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ROBATEL INDUSTRIES TECHNOLOGIES

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ABSTRACT

ROBATEL INDUSTRIES has been manufacturing transportation casks for radioactive components for over 50 years. ROBATEL INDUSTRIES has developed up to 73 type B casks and manufactured over 500 casks units. These casks are designed for different types of materials: spent fuel rods, metallic waste, radioactive liquids, sources ...

As an overview we present today three of our last transportation casks:

R68 package
This cask has been designed for EDF in order to transport C1PG concrete hulls which can not be classified as IP2 package because they are beyond the dose limit. The cover makes the upper third of the cask, which enables the gripping of the hull. The cavity gap is Ø 1440 mm x 1320 mm. The loaded weight is 21 tons. The cask is shielded with stainless steel.

R72 package
This cask has been ordered for R&D purpose by EDF for rods transportation. It contains up to 10 rods type UOX or MOX of a total thermal power of 1250 W. The loaded weight is 21.5 tons. The cask is shielded with lead and ROBATEL PNT7 compound. The rods are put into a canister which is placed into a sealed casing. The casing can be horizontally transferred into the examination cells.

R73 package
This cask has been ordered by EDF and is currently being designed by ROBATEL INDUSTRIES. It is designed for the transportation of activated metallic waste issued from dismantling of nuclear plants. The transported waste is packaged before storage.
The capacity is about 2 tons of activated metallic waste, or 0,74m^3, for an activity of maximum 400 TBq of equivalent ^{60}Co and a 555 kg/ m^3 specific gravity.
Its large cavity (Ø 1040 mm x 935 mm) is designed to receive a basket containing the waste. The cask is shielded with lead and stainless steel.

INTRODUCTION

As a French company ROBATEL Industries has been designing and manufacturing transportation packages for over 50 years. From the first container designed in 1954 to transport fuel rods for the first French nuclear reactor named ZOE, to the R73 type B package (which is our type B cask number 73), ROBATEL Industries has always adapted itself to meet the international regulatory requirements and to offer an industrial approach from design to manufacturing.

To offer our customers the best service we suggest an inclusive management of their needs: from their technical specification describing the cask content and the loading / unloading interfaces we provide them with turn-key type B packages. We are thus able to deliver a package with its approval within 2 years.
This can only be performed thanks to complete knowledge and control of all the package development stages by means of:

- experienced engineers
- internal calculations (mechanical, thermal, radio protection calculations)
- cooperation with the manufacturing control and safety organizations.

EDF has thus contracted with ROBATEL Industries to design and manufacture the R73 package and corresponding approval, which will be used for waste transportation to dismantle the 1st generation French nuclear plants.

ROBATEL Industries also offers full service by adding to design and manufacturing the transportation and the loading / unloading packages. A teaming agreement has been signed with a specialized transportation company.
We are carrying out this type of turnkey service for EDF with the R72 package which transports irradiated fuel rods from power plants to hot labs for expertise and research purposes.

ROBATEL Industries offers specific solutions to meet all experts requirements from the nuclear field in France (EDF, CEA, CIS BIO, DGA, ...) and abroad.

R68 – CASK FOR CONCRETE SHELL – B(U) TYPE

General context

EDF (Electricité de France) is packing some of its exploitation waste into concrete shells named C1PG or C4PG. Most of them enter in the industrial categories defined by the regulations of radioactive material transportation. However, the content of a few ones exceeds the limits set for low specific activity substances. Thus, these shells must be transported into type B packages.
For this purpose ROBATEL Industries has been developing the R68 concept for EDF.

Characteristics and design

The R68 package, which general form is cylindrical, is composed of three main parts: its body (closed with a lid) which is equipped with two shock absorbers. The package is designed to be transported in a vertical position.

The connection between the lid and the body of the package is located at $^2/_3$ of the package height to free the concrete shell groove used for its handling.

The R68 package ensures all the safety functions required by the transportation regulation:

- Its closing system is ensured by the lid linked to the body with 36 screws.
- The confinement of the radioactive content is ensured by the body and its lid equipped with the airtight gasket.
- The radiological shielding against γ radiation is ensured by 120 mm of stainless steel.
- The thermal protection against fire is ensured by a 30 mm thick layer of ROBATEL PNT7 compound. This compound was developed by ROBATEL in 1988. It is frequently used for its huge thermal energy absorption capacity which is provided by its dehydration during fire.

The main dimensions and masses of the package are consigned into the following table:

R68's main dimensions :			R68's main masses :		
- Package height	:	2 240 mm	- Empty package weight	:	14 300 kg
- Package diameter	:	Ø 2 450 mm	- Body weight	:	7 500 kg
- Body height	:	1 635 mm	- Lid weight	:	3 600 kg
- Body diameter	:	Ø 1 940 mm	- Upper shock absorber weight	:	2 700 kg
- Cavity diameter	:	Ø 1 440 mm	- Lower shock absorber weight	:	500 kg
- Cavity height	:	1 320 mm			

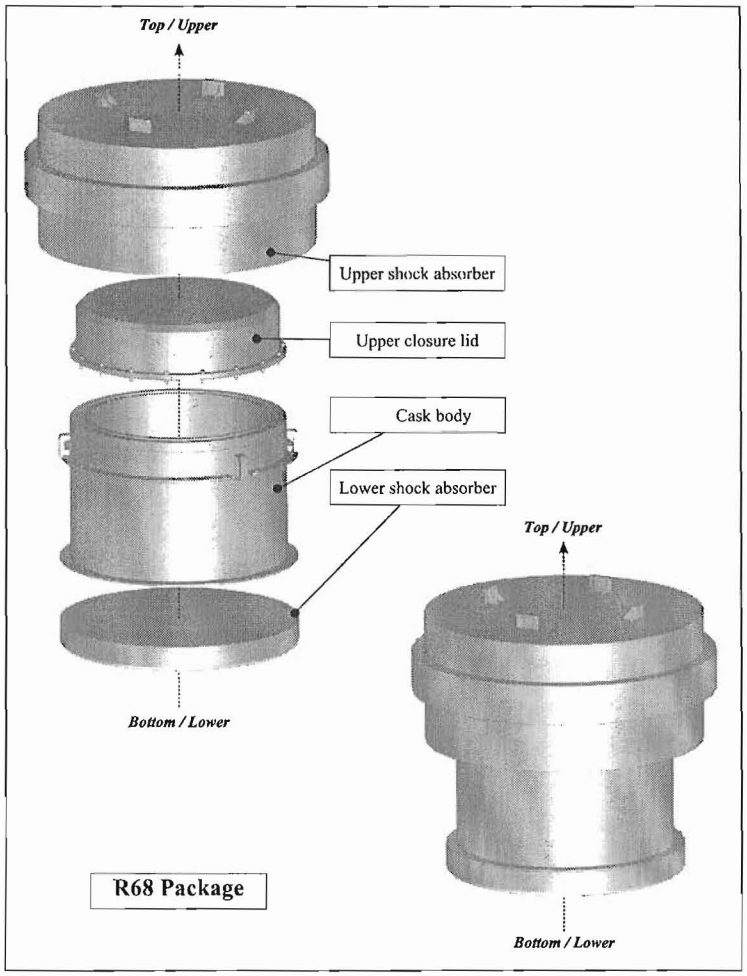

Figure 1. R68 package

Content

The content of the R68 package is a concrete shell filled with irradiated and contamined metallic waste. The characteristics of this shell and its filling are consigned into the following table:

R68's content :		
- Total weight	≤	6 300 kg
- Total activity	≤	120 A_2
- γ activity (equivalent of ^{60}Co)	≤	31 TBq

Validation and manufacturing process

The EDF first order was placed in April 2000. The regulatory drop tests were carried out on a $^1/_3$ scale model in April 2002.

The initial approval was obtained in July 2004. The approval extend is currently being examined.

In the next future ROBATEL Industries will receive the manufacturing order for the first unit.

R72 – CASK FOR SPENT FUEL RODS – B(U)F TYPE

General context

For expertise and research purposes EDF must transport irradiated fuel rods from its power plants to hot labs and has until now been using the R62 package, which was designed and manufactured by ROBATEL in the early eighties. Because this package is over dimensioned for EDF current needs and its design becomes obsolete, EDF has contracted with ROBATEL Industries for a new package concept called R72.

Characteristics and design

The R72 package, which general form is cylindrical, is composed of three main parts: its body (closed with two lids at each of its extremities) which is equipped with two shock absorbers. The package is designed to be transported in an horizontal position.

Concerning the R72's inner layout, the package is equipped with a basket placed inside a canister including a shielded plug.

The R72 package ensures all the safety functions required by the transportation regulation:

- Its closing system is ensured by the two lids linked to the body with respectively 21 and 8 screws.
- From a regulatory standpoint the confinement is ensured by the body and its two lids, which are both equipped with a airtight joint.
  However the canister is also airtight and can be considered as a second confinement system for user operations.
- The biological protection is ensured by the cask body and by the extremity of the canister. It is made of stainless steel, lead and neutron shielding compound. The equivalent gamma shielding is 180 mm of lead.
- The neutron and thermal protection is 210 mm of compound ROBATEL PNT7. It is also an efficient neutron absorbing material.

The body of the cask is equipped with 4 trunnions at the front end and 2 trunnions at the rear end. It could be handled horizontally by 4 trunnions or vertically (front end on top) by 2 or 4 trunnions.

The package is designed in order to be loaded/unloaded under water, or under a loading pool, as well as horizontally, in hot labs cells.

The main dimensions and masses of the package are consigned into the following table:

R72's main dimensions :			R72's main masses :		
- Package length	:	6 254 mm	- Package weight	:	21 500 kg
- Package diameter	:	Ø 1 680 mm	- Body weight	:	19 100 kg
- Body length	:	5 445 mm	- Front lid weight	:	155 kg
- Body diameter	:	Ø 950 mm	- Rear lid weight	:	25 kg
- Cavity diameter	:	Ø 140 mm	- Front shock absorber weight	:	1 100 kg
- Cavity length	:	5 330 mm	- Rear shock absorber weight	:	1 100 kg

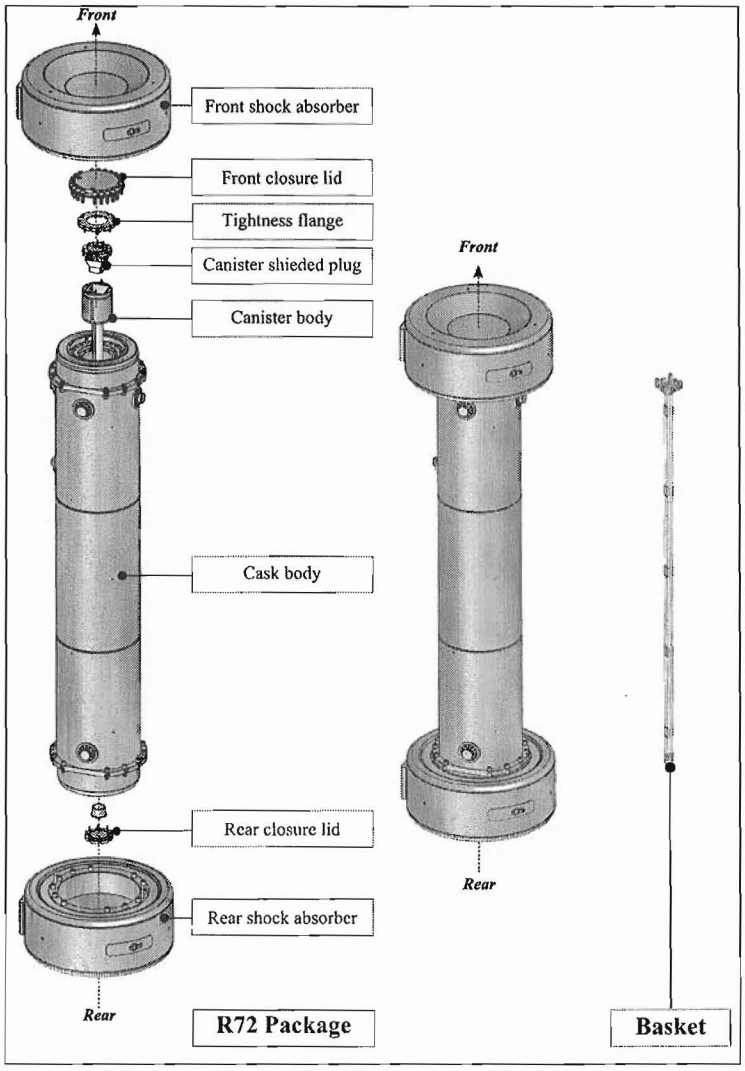

Figure 2. R72 package

Content

The R72 package can be filled with up to ten fuel rods. Those are placed in a basket introduced then into the airtight canister loaded in the cask's cavity. The characteristics of the content of the R72 package are consigned into the following table:

	UOX	MOX
Number of fuel rods	≤ 10	
Fuel weight	≤ 25.6 kg	
Burn-up	≤ 120 000 MWd/tM	
U235 enrichment (% weight)	≤10 %	≤1.5 %
Pu rate (% weight)		≤15 %
Cooling time	≥ 6 month	
Residual linear thermal power	≤ 310 W/m	
Residual thermal power	≤ 1250 W	
Maximal activity	≤ 4.19 x 10^5 A_2	

Validation and manufacturing process

The regulatory drop tests were passed with success in presence of the nuclear safety's French authority in January 2007 in the Genas plant of ROBATEL Industries. Six drop tests were done on a $^1/_3$ scale model (three punctures tests and three nine meters drops).

The safety file was introduced to the French safety authority in December 2006. The approval is expected by the end 2007 or early 2008. According to the agreement made with ROBATEL Industries, TRANSNUBEL has begun the validation process in Europe in order to be able to use the package for its own customers.

ROBATEL Industries has started the manufacturing of the first unit in its Genas plant. The package should be operational at the beginning 2008.

R73 – CASK FOR METALLIC WASTE – B(U) TYPE

General context

To dismantle its 1st generation nuclear power plants EDF must send its metallic radioactive waste to the ICEDA facility. EDF has thus contracted with ROBATEL Industries to design and manufacture a new transportation cask able to meet its requirements. Twelve units are presently under development.

Characteristics and design

The R73 package, which general form is cylindrical, is composed of three main parts: its body (closed with a lid) which is equipped with two shock absorbers. The package is designed to be transported in vertical position and is also equipped with two handling devices enabling its vertical handling.

The radioactive waste is loaded into a metallic basket located in the cylindrical body cavity.

The body is equipped with a shielded plug and with a closure lid.

The R73 package ensures all the safety functions required by the transport regulation:

- Its closing system is ensured by the lid linked to the body with 30 screws.
- The confinement is ensured by the body and its lid equipped with a airtight gasket.
- The radiological shielding against γ radiation is ensured by the package body. It is mainly made of lead and stainless steel (equivalent to 210 mm of lead).
- The thermal shielding is ensured by the PNT3 compound, a material which has been developed by ROBATEL Industries. This compound is frequently used for its huge energy absorption capacity which is provided by its dehydration during fire.

The main dimensions and masses of the package are consigned into the following table:

R73's main dimensions :			R73's main masses :		
- Package height	:	2 365 mm	- Package weight (full loaded)	:	23 900 kg
- Package diameter	:	Ø 2 208 mm	- Body weight	:	16 250 kg
- Body height	:	1 473 mm	- Lid weight	:	730 kg
- Body diameter	:	Ø 1 744 mm	- Shielded plug weight	:	1 600 kg
- Cavity diameter	:	Ø 1 040 mm	- Upper shock absorber weight	:	1 980 kg
- Cavity height	:	935 mm	- Lower shock absorber weight	:	970 kg

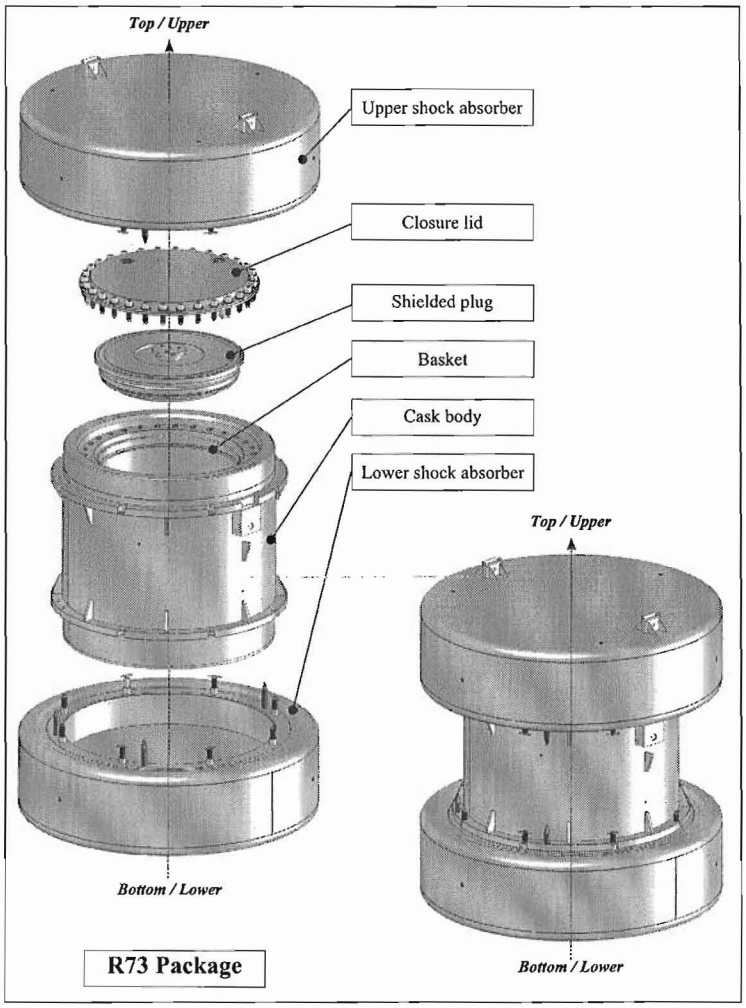

Figure 3. R73 package

Content

The R73 cask contains radioactive metallic waste which is loaded in bulk into the metallic baskets. The characteristics of this content are consigned into the following table:

R73's content :		
- Maximum payload of waste	≤	2 000 kg
- Total activity	≤	6 500 A_2
- γ activity (equivalent of ^{60}Co)	≤	400 TBq

Validation and manufacturing process

The regulatory drop tests were passed with success on a $^1/_{2.8}$ scale model in the Genas plant of ROBATEL Industries. Seven drop tests were carried out (three punctures tests and four nine meters drops).

The safety file will be introduced to the French safety authority mid 2008. The approval is expected by mid 2009.

ROBATEL Industries has started the manufacturing of twelve units of the R73 cask model in its Genas plant. The first packages should be operational by the end 2010.

CONCLUSIONS

Based upon its half-century experience in design and manufacture of transportation packages, ROBATEL Industries is clearly positioned as a major actor in this field, with its specific approach consisting in an inclusive management of its customers needs, from design to transportation.

ACKNOWLEDGMENTS

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