



Beratung - Schadensfallaufklärung - Qualitätssicherung - Forschung - Prüfung

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Test Report

PB300/113/11

Orderer: E. W. Gohl GmbH
Pfaffenhäule 28
78224 Singen

Date of order: 2011-01-05

Receipt of samples: 2011-01-12

Period of handling: 2011-01-17 to 2011-04-07

Order: Investigation of coated test plates similar to the requirements of DIN EN ISO 12944-6, corrosion category C5-I, durability high

Laboratory order No.: LA3/14/11/113028

Pages: 5

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Dresden, 07.04.2011

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1 Test Specimen

The orderer delivered 11 test plates (100 x 150) mm with coating on both sides. The following specification was made by the orderer:

| | |
|-----------------------------|--|
| Substrate: | continuously hot-dip coated steel (275 g/m ² , on both sides) |
| Surface preparation: | sweep blast-cleaning |
| Coating: | vortex sintering coating (Performance Polymer Alloy, thermoplastic coating powder) |

The specimens should investigate in corrosion protection tests according to DIN EN ISO 12944-6, corrosivity category C5-M, durability high.

2 Loading

Loading of test plates was carried out with the following conditions similar to DIN EN ISO 12944-6:

– Condensation of water according to DIN EN ISO 6270-1

Test plates (fixed in a horizontal angle of 60°) were loaded on one side by condensate water of 38 °C. The back of the test plates is exposed to laboratory atmosphere (NK 23/50), creating a temperature gradient across the sample.

Exposure time was 720 hours.

– Salt spray according to DIN EN ISO 9227-NSS*

Continuous loading by salt spray mist (50 g/L NaCl, 35 °C) was carried out in a salt spray test chamber SC/KWT 1000 (Weiss Umwelttechnik GmbH, Reiskirchen). It was not made a scratch.

Exposure time was 1440 hours.

* This loading was additionally agreed

3 Test Procedure

– Film thickness

Measurement of film thickness including zinc layer (before loading) was carried out according to DIN EN ISO 2808.

Method: 7 C - magnetic induction

Test tool: Fischer DUALSCOPE FMP10

Adjustment: on a smooth steel plate with foils of known thickness

– Visual assessment

The assessment of visual alterations was carried out immediately after the end of loading.

Degree of blistering according to DIN EN ISO 4628-2

Degree of rusting according to DIN EN ISO 4628-3

Degree of cracking according to DIN EN ISO 4628-4

Degree of flaking according to DIN EN ISO 4628-5

– Determination of pull-off-strength

The pull-off-test was carried out according to DIN EN ISO 4624 with sandwich method.

Adhesive: Loctite 480 (Cyanacrylat, 24 hours for curing)

Test instrument: AGS-10 KNG der Firma Hegewald & Peschke Mess- und Prüftechnik GmbH, Nossen

The pull-off-strength and the fracture face were determined before as well as after loading, 24 hours after taking out of the apparatus and storage at laboratory conditions.

The fracture faces mean:

B/Y adhesive failure between coating layer and adhesive layer

4 Test Results

See table 1

4 Test Results

Table 1: Test results similar to DIN EN ISO 12944-6, corrosion category C5-M, durability high

| System: continuously hot-dip zinc coated steel / vortex sintering coating | | | | | | | |
|--|--------------------------------|------------|---|------------|---|------------|---|
| assessment before loading | | test plate | 1 | test plate | 2 | test plate | 3 |
| DIN EN ISO 2808 | film thickness μm^* | 474 ± 16 | | 443 ± 25 | | 441 ± 18 | |
| DIN EN ISO 4624 | pull-off-strength MPa | 4,1 | | 3,6 | | 5,5 | |
| | fracture face % | 100 B/Y | | 100 B/Y | | 100 B/Y | |
| assessment after loading | | | | | | | |
| test 1: DIN EN ISO 6270-1 (condensation of water) | | | | | | | |
| duration: 720 h | | test plate | 4 | test plate | 5 | test plate | 6 |
| DIN EN ISO 2808 | film thickness μm^* | 449 ± 15 | | 458 ± 16 | | 455 ± 12 | |
| DIN EN ISO 4624 | pull-off-strength MPa | 4,2 | | 4,5 | | 2,9 | |
| | fracture face % | 100 B/Y | | 100 B/Y | | 100 B/Y | |
| DIN EN ISO 4628-2 | degree of blistering | 0 (S0) | | 0 (S0) | | 0 (S0) | |
| DIN EN ISO 4628-3 | degree of rusting | Ri 0 | | Ri 0 | | Ri 0 | |
| DIN EN ISO 4628-4 | degree of cracking | 0 (S0) | | 0 (S0) | | 0 (S0) | |
| DIN EN ISO 4628-5 | degree of flaking | 0 (S0) | | 0 (S0) | | 0 (S0) | |
| test 2: DIN EN ISO 9227 (salt spray mist) | | | | | | | |
| duration: 1440 h | | test plate | 7 | test plate | 8 | test plate | 9 |
| DIN EN ISO 2808 | film thickness μm^* | 431 ± 25 | | 470 ± 12 | | 463 ± 23 | |
| DIN EN ISO 4624 | pull-off-strength MPa | 1,3 | | 2,1 | | 2,1 | |
| | fracture face % | 100 B/Y | | 100 B/Y | | 100 B/Y | |
| DIN EN ISO 4628-2 | degree of blistering | 0 (S0) | | 0 (S0) | | 0 (S0) | |
| DIN EN ISO 4628-3 | degree of rusting | Ri 0 | | Ri 0 | | Ri 0 | |
| DIN EN ISO 4628-4 | degree of cracking | 0 (S0) | | 0 (S0) | | 0 (S0) | |
| DIN EN ISO 4628-5 | degree of flaking | 0 (S0) | | 0 (S0) | | 0 (S0) | |

* Film thickness including zinc layer

Comments:

Because of low values (1 - 2 MPa partly) of the pull-off-strength in combination with adhesive failure between coating layer and adhesive layer the determination of pull-off-strength was repeated after drying back of the coating. It was used Scotch-Weld 490 (2K-EP-Klebstoff, Co. 3M, 24 h curing time).

Values of pull-off-strength of approx. 3 - 7 MPa at the same fracture face were determined.

5 Conclusions from Test Results

Coating systems on hot dip coated steel with film thickness >250 µm pass the test according to DIN EN ISO 12944-6, if two of three test plates fulfil the following requirements:

Assessment before loading:

Pull-off-strength DIN EN ISO 4624: no adhesive failure to the substrate (A/B), excepting values of pull-off-strength ≥ 5 MPa

Assessment after loading:

Pull-off-strength DIN EN ISO 4624: no adhesive failure to the substrate (A/B), excepting values of pull-off-strength ≥ 5 MPa

Degree of blistering DIN EN ISO 4628-2: 0 (S0)

Degree of rusting DIN EN ISO 4628-3: Ri 0

degree of cracking DIN EN ISO 4628-4: 0 (S0)

degree of flaking DIN EN ISO 4628-5: 0 (S0)

The coating system under point 1 fulfils the requirements of DIN EN ISO 12944-6, corrosion category C5-M, durability high.