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Customer / Contact / Reference			Customer Responsible
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Title

Testing of protective coatings – Teknoniso 333-300 - in accordance with ISO 12944-6:2018 – Corrosivity category C3 Very High.

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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 C3 Very High.

Conclusions

Tested coating system – Teknoniso 333-300 – is in accordance with the requirements given in ISO 12944-6:2018 - Corrosivity category C3 Very High.

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
- PAF from customer.

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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 C3 Very High.

Test regime 1:

Water Condensation ISO 6270-1 480 h.

Neutral Salt Spray ISO 9227 720 h.

The condensation testing was performed between 22.11.2022 and 12.12.2022. The NSS testing was performed between 22.11.2022 and 22.12.2022. The adhesion was done after 7 days conditioning.

The application was performed by Teknos.

Tested coating system:

1st Layer Teknoniso 333-300 240 µm

Customer reference: System 1

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	HC1	TEKNONISO 333-300	308	17
1	HC2	TEKNONISO 333-300	216	12
1	HC3	TEKNONISO 333-300	242	13
1	HC4	TEKNONISO 333-300	292	11
1	SS1	TEKNONISO 333-300	248	26
1	SS2	TEKNONISO 333-300	225	14
1	SS3	TEKNONISO 333-300	290	9

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 C3 Very High.
Test standards are given below in Table 2.

Table 2 Test program

Test	Applicable standard
Adhesion test	ISO 4624 - Method B
Cross-cut	ISO 2409
Blistering	ISO 4628-2
Rusting	ISO 4628-3
Cracking	ISO 4628-4
Flaking	ISO 4628-5
Neutral Salt Spray	ISO 9227
Water Condensation	ISO 6270-1

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	Corrosion from Scribe (mm)	Adhesion (MPa)
Neutral salt spray (NSS)	≤ 1.5	≥ 2.5
Condensation		≥ 2.5

4. Test results

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

Table 4 Visual Assessments

Test	Panel ID	Blistering Density (size)		Rusting (Ri)		Cracking Density (size)		Flaking Density (size)	
		Req.	Res.	Req.	Res.	Req.	Res.	Req.	Res.
NSS	SS1	0(0)	0(0)	0	0	0(0)	0(0)	0(0)	0(0)
	SS2	0(0)	0(0)	0	0	0(0)	0(0)	0(0)	0(0)
	SS3	0(0)	0(0)	0	0	0(0)	0(0)	0(0)	0(0)
Condensation	HC2	0(0)	0(0)	0	0	0(0)	0(0)	0(0)	0(0)
	HC3	0(0)	0(0)	0	0	0(0)	0(0)	0(0)	0(0)
	HC4	0(0)	0(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
NSS	SS1	15.0	15.5	20%A/B 80%B
		15.9		20%A/B 80%B
		15.7		20%A/B 80%B
	SS2	14.8	15.3	20%A/B 80%B
		15.7		20%A/B 80%B
		15.5		20%A/B 80%B
	SS3	14.2	15.1	20%A/B 80%B
		16.4		20%A/B 80%B
		14.6		20%A/B 80%B
Condensation	HC2	14.0	13.2	20%A/B 80%B
		12.5		20%A/B 70%B 10%C/Y
		13.2		20%A/B 80%B
	HC3	15.4	14.6	20%A/B 80%B
		14.5		30%A/B 70%B
		13.8		20%A/B 70%B 10%C/Y
	HC4	15.1	15.1	20%A/B 70%B 10%C/Y
		15.2		20% 80%B
		14.9		20%A/B 80%B
Adhesion Unexposed	HC1	17.7	17.6	20%A 80%B
		17.4		20%A 80%B
		17.6		20%A 80%B

Table 6 Corrosion from scribe

Test Parameter	Panel ID	Measured Corrosion including scribe (mm)										Average (mm)	Corrosion from scribe (mm)
NSS	SS1	2.1	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	0.2
	SS2	2.4	2.4	2.4	2.4	2.4	2.7	2.7	2.4	2.4	2.4	2.5	0.2
	SS3	2.6	2.4	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.5	0.2

5. Conclusion

Tested coating system – Teknoniso 333-300 – is in accordance with the requirements given in ISO 12944-6:2018 - Corrosivity category C3 Very High.

6. General test information

NSS

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

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).

Panel size: 100 mm x 150 mm x 5 mm

Adhesion test

Adhesion has been performed in accordance with ISO 4624 – Pull-off adhesion and ISO 2409- Cross cut after 7 days of conditioning.

Table 7 Equipment used in project

Application	Equipment	Manufacture
NSS	Salt fog chamber	Ascott and Q-Lab
Condensation	Condensation cabinet	Cromocol
Assessment	Cross-cut single blade	TQC
	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 NSS – 720 hours



Figure 2 Condensation – 480 hours

End of report