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240 - TEST
ISO 17025

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3545 HALEN (ZELEM)

TEST REPORT

IDENTIFICATION NUMBER: ES-100708.a **DATE:** 5.7.2010

LABORATORY: Coatings Research Institute
Avenue P. Holoffe
1342 LIMELETTE

CUSTOMER: MARTIN MATHYS
Kolenbergstraat 23
3545 HALEN (ZELEM)

REFERENCE ORDER: Your order 6291051 dd. 11.09.2009

DATE OF RECEPTION OF THE SAMPLES: 23.04.2010

NUMBER OF THE DOCUMENT OF RECEPTION: ES/6663

SAMPLES: steel panels coated with Noxyde

PERFORMED TESTS AND TESTING METHODS:

The tests are realized following the standard ISO 12944-6 "Corrosion protection of steel structures by protective paint systems -- Part 6: Laboratory performance test methods" for corrosion class C5 M(mean and high)"

Adhesion (*)

Realized initially and after the weathering tests according to ISO 4624 "Pull-off test for adhesion"
Apparatus: Seaberg Adhesion Tester
Method: loading fixtures are glued on the paint film by means of a 2 component solventless epoxy adhesive, slow drying type. After the adhesive is cured, a testing apparatus is attached to the loading fixture and aligned to apply tension (perpendicular) to the test surface. The force applied to the loading fixture is then gradually increased and monitored until either a plug of coating material is detached or a specified value is reached. The nature of the failure is qualified in accordance with the percent of adhesive and cohesive failures. The pull-off strength is computed based on the maximum indicated load.

(*): not covered by accreditation

TEST REPORT

Resistance to continuous condensation

Realized according to ISO 6270-2 "Determination of resistance to humidity - Part 2: Procedure for exposing test specimens in condensation-water atmospheres"
The samples are continuously exposed in a climatic chamber to a temperature of 40±3 °C and a relative humidity of 95 to 100 %.
Exposure time: 720 h
After 48 h, 120 h, 240 h, 480 h and at the end visually observations are made. At each observation 1 of the panels is removed and after drying the adhesion is tested on it.

Resistance to neutral salt spray

Realized according to ISO 9227 "Corrosion tests in artificial atmospheres - Salt spray tests" - Method NSS
A scratch of 0,5 mm wide was made through the coating down to the metallic substrate with a sharp cutter on 2 panels.
Experimental conditions:

- temperature in the test chamber: between 33 and 37°C
- NaCl-concentration: 5±0,5 %
- collected volume of salt solution per hour: between 1 and 2 ml/80 cm²
- pH of the solution: between 6,5 and 7,2
- air pressure: 1 bar

Exposure time: 1440 h
After 120 h, 240 h, 480 h, 720 h and at the end visually observations are made. At each observation 1 of the panels is removed and after drying the adhesion is tested on it.

DATE OF EXECUTION OF THE TESTS: April - July 2010

RESULTS: see pages 3 to 8

Performed by: V. Pirsoul/R. Guns **Approved by:** S. Vonckx

!!!!!!!!! Samples will be stored at CoRI during 6 months and then removed in accordance with the waste legislation, unless you make an appeal to prolongate this period or you recall the samples yourself (on charge of the customer).

*** This test report concerns only the samples subjected to these tests**
*** This test report can not be copied partially without the written permission of the CoRI**

Initial adhesion

Panel	Rupture at	Mode of rupture
1	1. 4,62 MPa 2. 4,70 MPa	1. 50 % cohesive somewhere in the paint layer - 50 % cohesive in the lowest part of the paint 2. 35 % cohesive somewhere in the paint layer - 65 % cohesive in the lowest part of the paint
2	1. 4,32 MPa 2. 4,25 MPa	1. 40 % cohesive somewhere in the paint layer - 60 % cohesive in the lowest part of the paint 2. 50 % cohesive somewhere in the paint layer - 50 % cohesive in the lowest part of the paint
17	1. 4,32 MPa 2. 3,56 MPa	1. 50 % cohesive somewhere in the paint layer - 50 % cohesive in the lowest part of the paint 2. 70 % cohesive somewhere in the paint layer - 10 % cohesive in the lowest part of the paint - 20 % adhesive between paint and dolly

Resistance to continuous condensation

Panel	**48 h**	**120 h**	**240 h**	**480 h**	**720 h**
3	mat and discoloured zones	(*)	(*)	(*)	(*)
4	discoloured zones	discoloured zones	(*)	(*)	(*)
5	discoloured zones	discoloured zones	discoloured zones + a few clear green stains	(*)	(*)
6	white stains	white stains + discoloured zones	discoloured zones + a few clear green stains	discoloured zones + a few clear green stains	(*)
7	1 white stain + discoloured zones	1 white stain + discoloured zones	discoloured zones + 1 clear green stain	discoloured zones + 1 clear green stain	discoloured zones + 1 clear green stain
8	unchanged	discoloured zones	discoloured zones	discoloured zones	discoloured zones
9	unchanged	discoloured zones	discoloured zones	discoloured zones	discoloured zones

(*): removed for adhesion test

Adhesion after drying

Preliminary remark: sometimes the panels are dried for more than 24 h, because they were still too wet to glue the dollies on it after 24 h

Panel	**Rupture at**	**Mode of rupture**	**Remark**
3 (48 h)	1. 4,70 MPa 2. 4,85 MPa	1. 60 % cohesive somewhere in the paint layer - 40 % cohesive in the lowest part of the paint 2. 45 % cohesive somewhere in the paint layer - 55 % cohesive in the lowest part of the paint	dried for 72 h before testing
4 (120 h)	1. 2,88 MPa 2. 2,43 MPa	1. 90 % adhesive between paint and dolly - 10 % cohesive in the lowest part of the paint 2. 90 % adhesive between paint and dolly - 10 % cohesive in the lowest part of the paint	dried for 24 h before testing
5 (240 h)	1. 2,88 MPa 2. 2,73 MPa	1. 85 % cohesive in the lowest part of the paint - 10 % adhesive between paint and dolly 2. 100 % cohesive in the lowest part of the paint	dried for 24 h before testing
6 (480 h)	1. 5,16 MPa 2. 5,00 MPa	1. 60 % cohesive somewhere in the paint layer - 40 % cohesive in the lowest part of the paint 2. 60 % cohesive somewhere in the paint layer - 40 % cohesive in the lowest part of the paint	dried for 72 h before testing
7 (720 h)	1. 2,27 MPa 2. 2,50 MPa	1. 85 % cohesive in the lowest part of the paint - 15 % adhesive between paint and dolly 2. 95 % cohesive in the lowest part of the paint - 5 % adhesive between paint and dolly	dried for 24 h before testing

Classification following ISO 4628 standards

Panel - Exposure time	ISO 4628-2 (blistering)	ISO 4628-3 (rust)	ISO 4628-4 (cracking)	ISO 4628-5 (flaking)
3 (48 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
4 (120 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
5 (240 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
6 (480 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
7 (720 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
8 (720 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
9 (720 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)

Resistance to neutral salt spray

Panel	120 h	240 h	480 h	720 h	1440 h
10	unchanged, but rust runs down at the edges	(*)	(*)	(*)	(*)
11	a few white stains and slight rust runs down from 1 edge	a few green/white stains and slight rust runs down from 1 edge	(*)	(*)	(*)

Panel	120 h	240 h	480 h	720 h	1440 h
12	unchanged, but rust runs down from the upper edge	unchanged, but a lot of rust runs down from the upper edge	unchanged, but a lot of rust runs down from the upper edge	(*)	(*)
13	a few slight white stains and slight rust runs down from the edges	a few slight white stains and slight rust runs down from the edges	a few slight white stains and slight rust runs down from the edges	a few slight white stains and rust runs down from the edges	(*)
14	slight rust runs down from 1 edge	slight rust runs down from 1 edge	rust runs down from 2 edges and 1 green stain	rust runs down from 2 edges + green runs down at 1 edge	rust runs down from 2 edges + green runs down at 1 edge
15	*Su:* unchanged, but rust runs down at the edges *Sc:* almost generalized rust in the scratch with runs down	*Su:* unchanged, but rust runs down at the edges *Sc:* almost generalized rust in the scratch with runs down	*Su:* unchanged, but rust runs down at the edges *Sc:* generalized rust in the scratch with runs down	*Su:* unchanged, but rust runs down at the edges *Sc:* generalized rust in the scratch with runs down	*Su:* unchanged, but rust runs down at the edges *Sc:* generalized rust in the scratch with runs down
16	*Su:* unchanged, but rust runs down from the upper edge *Sc:* almost generalized rust in the scratch with runs down	*Su:* unchanged, but rust runs down from the upper edge *Sc:* almost generalized rust in the scratch with runs down	*Su:* 2 blisters (⌀ 4 mm and 2 mm) and rust runs down from the upper edge *Sc:* generalized rust in the scratch with runs down + 2 blisters (⌀ 3 mm)	*Su:* 2 blisters (⌀ 4 mm and 2 mm) and rust runs down from the upper edge *Sc:* generalized rust upon 1 mm of the scratch with runs down + several blisters (⌀ max. 4 mm) upon max. 2 cm of the scratch	*Su:* generalized blistering (⌀ max. 8 mm) and rust runs down from the upper edge *Sc:* generalized rust upon 1 mm of the scratch with heavy runs down + several blisters

Su = surface/Sc = scratch
(*): removed for adhesion test

Adhesion after drying

Preliminary remark: sometimes the panels are dried for more than 24 h, because they were still too wet to glue the dollies on it after 24 h

Panel	Rupture at	Mode of rupture	Remark
10 (120 h)	1. 3,71 MPa 2. 2,88 MPa	1. 10 % cohesive somewhere in the paint layer - 90 % cohesive in the lowest part of the paint 2. 20 % cohesive somewhere in the paint layer - 80 % adhesive between paint and dolly	dried for 24 h before testing
11 (240 h)	1. 4,85 MPa 2. 5,00 MPa	1. 50 % cohesive somewhere in the paint layer - 40 % cohesive in the lowest part of the paint - 10 % adhesive between paint and dolly 2. 50 % cohesive somewhere in the paint layer - 45 % cohesive in the lowest part of the paint - 5 % adhesive between paint and dolly	dried for 72 h before testing
12 (480 h)	1. 3,79 MPa 2. 5,00 MPa	1. 50 % cohesive somewhere in the paint layer - 10 % cohesive in the lowest part of the paint - 40 % adhesive between paint and dolly 2. 100 % cohesive in the lowest part of the paint	dried for 72 h before testing
13 (720 h)	1. 5,31 MPa 2. 5,00 MPa	1. 40 % cohesive somewhere in the paint layer - 60 % cohesive in the lowest part of the paint 2. 20 % cohesive somewhere in the paint layer - 80 % cohesive in the lowest part of the paint	dried for 72 h before testing
14 (1440 h)	1. 4,09 MPa 2. 4,62 MPa 3. 4,70 MPa	1. 60 % cohesive in the lowest part of the paint - 40 % cohesive somewhere in the paint layer 2. 65 % cohesive in the lowest part of the paint - 35 % cohesive somewhere in the paint layer 3. 50 % cohesive in the lowest part of the paint - 50 % cohesive somewhere in the paint layer	dried for 72 h before testing

Classification following ISO 4628 standards

Panel - Exposure time	ISO 4628-2 (blistering)	ISO 4628-3 (rust)	ISO 4628-4 (cracking)	ISO 4628-5 (flaking)
10 (120 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
11 (240 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
12 (480 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
13 (720 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
14 (1440 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
15 (1440 h)	0 S (0)	Ri 0	0 S (0)	0 S (0)
16 (1440 h)	3 S (4) to 4 S(4)	Ri 0	0 S (0)	0 S (0)

Undercreep corrosion

Panel 15: max. 0,5 mm
Panel 16: max. 5 mm + rust pits under the blisters

Remark

The bad and different results on panel 16 can be due to sample preparation, because when removing the paint, the aspect of the panel differs from the aspect of panel 15

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ATTACHMENT TO TEST REPORT ES100708.a

We can conclude, based on the results mentioned in our test report ES100708.a, that the paint system Noxyde, applied on steel, resisting at

1440 h salt spray test according to ISO 9227 - Method NSS
720 h continuous condensation according to ISO 6270-2

fullfils the requirement for a corrosivity class **C5-M high** as defined in the standard ISO 12944.

Sophie Vonckx
Resp. testing Dept