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## **BAM-GGR 003 – Procedural rules on the suitability proof for alternative plastics resins used for dangerous goods packagings and Intermediate Bulk Containers (IBC's)**

*With respect to the material used for plastics drums and jerricans, combination packagings with plastics inner packagings, rigid plastic IBC's and composite IBC's with plastic inner containers, the design type specification in the type approvals of BAM and the former second approval authority Bundesbahn - Zentralamt (Federal Railway Central Office), Minden, refer to the type and grade (trade names) of the resin manufacturers. Any change with respect to the resins producer or of the resin was, independent from the properties in concern, deemed as a new material, constituting a new design. As a consequence, a full design testing program was required, leading to a new type approval and a new UN-marking.*

*As a result of deliberations with experts from European resin producers, converters and competent test houses and approval authorities, based, among others, on round robin tests the following procedural rules determine under which conditions and with which consequences alternative resins may be used for the manufacture of packaging and IBC types indicated above. With the application of these rules, the requirements on the compatibility proofs according to ADR/RID 6.1.5.2.5 and 6.5.4.3.4 are considered as complied with. They may be applied either in context with the amendment of existing type approvals or for new design type approvals.*

*It is envisaged that, after a period of experience, these rules may be transformed into a European standard. BAM keeps its right to require additional proofs for borderline cases.*

*As competent authority according to the rules on competences within the German dangerous goods transport regulations and in agreement with the Federal Department of Transport, Construction and Housing and after consultation of the concerned industry, BAM notifies hereby the following procedural rules on the suitability proof for alternative plastics resins for the manufacture of packagings and IBC's for the transport of dangerous goods.*

*They may be applied immediately and replace the "Procedures on the Extension of Design Type Approvals for Plastics Packagings for Solid Dangerous Goods With Respect to the Plastics Materials Used", issued by BAM on July 22, 1998.*

**Berlin, June 20, 2001**

### **Revisionen**

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Rev.1, dated march 5, 2002: Editorial amendments; amendments to 3.6 and Attachment.

## **BAM-GGR 003 – Procedural rules on the suitability proof for alternative plastics resins used for dangerous goods packagings and Intermediate Bulk Containers (IBC's)**

### **1 Scope**

1.1 These rules apply to the resin (plastics) of the body of plastics drums and jerricans (definition e.g. acc. to ADR- 6.1.4.8), of inner receptacles of composite packagings (ADR- 6.1.4.19), of rigid plastics IBC's (ADR- 6.5.3.3) and of plastics inner containers of composite IBC's (ADR-6.5.3.4), the design of which has been or shall be approved in Germany for the shipment of solid<sup>1)</sup> and liquid dangerous goods.

1.2 They apply to resins from high-molecular polyethylene with the following specifications<sup>2)</sup>:

- Relative density D at 23 °C after thermal conditioning for one hour at 100 °C in accordance with ISO 1183 with specimen made from the pressed plate acc. to ISO 1872, Part 2:

$$D \geq 0,940 \text{ g/cm}^3;$$

- melt flow rate MFR at 190 °C/21.6 kg load established with the resin in accordance with ISO 1133:

$$\text{MFR} \leq 12 \text{ g/10 min}$$

and to resins from medium-molecular polyethylene with the following specifications<sup>2)</sup>:

- Relative density D at 23 °C after thermal conditioning for one hour at 100 °C in accordance with ISO 1183 with specimen made from the pressed plate acc. to ISO 1872, Part 2:

$$D \geq 0,940 \text{ g/cm}^3;$$

- melt flow rate MFR at 190 °C/2.16 kg load established with the resin in accordance with ISO 1133:

$$\text{MFR} \leq 0,5 \text{ g/10 min und } \geq 0,1 \text{ g/10 min.},$$

- melt flow rate MFR at 190 °C/5 kg load established with the resin in accordance with ISO 1133:

$$\text{MFR} \leq 3 \text{ g/10 min und } \geq 0,5 \text{ g/10 min.}$$

They do not apply to resins made from recycled plastics material.

### **2 Procedures**

2.1 The reference to alternative resins in design type approvals of the kinds of packages and IBC's mentioned above may be applied for based on the following procedures. These may be used in combination with the standard testing and approval procedure for a new design type or with the amendment of an existing approval.

2.2 Both cases shall be based on a complete design type test, performed by a test house, accredited by BAM.

2.3 The applicant or the approval holder shall certify in writing, that the conditions thereafter are met. The comparison, as outlined in 3.2 and 3.4 of these rules shall be documented, signed by the responsible person of the applicant and be submitted to BAM together with the test documentation.

2.4 Necessary tests shall be performed by test houses, accredited by BAM for this purpose.

2.5 The inclusion of alternative resins in design type approvals by BAM will be charged (GGKostV in combination with BAM's cost order).

### **3 Criteria**

3.1 With the exception of the material specification of the original design type (Resin A) all other characteristics relevant to the design type, such as e.g. design, wall thickness, cross section, manner of construction as well as the performance levels (packing group, specific mass of the filling substance) shall be kept unchanged.

<sup>1)</sup> For the purpose of these rules, solid substances shall mean powderous or granular materials. Paste-like materials shall be treated like liquid materials, because they are also wetting the plastics surface.

<sup>2)</sup> These specifications comply with those of ADR 6.1.5.2.6.

- 3.2 The mean value of the melt flow rate  $MFR^3$  of the material specification of the alternative resin (Resin B) shall be within the following limits:

$$70\% MFR_A \leq MFR_B \leq 130\% MFR_A.$$

- 3.3 Samples of design types for liquids, manufactured from the alternative resin B shall pass a complete design type test for the standard liquid water<sup>4</sup>). The test parameters for the samples made from the alternative resin B (drop height, stacking load, hydraulic test pressure, leaktightness test pressure) shall at least conform to those used for resin A.
- 3.4 For design types for liquids, samples made from resin A shall have passed the relevant design type testing program for any of the damaging effects to be compared.
- 3.5 As far as testing is required in the Attachment to this rules, samples of design types for solids, manufactured from the alternative resin B, the test parameters (drop height, stacking load) shall, at least, conform to those applied for the testing of samples manufactured from resin A. The test contents (bulk good, inner package(s), articles) shall be equivalent to those used originally with respect to its impact on the test results.
- 3.6 The mean values for the relative density  $D^5$ ), the notched impact strength  $NIS^6$ ) and for design types for liquids, the crack stress resistance  $FNCT^7$ ) and the molecular degradation  $Ox^8$ ) of the material specification of the alternative resin B shall, each as established with samples prepared by a single party according to identical procedures and tested by the same test house, meet the following conditions:

$$\begin{aligned} D_B &\geq D_A \\ NIS_B &\geq NIS_A \\ FNCT_B &\geq FNCT_A \\ Ox_B &\leq Ox_A \end{aligned}$$

- 3.7 In case that mean values for alternative resin B are exceeding those of resin A, samples made from resin B shall pass the tests indicated in the **Attachment** with the same performance levels.
- 3.8 According to the present state of the art of test and measuring techniques the following tolerances may be considered for the alternative resin B:

$$\begin{aligned} D: & - 0,002 \text{ g/cm}^3 \\ NIS: & - 10\% \\ FNCT: & - 20\% \\ Ox: & + 20\%. \end{aligned}$$

- 3.9 Proofs for any other combined damaging effects not covered by the standard liquids shall be agreed with BAM.

#### 4 Special requirements in design type approvals

- 4.1 The manufacturer of the packagings and IBC's shall be capable, e.g. in the context of official quality inspections, to guarantee for the traceability of the plastics resin used for each manufactured packaging and IBC, either by marking of the item or by proper quality records.

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<sup>3</sup>) Measured according to the specifications in 1.2;

<sup>4</sup>) Remark: This test covers also differences in notched impact strength between resin A and B;

<sup>5</sup>) Measured according to the specifications in 1.2;

<sup>6</sup>) Measured according to ISO 179 at  $-30^\circ\text{C}$  with specimen made from the pressed plate;

<sup>7</sup>) Measured according to ISO DIS 16770 at  $50^\circ\text{C}/9.0 \text{ MPa}$  with specimen  $6 \times 6 \times 90 \text{ mm}$  with a 1mm deep circumferential notch;

<sup>8</sup>) Measured according to prEN/ ISO DIS 16101, laboratory test method C (MFR method only).

## Attachment

### Additional tests required for non-complying material data

Material data	Conditions for additional tests <sup>1)</sup>	Additional packaging tests								
		Type of testing	for standard liquids					for filling substances (liquids)		
			Acetic acid	Wetting solution	n-Butyl-acetate <sup>2)</sup>	White spirit	Nitric acid (55%)	Stress cracking sensitivity stronger than wetting solution	Swelling stronger than 7,5% white spirit	Molecular degradation stronger than HNO <sub>3</sub>
Relative density D	$D_B < D_A$	Drop test	-	-	-	+	-	-	+	-
		Stacking test <sup>3)</sup>	-	-	+ <sup>6)</sup>	+	-	-	+	-
		Hydraulic test	-	-	+ <sup>6)</sup>	+	-	-	+	-
Notched impact strength NIS	$NIS_B < NIS_A$	Drop test	-	-	+ <sup>6)</sup>	-	+	+	-	+
Crack stress resistance FNCT	$FNCT_B < FNCT_A$	Stacking test <sup>3)</sup>	+ <sup>4)5)</sup>	+ <sup>4)</sup>	+		-	+	-	-
Molecular degradation Ox	$Ox_B > Ox_A$	Drop test					+			+
		Stacking test <sup>3)</sup>					+			+
		Hydraulic test					+			+

#### Legend:

+	Test necessary
-	No test required
	Not applicable

For design types for solids, the marked fields of the table apply only.

<sup>1)</sup> Considering item 3.6 of these rules.

<sup>2)</sup> For: Normal butyl-acetate (for prestorage) and normal butyl-acetate saturated wetting solution (for performance testing).

<sup>3)</sup> May be omitted in case of composite packagings and composite IBC's, where the outer packaging carries the stacking load;

<sup>4)</sup> Without prestorage.

<sup>5)</sup> Proof for resin B may be dropped when proof for resins A/B has been provided for wetting solution.

<sup>6)</sup> Proof for resin B may be dropped when proof for resins A/B has been provided for white spirit.