TRANSPORT AND STORAGE CASKS FOR IRRADIATED FUEL ASSEMBLIES FROM RESEARCH REACTORS

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SUMMARY

For irradiated fuel assemblies from various research reactors, the Gesellschaft für Nuklear-Behälter (GNB) has designed transport casks as well as combined transport and storage casks. The transport cask of the type GNS 16 and the combined transport and storage cask of the type CASTOR MTR 2 are described in the following sections.

GNS 16 Transport Cask

The GNS 16 transport cask mainly consists of the cask body manufactured as a sandwich construction (stainless steel/lead/stainless steel) and the massive lid made of stainless steel.

The cask body is formed by the side-wall (40 mm stainless steel), the inner liner (30 mm stainless steel), the bottom plates belonging to the side-wall and the inner liner as well as the head ring. The side-wall and the inner liner are welded to the head ring. The hollow space formed by the side-wall and the inner liner is completely cast with lead. The lead thickness at the side-wall is 153.5 mm and at the bottom 135 mm.

The 325 mm thick lid closes the cask cavity with its sealing system. Together with the head ring, the inner liner and the inner liner bottom, it forms the leak-tight containment of the cask. The lid is attached by means of 16 cylindrical bolts (M30). Handling connections for dewatering and drying the cask as well as for the test of its leak-tightness are located in the lid. During transport, these handling connections are tightly closed by means of a closure lid and/or closure bolts.

A protection plate is installed above the lid, which protects the lid system from dust, moisture and mechanical influences during handling and transport of the cask.

Different fuel baskets can be inserted in the cavity of the cask for accommodating the following contents:

- 33 square-shaped MTR-fuel assemblies of enrichment levels HEU (max. initial enrichment: 95.1 M% U-235), MEU (max. initial enrichment: 45.7 M% U-235) and LEU (max. initial enrichment 20.3 M% U-235) with a max. decay heat of 40W/fuel assembly.

- 28 tubular MTR-fuel assemblies of enrichment levels HEU, MEU and LEU with a maximum decay heat of 26 W/fuel assembly.
- 90 TRIGA-fuel assemblies of enrichment level LEU with a maximum decay heat of 1W/fuel assembly.

In order to handle the cask, two trunnions are arranged opposite each other on the head ring. The transport of the GNS 16 cask is performed in a special 20 ft container. For this purpose, cupped shock absorbers are installed at the top and bottom ends.

The overall dimensions (without shock absorbers) of the GNS 16 are as follows:

- Overall height: 1535 mm
- Outer diameter: 1180 mm
- Cavity height: 944 mm
- Cavity diameter: 723 mm

The mass of the loaded cask without shock absorbers is approx. 13 100 kg. The total mass of both shock absorbers is approx. 2020 kg.

A schematic presentation of the GNS 16 transport cask is shown in Figure 1.

The GNS 16 complies with the international regulations of the IAEA (International Atomic Energy Agency) for package designs of the type B(U) and the nuclear safety class I.

CASTOR MTR 2 Transport and Storage Cask

The CASTOR MTR 2 serves for the transport as well as the dry interim storage of irradiated fuel assemblies from various research reactors.

The cask mainly consists of a thick-walled cylindrical cask and a testable and monitorable double-lid system.

The cask body is made of ductile cast iron and is cast as a hollow cylinder closed on one side with a smooth surface and subsequently machined. The wall thickness of the cask body is 354.5 mm at the side-wall and 360 mm at the bottom.

The 280 mm thick primary lid is made of steel with high ductility at low temperatures. With its sealing system, it closes the cask cavity and forms, together with the cask body, the leak-tight containment under normal conditions. The primary lid is attached to the cask body by means of 28 cylindrical bolts (M30). The sealing system of the primary lid consists of a metal and an elastomer seal. In the space formed by both seals, a test bore hole is inserted, from the lid top side, through which the long-term leak-tightness of the primary lid can be obtained and tested already during the dispatch of the cask. Handling connections for dewatering, drying and filling the cavity with inert gas are also located in the primary lid. For transport and storage, these handling connections are tightly closed by means of the closure lid.

Above the primary lid, there is a second, 60 mm thick lid, the so-called secondary lid. The secondary lid forms, with its sealing system, a second, independent sealing barrier for the

cask. Together with the cask body, it can form an alternative leak-tight containment. The secondary lid is also made of steel with high ductility at low temperatures. Its sealing system is similar to the one of the primary lid and it is attached by means of 28 cylindrical bolts (M30). A connection for filling the space between the primary and secondary lids with helium is located in the secondary lid as well as a pressure switch. For the storage of the cask, the inter-lid sapce is filled with an overpressure compared with the cavity and the outer ambience. This overpressure and thus the leak-tightness of the cask is continuously monitored by means of the pressure switch during the whole storage period.

Different fuel baskets can be inserted in the cavity of the cask for accommodating the following contents:

- 33 square-shaped MTR-fuel assemblies of enrichment levels HEU (max. initial enrichment: 93.2 M% U-235), MEU (max. initial enrichment: 45.5 M% U-235) and LEU (max. initial enrichment 20.0 M% U-235) with a max. decay heat of 25W/fuel assembly.
- 28 tubular MTR-fuel assemblies of enrichment levels HEU, MEU and LEU with a maximum decay heat of 25 W/fuel assembly.
- 90 TRIGA-fuel assemblies of enrichment level LEU with a maximum decay heat of 1W/fuel assembly.
- 147 VVER-M or VVER-M2-fuel assemblies of Soviet type with a maximum initial enrichment of 36.6 M% U-235 and a maximum decay heat of 1W/fuel assembly.
- 42 EK-10-fuel assemblies of Soviet type with a maximum initial enrichment of 10.0M% U-235 and a maximum decay heat of 1W/fuel assembly.
- 5 compact fuel assemblies with a maximum initial enrichment of 93 M% U-235 and a maximum decay heat of 165W/fuel assembly.

For handling of the cask, two trunnions are bolted to the cask body. The transport of the CASTOR MTR 2 cask is performed in a special 20 ft container. For this purpose, cupped shock absorbers are installed at the top and bottom ends of the cask.

For storage of the cask, a lid protection plate is installed above the secondary lid and a bottom protection plate below the cask bottom.

The dimensions (without shock absorbers and protection plate) of the CASTOR MTR 2 are as follows:

- Overall height: 1631 mm
- Outer diameter: 1430 mm
- Cavity height: 920 mm
- Cavity diameter: 721 mm

The mass of the loaded cask without shock absorbers and protection plate is approx. 15800 kg. The total mass of both shock absorbers is approx. 2130 kg.

A schematic presentation of the combined transport and storage cask CASTOR MTR 2 is shown in Figure 2.

The CASTOR MTR 2 complies with the international regulations of the IAEA for package designs of the type B(U) and the nuclear safety class I. The application for dry interim storage of irradiated fuel assemblies from research reactors in the CASTOR MTR 2 has been submitted. The application documents are being currently evaluated by the German licensing authorities.

REFERENCES

Regulations for the Safe Transport of Radioactive Material. 1985 Edition (as amended 1990). Safety Series No. 6, Vienna, 1990. IAEA

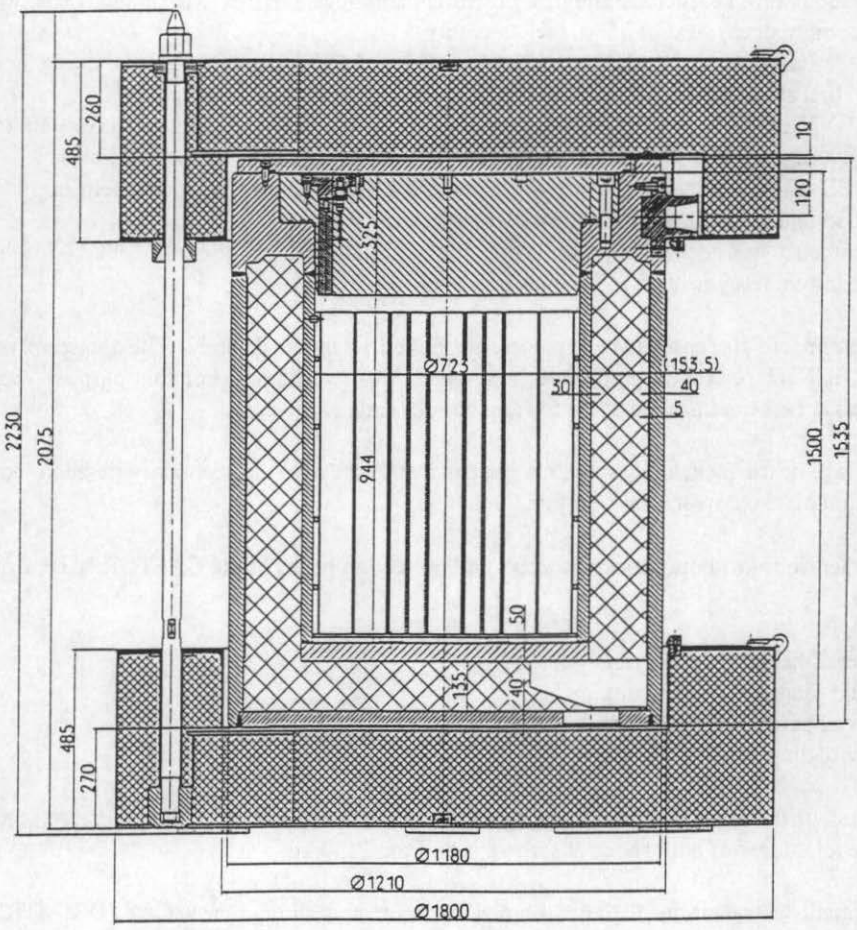

Fig. 1: GNS 16 Transport Cask

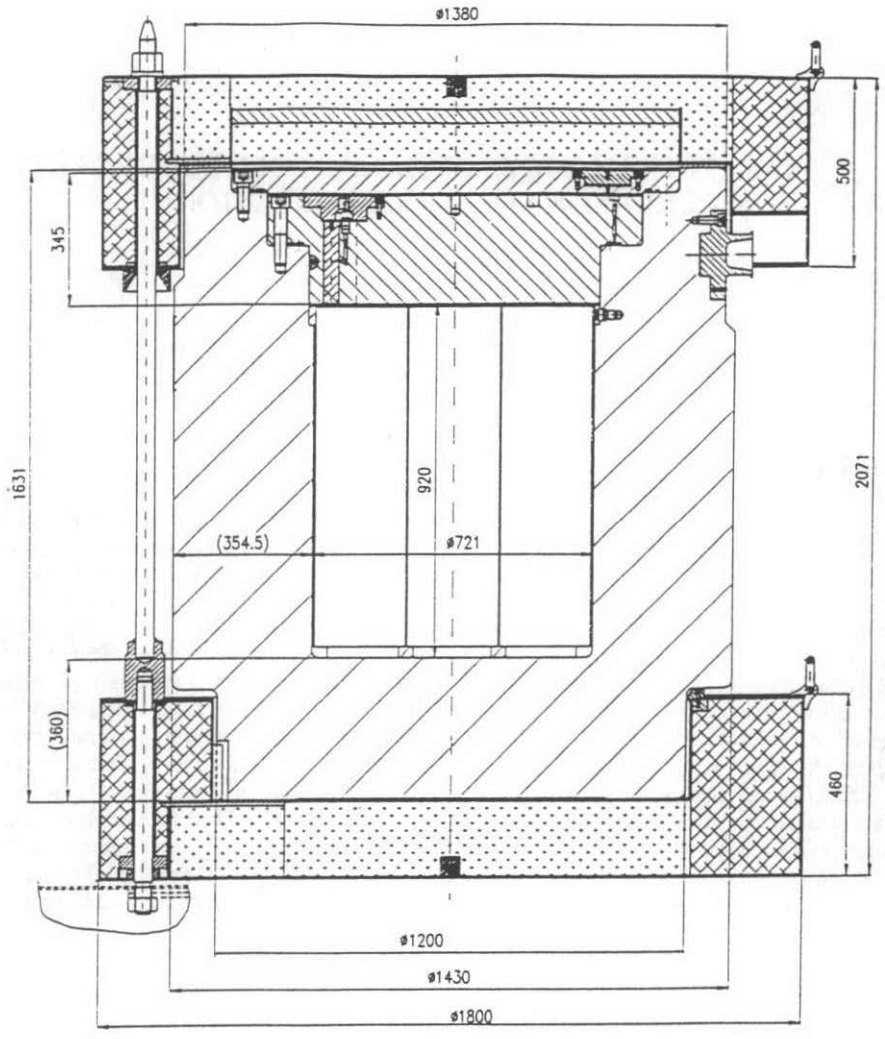

Fig. 2: CASTOR MTR 2 Transport and Storage Cask