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# Test Report
No.: 5421028/1b_en

| | |
|---|---|
| Orderer: | see consignee |
| Order Date: | 16.03.2012 |
| Order number: | 4541781419 |
| Scope: | Testing of the chemical resistance of the interior surfaces of plastics and linings according to DIN 858-1, clause 8.1.4.2 on an epoxy resin |
| Samples Received: | 25.03.2012 |
| Testing Period: | 29.03. till 21.05.2012 |
| Attachments: | --- |





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Geschäftsführer: Dipl. Ing. Jörg Mähler
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Steuer-Nr. 216/5715/1213 Ust-IdNr. DE 811835490

## 1. Task

Per mailing of March 16, 2012 the TÜV Rheinland LGA Products GmbH was instructed to perform tests of the chemical resistance of the interior surfaces of plastics and linings according to DIN 858-1, clause 8.1.4.2 on an epoxy resin.

## 2. Description of samples

10 green sheets with the dimensions of ca. 290 mm x 200 mm x 4 mm were made available. The sheets were marked with III-1 to III-10.

According to the given information the material is the type Brawoliner III, an epoxy resin designed for inliners and the corresponding support material. The layers correspond with the composition in liners.

## 3. Performance of the tests

### 3.1 Media storage

Ever 2 of the above mentioned sheets were stored in the following media according to ISO 858-1, section 8.1.4.1 1000 h

- Demineralized water, at (40 ± 2) °C;
- Fuel oil according to ISO 8217, named ISO-F-DMA, at (23 ± 2) °C;
- Unleaded fuel according to EN 228, at (23 ± 2) °C;
- A mixture of different substances, as specified in DIN 858-1, at (40 ± 2) °C.

After the storage the sheets were removed from the media and tested according to DIN 858-1, clause 8.1.4.2:

### 3.2 Tensile Test

The tensile strength and modulus was determined according to DIN EN ISO 527-4 (supersedes EN 61).

Parameters: Test speed: 100 mm/min, sample type 1A, measuring distance: 50 mm, testing climate: 23 °C / 50 % RH.

### 3.3 Flexural strength

The flexural strength and flexural modulus were determined according to DIN EN ISO 14125 (supersedes EN 63).
Parameters: Test speed: 5 mm / min, test specimen dimensions: 80 mm x 10 mm x thickness, climate: 23 °C / 50 % RH.

### 3.4 Izod impact strength

The Izod impact strength was measured according to ISO 180 / U.
Parameters: Test equipment: Zwick type 5113, specimen dimensions: 80 mm x 10 mm x thickness, pendulum used: 5.5 J, sample temperature: + 23 °C. Test conditions: climate 23/50-2 according to DIN 50 014.

### 4. Results

The correlation of the testing media for the chemical resistance is to be seen in the following table.

Table 1. Correlation of the testing medium for the chemical resistance

| No. of medium | Medium | According to standard | Storage temperature, °C |
|---|---|---|---|
| 1 | Zero samples, stored at room conditions | --- | 23 |
| 2 | Demineralized water | EN 858-1 | 40 |
| 3 | Fuel according to ISO 8217 | EN 858-1 | 23 |
| 4 | Unleaded fuel according to EN 228 | EN 858-1 | 23 |
| 5 | A mixture of different substances with de-mineralized water as specified in DIN 858-1 | EN 858-1 | 40 |

Table 2. Tensile test and E-Modulus according to DIN EN ISO 527-4

| Medium | Tensile strength, MPa | | | Modulus, MPa | | |
|---|---|---|---|---|---|---|
| | actual | nominal | passed | actual | nominal | passed |
| 1 | 32,0 | --- | --- | 3160 | --- | |
| 2 | 31,2 | ≥ 25,6 [1)] | yes | 3080 | ≥ 2528 [1)] | yes |
| 3 | 33,7 | ≥ 25,6 [1] | yes | 3220 | ≥ 2528 [1)] | yes |
| 4 | 30,7 | ≥ 25,6 [1] | yes | 3220 | ≥ 2528 [1)] | yes |
| 5 | 30,9 | ≥ 25,6 [1] | yes | 3120 | ≥ 2528 [1)] | yes |

1) ≥ 80 % of the actual value of no. 1 (zero sample)

Table 3. Flexural strength and flexural modulus according to DIN EN ISO 14125

| Medium | Flexural strenght, MPa | | | flexural modulus, MPa | | |
|---|---|---|---|---|---|---|
| | actual | nominal | passed | actual | nominal | passed |
| 1 | 73,4 | --- | --- | 3210 | --- | |
| 2 | 72,0 | ≥ 58,7 [1)] | yes | 3040 | ≥ 2568 [1)] | yes |
| 3 | 72,9 | ≥ 58,7 [1)] | yes | 3150 | ≥ 2568 [1)] | yes |
| 4 | 74,7 | ≥ 58,7 [1)] | yes | 3260 | ≥ 2568 [1)] | yes |
| 5 | 75,5 | ≥ 58,7 [1)] | yes | 3140 | ≥ 2568 [1)] | yes |

1) ≥ 80 % des Wertes von 1 (Nullprobe),

Table 4. Results of the mechanical tests according to ISO 180/U Izod

| Medium | Izod notched impact test, kJ/m² | | |
|---|---|---|---|
| | actual | nominal | passed |
| 1 | 14,6 (C) | --- | --- |
| 2 | 14,39 (C) | ≥11,7 [1)] | yes |
| 3 | 16,5 (C) | ≥11,7 [1)] | yes |
| 4 | 15,7 (C) | ≥11,7 [1)] | yes |
| 5 | 17,2 (C) | ≥11,7 [1)] | yes |

1) ≥ 80 % des Wertes von 1 (Nullprobe)

## 5. Summary

Based on the performed tests and our experience, we confirm that the tested material meets the requirements regarding the chemical resistance of the interior surfaces according to DIN 858-1, section 8.1.4.2.

Nürnberg, May 21, 2012
**TÜV Rheinland LGA Products GmbH**
Kunststoffprüfung

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