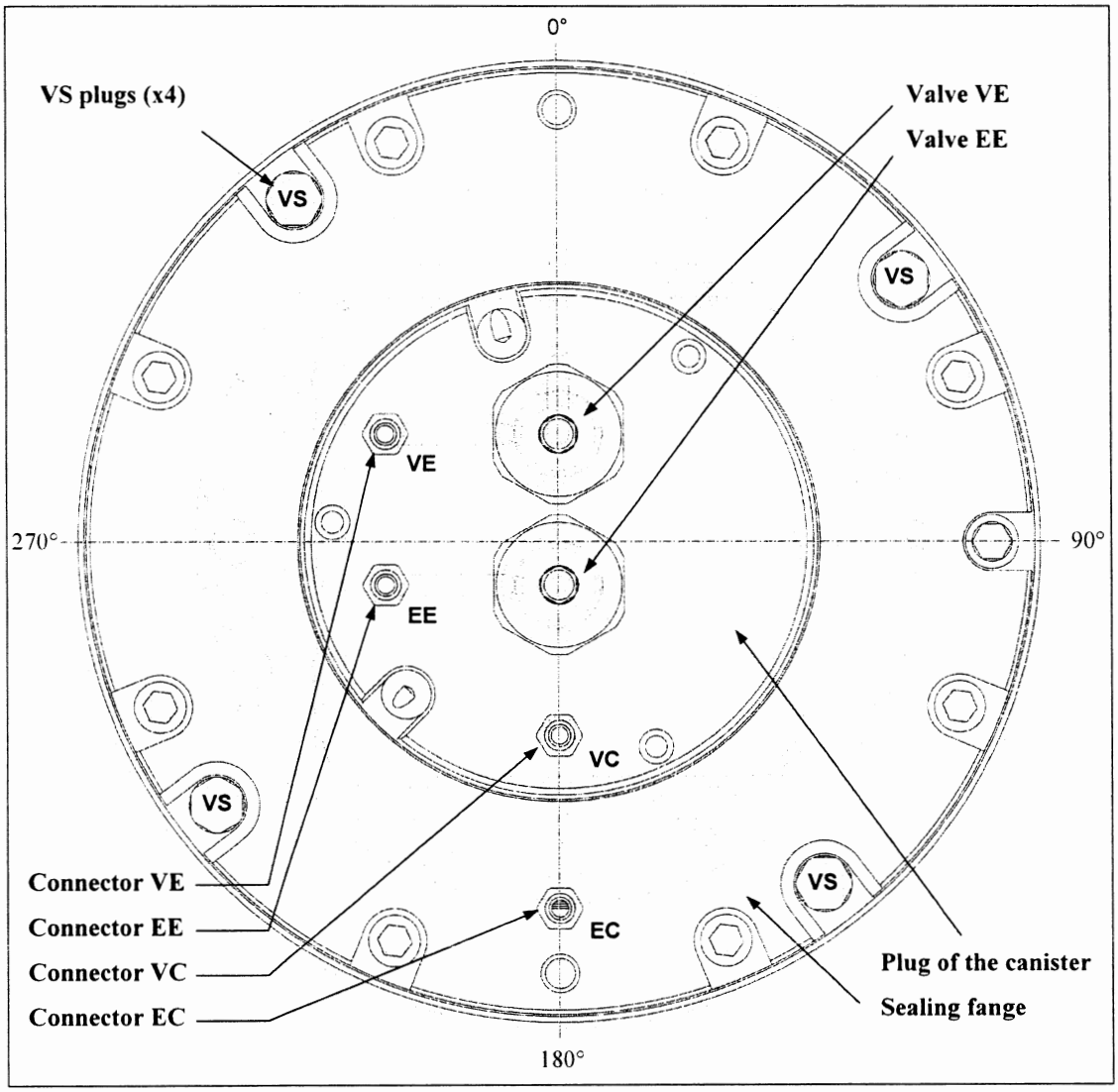


FIGURE 0.5

DIAGRAM OF THE AI2 INTERNAL ARRANGEMENTS

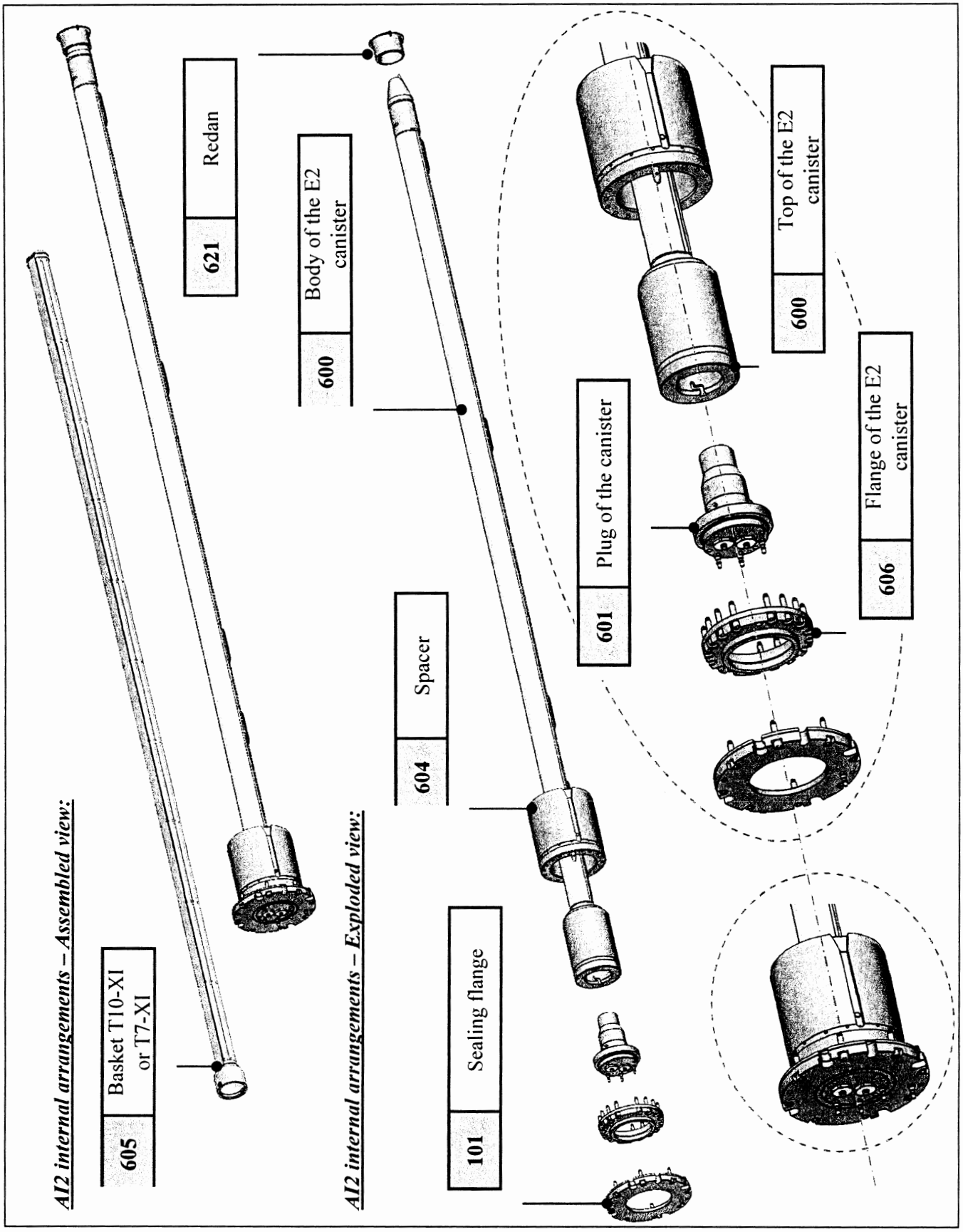
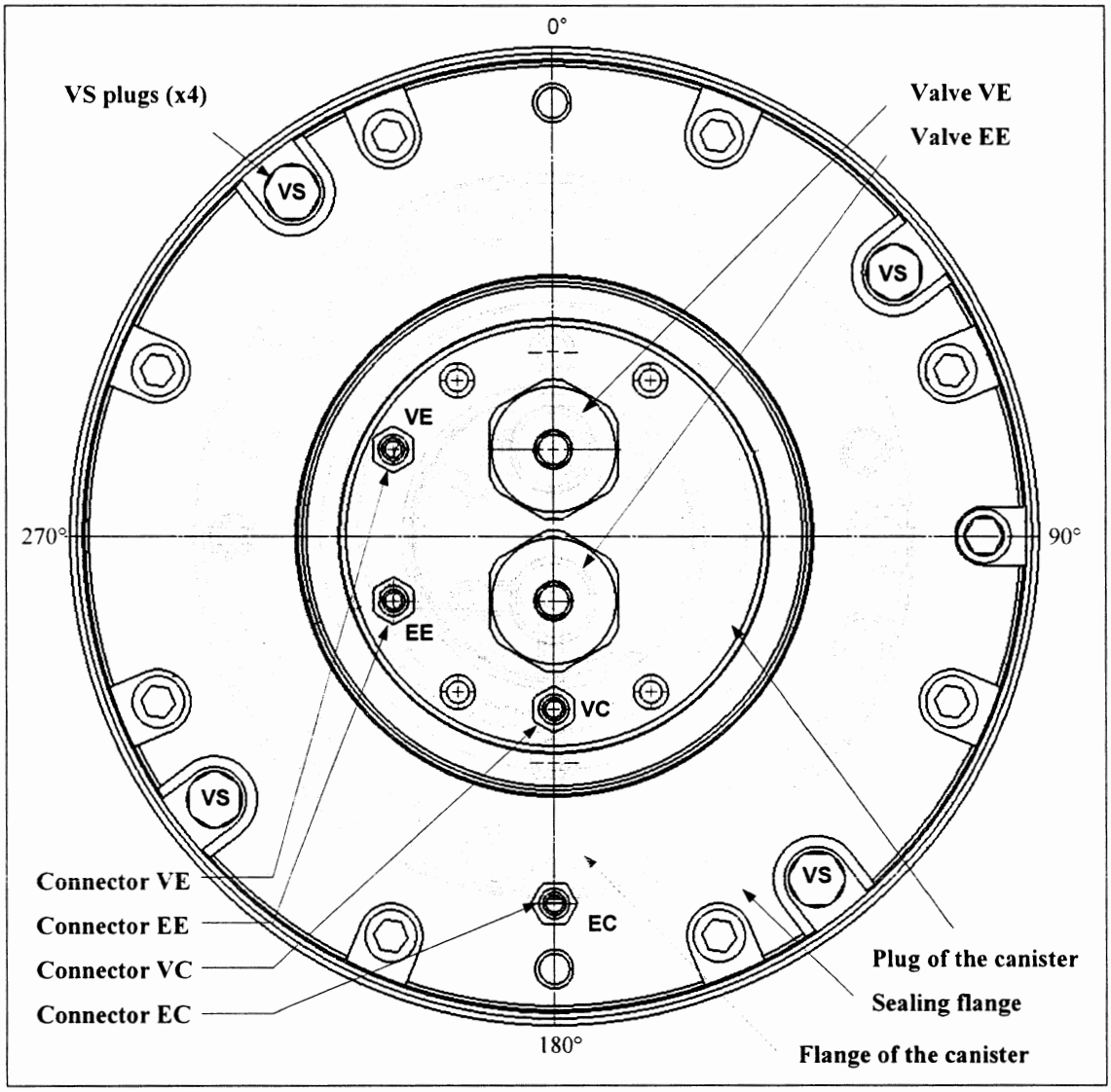


FIGURE 0.6
DIAGRAM OF THE OPENINGS OF THE AI2 INTERNAL ARRANGEMENTS



ANNEXE 1

CONTENT NO.1: UOX-A AND MOX-A IRRADIATED FUEL RODS

The safety dossier substantiating the content is R72 DAG 000 Rev. E.

1. DEFINITION OF THE AUTHORISED RADIOACTIVE CONTENT

The authorised radioactive content n°1, described in chapter R72 ANS 110 of the safety file, is made up of irradiated fuel rods from pressurised water reactors, as described below.

The R72 package model can transport:

- rods (or portions of rods) type PWR 900 MWe, 1300 MWe or 1450 MWe, UO2, whether or not irradiated. The rods must have no ruptured claddings;
- rods (or portions of rods) type PWR 900 MWe MOX, whether or not irradiated. The rods must have no ruptured claddings;
- capsules filled with rod sections or waste (reconstituted rod) of type PWR 900 MWe, 1300 MWe or 1450 MWe UO2, whether or not irradiated;
- capsules filled with rod sections or waste (reconstituted rod) of type PWR 900 MWe MOX, whether or not irradiated;

These elements are inserted into a sheath tube of an appropriate basket, itself loaded into a canister placed in the cask (see the internal arrangements in §3 of the present appendix).

The transport of parts, segments or waste of irradiated fuel elements stored under water before their loading into the body of the package, is excluded. These elements have to come from cells of dry analysis or dry storage.

The caps, if used, must have dimensions compatible with the basket, i.e.:

- Øext. ≤ 18 mm if they are loaded in the 6 tubes with 20 mm diameter of the basket T7-XI,
- Øext. ≤ 14 mm in any other basket (R10-XI, R10-I or T10-XI) or in the central tube with 16 mm diameter of the basket T7-XI,

and

- Length ≤ 3925 mm if they are loaded in a basket R10-I,
- Length ≤ 4570 mm if they are loaded in a basket R10-XI,
- Length ≤ 4645 mm if they are loaded in a basket T10-XI or T7-XI.

The rods can be inserted directly into a sheath tube of a basket or by being placed in a removable intermediate outer cladding. This outer cladding must be conform to the block diagram shown in chapter R72 ANS 110 of the safety dossier. These tubes must be equipped with holes in the lower part and not closed in the upper part.

The authorised radioactive content No.1, is made up of irradiated fuel rods, taken from pressurised water reactors whose characteristics before irradiation are described below:

	UOX-A		MOX-A	
	1300/1450 MWe	**900 MWe**	**900 MWe**	
Active length of a rod at 20°C:	4300 mm	3700 mm	3700 mm	
Cladding: - minimum thickness:	0.52 mm			
- minimum external diameter:	9.36 mm			
Pellets: - maximum diameter:	8.30 mm			
Maximum number of capsules or fuel rods carried:	10			
Maximal combustion level *(of the rod, segment, part or waste of the rod):*	85,000 MWj/tmli		75,000 MWj/tmli	
Maximum weight of oxide before irradiation: *per rod/capsule*	2.56 kg		2.20 kg	
Maximum weight of heavy metal before irradiation: *per rod/capsule*	2.25 kg		1.94 kg	
Maximum enrichment in U^{235}: *(% by weight)*	≤5 %		≤0.7 %	
Maximum Pu content: *(% by weight)*			≤11 %	
$\frac{(Pu^{241} + Am^{241})_{total}}{(U + Pu + Am^{241})_{total}}$			≤8.0 %	≤10.2 %
$\frac{Pu^{240}}{(Pu + Am^{241})_{total}}$			≥17 %	≥20 %
$\frac{Pu^{241}}{Pu^{240}}$			≤0.647	≤0.650
$\frac{Pu^{242}}{Pu^{241}}$			≥0.091	≥0.090
$\frac{Pu^{238}}{(Pu + Am^{241})_{total}}$			≤3.95 %	
$\frac{Pu^{241} + Am^{241}}{(Pu + Am^{241})_{total}}$			≤12.55 %	
$\frac{Pu^{236}}{(Pu + Am^{241})_{total}}$			$\leq 10^{-5}$ %	
Minimum cooling time:	6 months			
Maximum residual thermal power per unit length at the maximum of the combustion rate profile: *(for the whole of the loading)*	310 W/m			
Maximum total thermal power: *(for the whole of the loading)*	1000 W			

Fuel UOX-A:

Activity: 4.23×10^3 TBq

Origin of the uranium: UNE or URE

Chemical form: Sintered uranium oxide pellets whether or not containing the following additives in a proportion below 5000 ppm: niobium, chromium, titanium, silicon, iron, magnesium, zinc, calcium, nickel, zirconium, aluminium oxide.

Special form: No

The pellets can also contain up to 10 % of a neutronic poison (gadolinium or erbium).

MOX-A fuel: Activity: 4.23×10^3 TBq

Chemical form: Sintered uranium and plutonium oxide pellets.

Special form: No

2. LOADING CONDITIONS

The R72 package model, equipped with suitable internal arrangements, can simultaneously carry up to **10 capsules or fuel rods** (either type UOX-A or MOX-A, whether or not inserted into an outer cladding).

The rate of combustion and the duration of cooling of the rods to be transported must be such that the authorised residual maximum power and the permitted limits of dose rate around the package are not exceeded.

The presence of water or of materials more hydrogenated than water in the cask is not authorised.

The total weight of the elements loaded into a canister must not exceed: **180 kg**.

The total weight of the elements loaded into the R72 cask must not exceed: **650 kg**.

3. INTERNAL ARRANGEMENTS

Different types of internal arrangements can be associated, as required, to the radioactive contents No.1 described above (§1). These different internal arrangements are described in annexe 0.

4. CRITICALITY ANALYSIS

This is the subject of chapter R72 ANS 600 of the safety dossier.

The following hypotheses are used:

- the total destruction of the rods is assumed, it being possible for the material to be anywhere and in any form in the cavity of the cask.
- certain internal arrangements related to the different contents transported are ignored. In particular the following are ignored:
  - the cladding of the rods,
  - capsules that may contain segments or waste of rods,
  - the sheath tubes of a basket,
  - the sides of the canister.
- it is assumed that there has been water penetration, in spite of the presence of two sealed enclosures.

Criticality Safety Index (CSI): 50

ANNEXE 2

CONTENT NO.2: UOX-B AND MOX-B IRRADIATED FUEL RODS

The safety dossier substantiating the content is R72 DAG 000 Rev. E.

1. DEFINITION OF THE AUTHORISED CONTENT

The authorised radioactive content n°2, described in chapter R72 ANS 111 of the safety file, is made up of irradiated fuel rods, as described below.

The R72 package model can transport:

- rods (or portions of rod) type UO2, whether or not irradiated. The rods must have no ruptured claddings;
- MOX rods (or portions of rod), whether or not irradiated,. The rods must have no ruptured claddings;
- capsules filled with segments or waste of the rods (reconstituted rod) of type UO2, irradiated or not;
- capsules filled with segments or waste of the rods (reconstituted rod) of type MOX, irradiated or not;

These elements are inserted into a sheath tube of an appropriate basket, itself loaded into a canister placed in the cask (see the internal arrangements in §3 of the present appendix).

The transport of parts, segments or waste of irradiated fuel elements stored under water before their loading into the body of the package, is excluded. These elements have to come from cells of dry analysis or dry storage.

The caps, if used, must have dimensions compatible with the basket, i.e.:

- Øext. ≤ 18 mm if they are loaded in the 6 tubes with 20 mm diameter of the basket T7-XI,
- Øext. ≤ 14 mm in any other basket (R10-XI, R10-I or T10-XI) or in the central tube with 16 mm diameter of the basket T7-XI,

and

- Length ≤ 3925 mm if they are loaded in a basket R10-I,
- Length ≤ 4570 mm if they are loaded in a basket R10-XI,
- Length ≤ 4645 mm if they are loaded in a basket T10-XI or T7-XI.

The authorised radioactive content No.2, is made up of irradiated fuel rods whose characteristics before irradiation are described below:

	UOX-B	MOX-B
Maximum number of rods or capsules carried:	10	
Rods intact:		
Maximum irradiation (*BU=BurnUp*): → Maximum mass of heavy metal before irradiation: *(for the whole of the loading)*	BU ≤ 100,000 MWj/tmli 25.6 kg	
Segments or parts of rods:		
Maximum irradiation *(BU=BurnUp)*: → Maximum mass of heavy metal before irradiation: *(for the whole of the loading)*	BU ≤ 55 GWj/tmli 25.6 kg	BU ≤ 48 GWj/tmli 25.6 kg
Maximum irradiation *(BU=BurnUp)*: → Maximum mass of heavy metal before irradiation: *(for the whole of the loading)*	55 < BU ≤ 100 GWj/tmli 12,6 kg	48 < BU ≤ 100 GWj/tmli 18,3 kg
Maximum enrichment in U^{235}: *(% by weight)*	≤10 %	≤1.5 %
Maximum Pu content: *(% by weight)*		≤15 %
Isotropic vector Pu:		
$\frac{Pu^{239} + Pu^{241}}{(U + Pu)_{total}}$		≤12 %
$\frac{Pu^{239} + Pu^{241}}{(Pu + Am)_{total}}$		≤80 %
$\frac{Pu^{241} + Am^{241}}{(Pu + Am)_{total}}$		≤12 %
$\frac{Pu^{238}}{(Pu + Am)_{total}}$		≤4 %
$\frac{Pu^{239}}{(Pu + Am)_{total}}$		≤70 %
$\frac{Pu^{240}}{(Pu + Am)_{total}}$		≤30 %
$\frac{Pu^{242}}{(Pu + Am)_{total}}$		No restriction
Minimum cooling time:	6 months	
Maximum residual thermal power per unit length at the maximum of the combustion rate profile: *(for the whole of the loading)*	310 W/m	
Maximum total thermal power: *(for the whole of the loading)*	1000 W	

UOX-B fuel:

Activity: 6.65×10^3 TBq

Chemical form: Sintered uranium oxide pellets whether or not containing the following additives in a proportion below 5000 ppm: niobium, chromium, titanium, silicon, iron, magnesium, zinc, calcium, nickel, zirconium or aluminium oxides.

Special form: No

The pellets can also contain up to 10 % of a neutronic poison (gadolinium or erbium).

MOX-B fuel:	Activity:	6.65×10^3 TBq
	Chemical form:	Sintered uranium and plutonium oxide pellets.
	Special form:	No

2. LOADING CONDITIONS

The R72 package model, equipped with suitable internal arrangements, can simultaneously transport up to **10 fuel rods** (either type UOX-B or MOX-B).

The rate of combustion and the duration of cooling of the rods to be transported must be such that the authorised residual maximum power and the permitted limits of dose rate around the package are not exceeded.

The presence of water or of materials more hydrogenated than water in the cask is not authorised.

The total weight of the elements loaded into a canister must not exceed: **180 kg**.

The total weight of the elements loaded into the R72 cask must not exceed: **650 kg**.

3. INTERNAL ARRANGEMENTS

Different types of internal arrangements can be associated, as required, to the radioactive contents No.2 described above (§1). These different internal arrangements are described in annexe 0.

4. CRITICALITY ANALYSIS

This is the subject of chapter R72 ANS 600 of the safety dossier.

The following hypotheses are used:

- the total destruction of the rods is assumed, it being possible for the material to be anywhere and in any form within the cavity of the cask.
- certain internal arrangements related to the different contents transported are ignored. In particular the following are ignored:
  - the cladding of the rods,
  - capsules that may contain segments or waste of rods,
  - the sheath tubes of a basket,
  - the sides of the canister.
- it is assumed that there has been water penetration, in spite of the presence of two sealed enclosures.

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