Accredited Test Report

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NO230239	10410631	29.03.2023	Confidential

Customer / Contact / Reference	Customer Responsible
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Title

Testing of protective coatings – Spray Metalized / TEKNONISO 333-300 - in accordance with ISO 12944-6:2018 – Corrosivity category C5 Very High, Test regime 2.

Author(s)	Approved by
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Background

On behalf of Teknos, Norner AS has performed testing of one protective coating system in accordance with ISO 12944-6:2018 – Corrosivity category C5 Very High, Test regime 2.

Conclusions

Tested coating system – Spray Metalized / TEKNONISO 333-300 – is in accordance with the requirements given in ISO 12944-6:2018 - Corrosivity category C5 Very High, Test regime 2.

Accredited test (ISO 17025)

The test was executed under accreditation granted by Norwegian Accreditation with registration number TEST 308. The test standards included in the accreditation scope are ISO 12944-6, ISO 12944-9, ISO 9227, ISO 16474-3, ISO 4624, ISO 4628-2, -3, -4, -5, -6, ISO 9227, ISO 2812-1, -2, ISO 15711, ISO 6270-1 and ISO 2409. The sample preparation and DFT measurements are not a part of the accreditation scope. The results relate only to the items tested. The test report certificate shall not be reproduced except in full, without written approval by the laboratory.

Attachments

- Photos of exposed samples

[1] ***Legal notice***

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1. Introduction

On behalf of Teknos, Industrivej 19, 6580 DK
Norner AS has performed testing of one protective coating system according to the following test program:

ISO 12944-6:2018 – Corrosivity category C5 Very High.
Test regime 2:
Cyclic ageing 2688 h.

The testing was performed between dates 22.11.2022 and 14.03.2023. The adhesion was done after 7 days conditioning.

The application was performed by Teknos.

Tested coating system:

1st Layer	Spray Metalized	80 µm
2nd Layer	TEKNONISO 333-300	240 µm

Customer reference: System 2

2. Application

The surface preparation and paint application was performed by Teknos. The DFT measurements was performed by Norner AS. Teknos informs that the coating is applied onto grit blasted steel with cleanliness SA 2 ½ (ISO 8501-1) and Roughness minimum medium (ISO 8503-2).

Table 1 DFT measurements. Not accredited.

Coating Layer	Panel ID	System Applied	Mean (µm)	S.D (µm)
1	TSM CA1	TEKNONISO 333-300	275	6
1	TSM CA2	TEKNONISO 333-300	288	20
1	TSM CA3	TEKNONISO 333-300	290	21
1	TSM CA4	TEKNONISO 333-300	264	8

Note: DFT values are adjusted with 25 µm due to compensation of blast profile

3. Test program

Testing was performed according to ISO 12944-6:2018 – Corrosivity category C5 Very High. Test standards are given below in Table 2.

Table 2 Test program

Test	Applicable standard
Adhesion test	ISO 4624 - Method B
Blistering	ISO 4628-2
Rusting	ISO 4628-3
Cracking	ISO 4628-4
Flaking	ISO 4628-5
Cyclic ageing	ISO 12944-6 Annex B

The evaluation requirements after finished testing can be found in Table 3. No visual defects shall be present, as listed in Table 4.

Table 3 Evaluation requirements

Test regime	Corrosion from Scribe (mm)	Adhesion (MPa)
Cyclic ageing	≤ 3.0	≥ 2.5

4. Test results

The test results can be found in Table 4-6.

Table 4 Visual Assessments

Test regime	Panel ID	Blistering Density (size)		Rusting (Ri)		Cracking Density (size)		Flaking Density(size)	
		Req.	Res.	Req.	Res.	Req.	Res.	Req.	Res.
Cyclic ageing	TSM CA1	0(0)	0	0	0	0(0)	0	0(0)	0
	TSM CA2	0(0)	0	0	0	0(0)	0	0(0)	0
	TSM CA3	0(0)	0	0	0	0(0)	0	0(0)	0

Table 5 Adhesion Pull-off

Test Parameter	Panel ID	Result (MPa)	Average (MPa)	Type of fracture
Cyclic ageing	TSM CA1	11.5	11.1	40%B 60%C
		11.3		50%B 50%C
		10.5		40%B 60%C
	TSM CA2	6.5	7.3	90%B/C 10%C
		7.9		90%B/C 10%C
		7.6		90%B/C 10%C
	TSM CA3	11.1	10.5	20%B/C 80%C
		10.4		20%B/C 80%C
		9.9		30%B/C 70%C
Adhesion Unexposed	TSM CA4	13.6	13.7	20%B 20%B/C 60%C
		13.8		10%B 20%B/C 70%C
		13.6		30%B 10%B/C 60%C

Table 6 Corrosion from scribe

Test Parameter	Panel ID	Measured Corrosion including scribe (mm)									Average (mm)	Corrosion from scribe (mm)
Cyclic ageing	TSM CA1	6.8	7.1	7.6	8.2	7.0	6.1	6.5	5.4	5.4	6.7	2.3
	TSM CA2	5.0	3.5	4.2	5.9	5.0	4.4	6.3	5.5	2.5	4.7	1.4
	TSM CA3	8.4	5.0	9.2	7.8	8.1	7.5	7.9	7.8	4.9	7.4	2.7

5. Conclusion

Tested coating system – Spray Metalized / TEKNONISO 333-300 – is in accordance with the requirements given in ISO 12944-6:2018 - Corrosivity category C5 Very High, Test regime 2.

6. General test information

Cyclic ageing
Scribe line, 2 mm x 50 mm, was made mechanically on each sample.

The cyclic ageing was performed in accordance with ISO 12944-6 Annex B.

Panel size: 100 mm x 150 mm x 5 mm

Corrosion from scribe *M* has been calculated from the formula:
M=(C-W)/2
Where *C* = average of nine width measurements and W is the width of applied scribe (2 mm).

Three test panels were used for all exposure tests. Evaluation of adhesion was done after 7 days conditioning.

Table 7 Equipment used in project

Application	Equipment	Manufacture
Cyclic Ageing	Salt fog chamber	Ascott and Q-Lab
	UV Fluorescent/Condensation	Atlas
	Freezer	Whirlpool
Assessment	Adhesion tester PosiTest AT-A	DeFelsko
	Calipers CD-15APX	Mitutoyo
	True Color TC-60	Cromocol
Control	High surface tension Hydrometer	H & D Fitzgerald Ltd.
	FiveGo pH Meter	Mettler Toledo

All the equipment used are regularly calibrated and controlled. The pH and density of the seawater are controlled weekly.

Expanded uncertainty is estimated to be 0.35 mm for scribe measurements and 0.13 MPa for adhesion measurements. Decision rule applied in accordance with Simple Acceptance Rule (w=0) in accordance with ILAC G8. Uncertainty is considered as part of the conformance probability (Shared Risk / 50% PFA).

7. Attachments

Figure 1: Cyclic Ageing

End of report