Quality Assurance, Fabrication, and accompanying Quality Control of CASTOR® Transport and Storage Casks

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1. Quality Assurance

In Germany, the Federal Institute for Materials Research and Testing (BAM, Berlin) acts as the competent authority for the approval of quality assurance measures of packages used in the transport of radioactive material. For this purpose, the German Federal Ministry of Transport issued the "Technical Guideline on Measures for Quality Assurance (QM) and Quality Surveillance (QÜ) for packages for transport of radioactive materials (TRV 006)".

Due to this guideline, every applicant for a cask license is requested to issue a written programme for design, fabrication, testing, documentation, operation, maintenance, and recurrent testing of packages. This programme has to be approved by BAM.

Therefore, the company implemented and maintains a programme on basis of the TRV 006 and a Quality Management System on basis of the ISO 9001:2000 which cover all requirements of the guideline to ensure a controlled processes. The system is regularly assessed by BAM.

2. Competent Authority (BAM) and GNS mbH/GNB (see Fig. 1)

After the design process is finalized, the cask application documents (Safety Analysis Report, drawings, parts lists, material specifications and test procedures) are handed over to BAM. The competent authority examines these documents with regard to the requirements of the transport regulations. This includes the review of the Safety Analysis Report with regard to i.e. the mechanical and thermal design and (by BfS) the shielding and criticality calculations.

Prior to the start of the fabrication, Fabrication and Test Plans (FPP) are prepared by the commissioned vendors. The FPPs include the necessary work and test steps and are citing the obligatory GNS/GNB documents (drawings, test procedures etc.) to be used by the vendor during the fabrication. In addition, the FPPs are indicating the witness and holdpoints at suitable stages of the fabrication, where, beside the testing performed by the vendor, GNS/GNB Quality Control and/or BAM are participating in the testing.

These FPPs are send to GNS/GNB for pre-testing and release by the Quality Control department. Then these plans are send to BAM for pre-testing and release.

3. Fabrication and accompanying Quality Control

The prerequisites for the fabrication are:

- GNS/GNB is not a self-fabricating company
- All items are delivered by qualified vendors domestic and/or abroad
- GNS/GNB finally assembles the casks and performs acceptance tests.

3.1 Fabrication Process

On basis of GNS/GNB-released fabrication documents (i.e. drawings, parts list, material specifications, FPPs etc), the commissioned vendors start their fabrication process. During the fabrication of items (i.e. cask bodies, lids, trunnions etc.), GNS/GNB and BAM representatives participate in the testing of an item (i.e. ultrasonic testing) indicated in the FPP (see Fig. 2). The extent of the testing can be 100% by the vendor, 30% by GNS/GNB QC, and 30% by BAM.

The testing is performed on basis of written procedures, cited in the FPP. The results of the tests are documented in required protocols signed by all participating parties. If necessary, each party documents the results in independent protocols. The required test step in the FPP will also be signed by all three parties.

After all work and test steps, according to the FPP, have been performed, signed, and documented in the required protocols, these documents are compiled to the fabrication documentation of the item. The final step is that the commissioned vendor, GNS/GNB QC, and BAM will examine the whole fabrication documentation of the item and will close the documentation by signing the FPP for documentation tested. Now the single item is ready for despatch to the assembly shop of GNS/GNB.

3.2 Assembly Process

After receiving of all needed items, the items are subject to an receiving inspection. The extent of this inspection takes into account the range of the previous testing performed at the vendor´s premises. In accordance with an FPP for the assembly prepared by GNS/GNB and pre-tested by QC and BAM, the cask is completely assembled in the shop.

The main action of the assembly process is the performance of required acceptance tests with participation of BAM. These tests, performed in accordance with written procedures, are the leak thightness test and the load test of the load attachment points (the trunnions).

When all work and test steps of the assembly FPP have been successfully performed and documented, the documentation of the assembly is examined by QC and BAM and the FPP is closed by signing the document for documentation tested.

3.3 Final Fabrication Documentation

All fabrication documentation for single items (cask body, moderator, lids, metall gaskets, basket, trunnions, screws) are then compiled by QC as the Final Fabrication Documentation of a single cask. The QC performs now the final examination of the whole cask documentation.

The final step performed independent by BAM, is to examine Final Fabrication Documentation and to issue a Certificate of Conformance for each individual cask to testify the accordance of the cask with the general Cask Transport License.

4. Experience

The managers of our company are united by many years of experience as well as "lessons learnt" during the manufacturing of more than 900 CASTOR® casks of different types for different purposes (see Fig. 3), that a consequently implemented quality management system - with regard to the integration of quality, radiation protection, working safety and environmental protection - represents an indispensable prerequisite for the necessary activities of our company.

This necessitates strict adherence to the regulations TRV 006 and the ISO 9001:2000 as well as the complete fulfilment of the customer's requirements from the processing of enquiries, to engineering services (development, fabrication and cask loading service). Furthermore a process of continual improvement is implemented within our company with regard to

- Quality Assurance
- Accompanying Qualtiy Control and
- Capabilities

to ensure Safety Worldwide.

Competent Authority (BAM) and GNS mbH/GNB

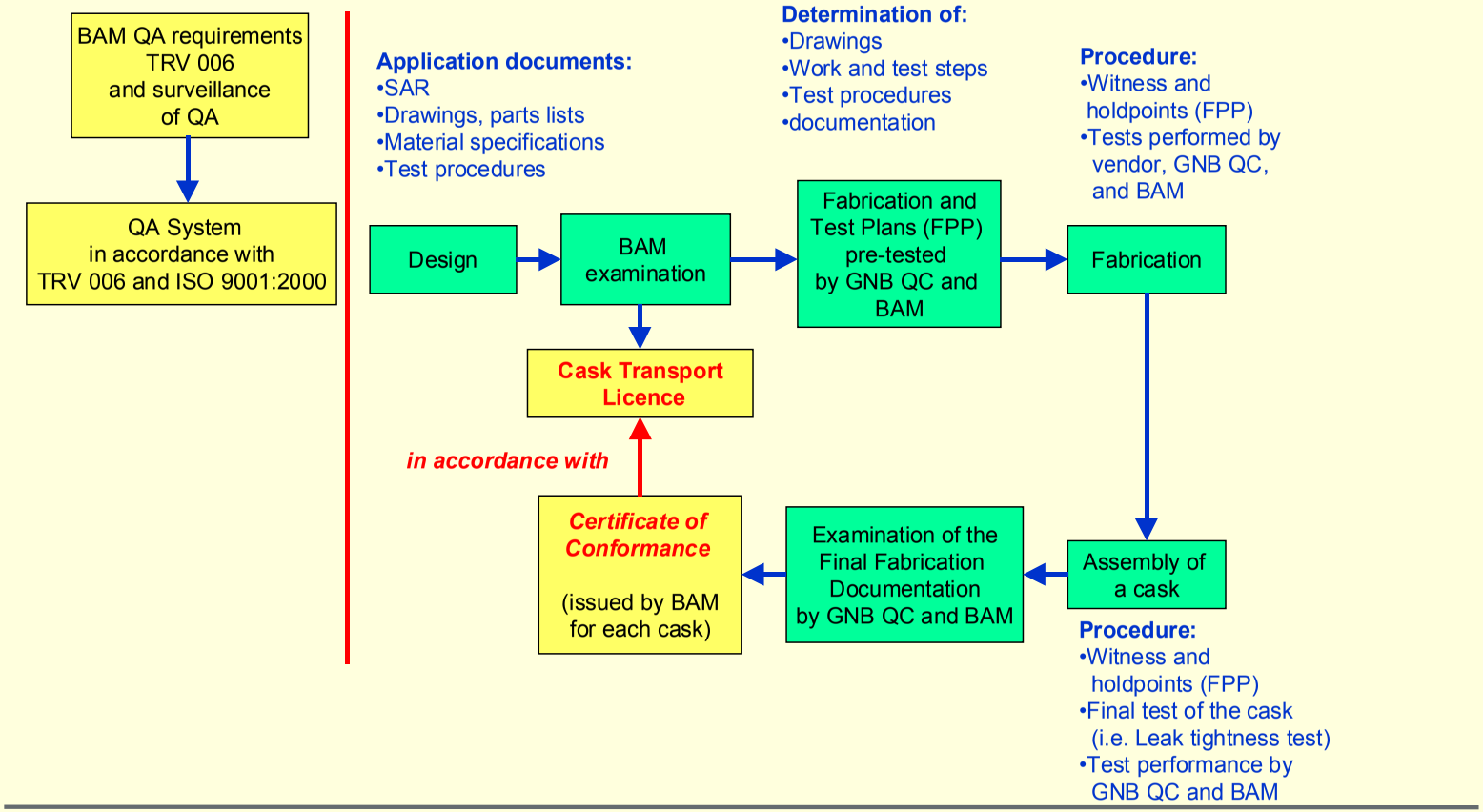
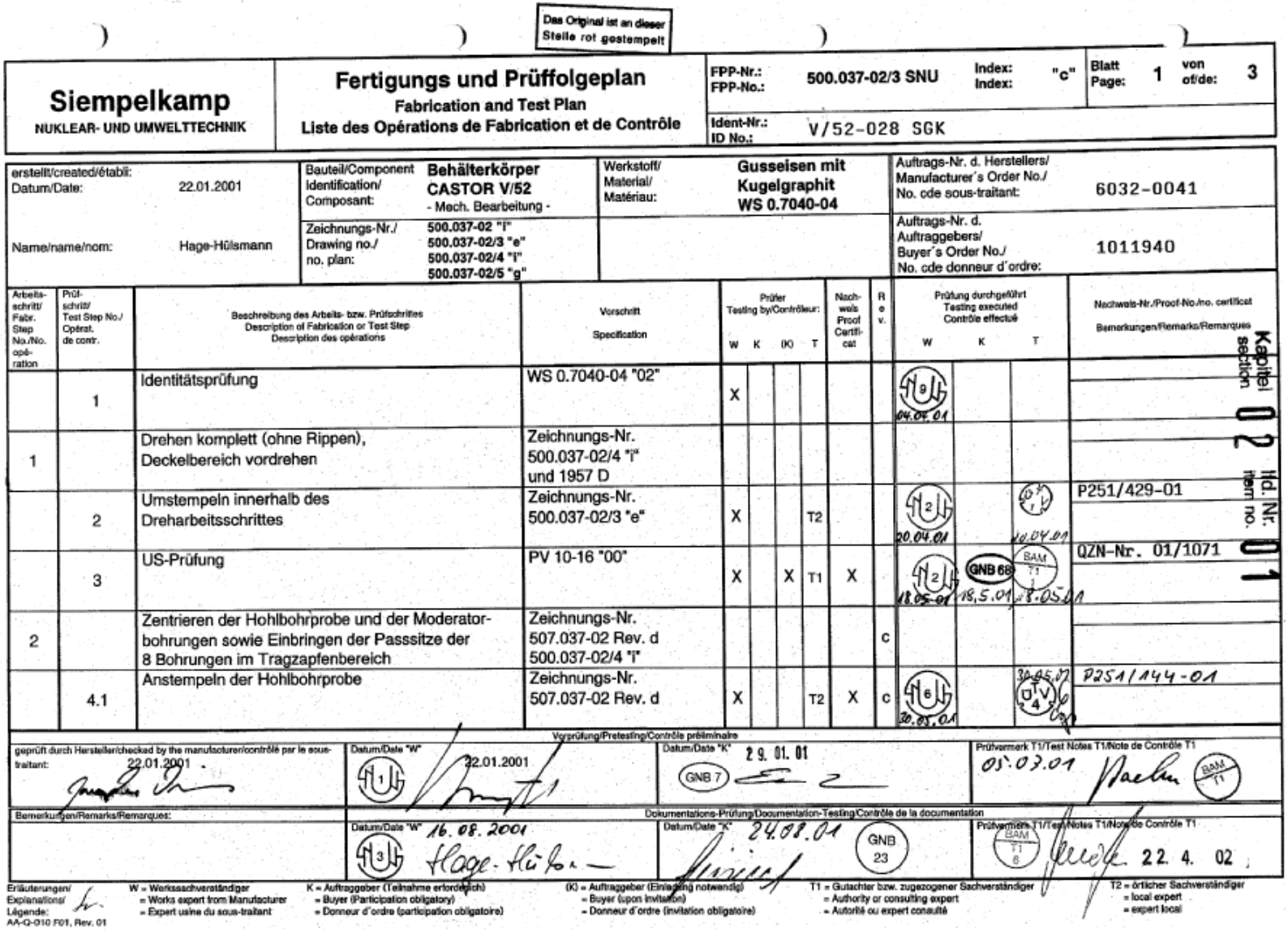


Fig. 1

Fabrication and Test Plan



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Siempelkamp
NUKLEAR- UND UMWELTTECHNIK

Fertigungs und Prüffolgeplan
Fabrication and Test Plan
Liste des Opérations de Fabrication et de Contrôle

FPP-Nr.: / FPP-No.: 500.037-02/3 SNU Index: / Index: "c" Blatt / Page: 1 von / of/de: 3

Ident-Nr.: / ID No.: V/52-028 SGK

erstellt/created/établi: Datum/Date: 22.01.2001
Name/name/nom: Hage-Hülsmann

Bauteil/Component Identification/ Composant: **Behälterkörper CASTOR V/52** - Mech. Bearbeitung -
Zeichnungs-Nr./ Drawing no./ no. plan: 500.037-02 "i" 500.037-02/3 "e" 500.037-02/4 "i" 500.037-02/5 "g"

Werkstoff/ Material/ Matériau: **Gusseisen mit Kugelgraphit WS 0.7040-04**

Auftrags-Nr. d. Herstellers/ Manufacturer's Order No./ No. ode sous-traitant: 6032-0041
Auftrags-Nr. d. Auftraggebers/ Buyer's Order No./ No. ode donneur d'ordre: 1011940

Arbeitsschritt/ Fabr. Step No./No. opération	Prüfschritt/ Test Step No./ Opérat. de contr.	Beschreibung des Arbeits- bzw. Prüfschrittes / Description of Fabrication or Test Step / Description des opérations	Vorschrift / Specification	Prüfer Testing by/Contrôleur: W	K	(K)	T	Nachweis Proof Certificat	Rev.	Prüfung durchgeführt Testing executed Contrôle effectué W	K	T	Nachweis-Nr./Proof-No./no. certificat / Bemerkungen/Remarks/Remarques
	1	Identitätsprüfung	WS 0.7040-04 "02"	X						9 04.04.01			
1		Drehen komplett (ohne Rippen), Deckelbereich vordrehen	Zeichnungs-Nr. 500.037-02/4 "i" und 1957 D										
	2	Umstempeln innerhalb des Dreharbeitsschrittes	Zeichnungs-Nr. 500.037-02/3 "e"	X			T2			2 20.04.01		T1 20.04.01	P251/429-01
	3	US-Prüfung	PV 10-16 "00"	X		X	T1	X		2 18.05.01	GNB 68 18.5.01	BAM T1 18.05.01	QZN-Nr. 01/1071
2		Zentrieren der Hohlbohrprobe und der Moderatorbohrungen sowie Einbringen der Passsitze der 8 Bohrungen im Tragzapfenbereich	Zeichnungs-Nr. 507.037-02 Rev. d 500.037-02/4 "i"						c				
	4.1	Anstempeln der Hohlbohrprobe	Zeichnungs-Nr. 507.037-02 Rev. d	X			T2	X	c	6 30.05.01		TV 4 30.05.01	P251/144-01

Kapitel / section 02 lfd. Nr. / item no. 01

Vorprüfung/Pretesting/Contrôle préliminaire

geprüft durch Hersteller/checked by the manufacturer/contrôlé par le sous-traitant: 22.01.2001
Datum/Date "W" 1 22.01.2001
Datum/Date "K" GNB 7 29.01.01
Prüfvermerk T1/Test Notes T1/Note de Contrôle T1: 05.07.01 BAM T1

Bemerkungen/Remarks/Remarques:

Dokumentations-Prüfung/Documentation-Testing/Contrôle de la documentation

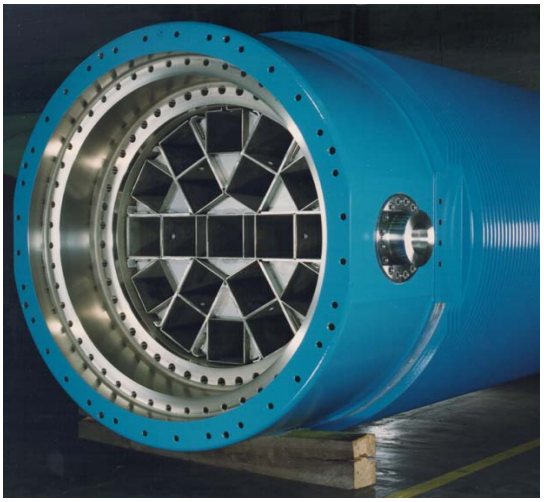
Datum/Date "W" 3 16.08.2001 Hage-Hülsmann
Datum/Date "K" 24.08.01 GNB 23
Prüfvermerk T1/Test Notes T1/Note de Contrôle T1: BAM T1 6 22.4.02

Erläuterungen/ Explanations/ Légende: AA-Q-010 F01, Rev. 01
W = Werkssachverständiger = Works expert from Manufacturer = Expert usine du sous-traitant
K = Auftraggeber (Teilnahme erforderlich) = Buyer (Participation obligatory) = Donneur d'ordre (participation obligatoire)
(K) = Auftraggeber (Einladung notwendig) = Buyer (upon invitation) = Donneur d'ordre (invitation obligatoire)
T1 = Gutachter bzw. zugezogener Sachverständiger = Authority or consulting expert = Autorité ou expert consulté
T2 = örtlicher Sachverständiger = local expert = expert local

Fig. 2

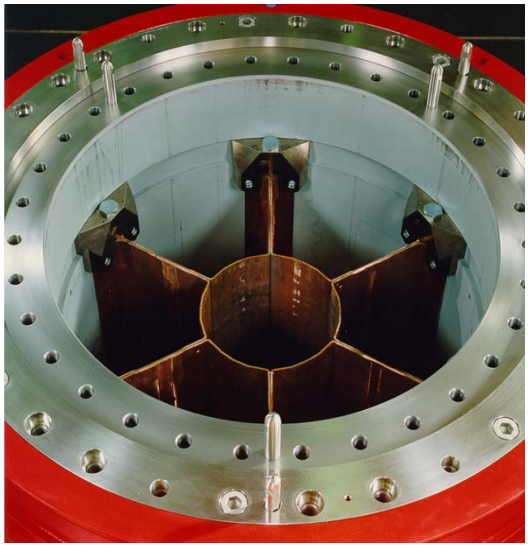
Various Types of CASTOR® Casks

CASTOR® V/19 for PWR Fuel Assemblies



CONSTOR® RBMK a concrete cask for PWR FA

CASTOR® HAW20/28CG for vitrified residues



CASTOR® MTR2 for FA of Research Reactors

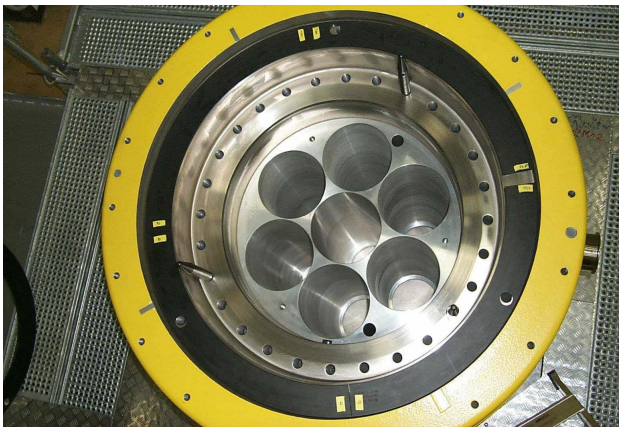


Fig. 3