COT bv
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Consultancy
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REPORT

Testing coated samples with COT sample number 12-11-21/0552
according to ISO 12944-6 C5 High, test regime 1

Haarlem, April 8th, 2022

Client	:	Kanat Paints & Coatings Tic. Ve San. A.S. Asfalti 29.KM No.357 41 Izmir Turkey Contact person: Mrs. R.S. Kayakol

Specified system :

Coat		**Product name**	**nDFT**
1st	:	15550 Kanepox Masticoat	240 µm
2nd	:	37770 Kanpoly ACR Enamel HS	60 µm
Total	:		300 µm

Project number	:	20210290
Report number	:	LAB22-0041-REP Rev. 1
Handled by	:	Ms. F.F. Sudarso

Conclusion
The coated test panels with COT sample number 12-11-21/0552 meet the requirements of ISO 12944-6 C5 High, test regime 1.

CONTENTS

Revision 1:
- Added DFT "specified system"
- Corrected "2 Procedure" and "3 Requirements" according to ISO 12944-6
- Corrected 3.1 Table 2, 3.2 Table 3 and 3.3 Table 4
- Removed ISO 2409 cross-cut test in 4.2 Table 6

1 INTRODUCTION

1.1 Order

At the request of Kanat Paints & Coatings in Izmir, Turkey, the COT (Centrum voor Onderzoek en Technisch advies) B.V. in Haarlem, The Netherlands, has tested the samples with COT sample number 12-11-21/0552 according to ISO 12944-6 C5 High, test regime 1.

The order has been confirmed in email by the client dated 27th October 2021, with reference number DWZ/ER LAB21-0359-OFF, dated July 4th, 2021.

Tests marked with 'Q' are under accreditation according to ISO/IEC 17025:2017 with registration number L535.

1.2 General information

Table 1: Received samples

COT sample number	Sample	Received
12-11-21/0552	9x Off-White coated steel panels, dimensions 75 x 150 x 5 mm. Coded*: 15550 Kanepox Masticoat 37770 Kanpoly ACR Enamel HS	12-11-2021

*) coded by the client

The coating system has been applied to the test panels by the client. The following information has been received from the client.

Application data
Substrate
Steel panels.

Surface preparation
Blasted to Sa 2.5 grade cleanliness according to ISO 8501-1.
Surface roughness Medium (G) according to ISO 8503-1.

Coating system build up and specified dry film thickness

15550 Kanepox Masticoat	240 µm
37770 Kanpoly ACR Enamel HS	60 µm
Total:	300 µm

Test specification : ISO 12944-6
Corrosivity category : C5
Durability range : High Regime 1

2 PROCEDURE

2.1 Determination of the dry film thickness using a magnetic induction gauge, ISO 17025 Scope number 1 (Q)

Before starting the tests the total dry film thickness of the coating system has been measured according to ISO 2808:2019-7B2, COT Instruction 30.01.12-2 with a magnetic induction dry film thickness meter (COT_E004 or COT_E005) and corrected for surface roughness (C = correction value) according to ISO 19840. On each panel 5 measurements have been carried out.

2.2 Adhesion

Before adhesion testing the panels have been conditioned for 7 days at 23 ± 2°C and 50 ± 5% R.H., the test has been performed under the same conditions. All individual values have been reported.

Depending on the uncorrected mean DFT of the coating system, the following methods are used:

If lower or equal to 250 micrometers; crosscut method according to ISO 2409,
If higher than 250 micrometers; pull-off method B according to ISO 4624.

2.2.1 Crosscut test assessing the resistance of paint coatings to separation from substrates when a right-angle lattice pattern is cut into the coating, penetrating through to the substrate, according to ISO 2409, ISO 17025 Scope number 3 (Q)

The adhesion of the coating system has been determined according to ISO 2409, COT Instruction 30.01.20-1 by cross-cut test using a single blade cutting tool.

Distance between incisions is determined by the nDFT of the coating system;
- <60 µm: 1 mm,
- 60-120 µm: 2 mm,
- 120-250 µm: 3 mm,
- >250 µm: method unsuitable.

Loose paint will be removed using ISO 2409 method A1 (brushing).

On each panel three trials have been performed, with three extra when the variation of results was greater than 1 unit.

2.2.2 Pull-of adhesion according to ISO 4624 Method B

On each panel three trials have been performed.

The adhesion of the coating system has been determined by an automatic hydraulic adhesion tester (COT_A004 or COT_A012) in accordance with ISO 4624 Method B. The coating surface and the dolly (diameter 20 mm) have been sanded lightly and the epoxy adhesive has been applied. After curing of the adhesive and prior to testing, the coating and the adhesive have been scribed around the dolly down to the bare metal.

The fractures of the adhesion test have been evaluated according to this scheme:
A/B Fracture between the steel surface and 1st coat (adhesion failure).
B Fracture in the 1st coat (cohesion failure).
B/C Fracture between the 1st and 2nd coat (adhesion failure).
C Fracture in the 2nd coat (cohesion failure).
C/D Fracture between the 2nd and 3rd coat (adhesion failure).
D Fracture in the 3rd coat (cohesion failure).
-/Y Fracture between the outer coat and the glue (adhesive failure).

2.3 Determination of the resistance against corrosion in artificial atmospheres, Neutral Salt Spray, ISO 17025 Scope number 4 (Q)

Resistance to Neutral Salt Spray (NSS) has been tested in accordance with ISO 9227 NSS, COT Instruction 30.01.27-1 on three test panels. The fully cured coating system has been scribed horizontally down to the steel substrate, the scribe line being 2 mm wide and 50 mm long.

General data

Apparatus number	:	COT_S006
Type of water	:	Demineralised water (< 1 µS) (COT_D108)
Salt	:	Sodium chloride (NaCl) p.a.
Test temperature	:	35 ± 2 °C (COT_T010)
Collected salt solution	:	1.0 – 2.0 ml/hour/80 cm^2
pH of the collected salt solution	:	6.5 – 7.2 (COT_P126)
Salt concentration of the collected solution	:	50 ± 5 g/l
Exposition angle	:	approx. 20 ° from the vertical
Test duration	:	1440 hours

Immediately after exposure the panels were evaluated for visual surface defects according to ISO 4628-2, -3, -4 and -5.

The corrosion at the scribe has been determined within 8 hours after the end of the exposure. The corrosion at the scribe is calculated from the equation: M=(C-W)/2, where

M = corrosion creep (mm)
C = average of the nine measurements (mm)
W = the original width of the scribe (mm)

After the assessments photos have been taken (see Annex).

2.4 Determination of the resistance to Humidity–CH test, ISO 17025 Scope number 6 (Q)

Resistance to water condensation has been tested in accordance with ISO 6270-1, COT Instruction 30.01.41 on three test panels.

General data

Apparatus	:	Cleveland condensation tester (COT C001)
Temperature of the air space	:	38 ± 2 °C
Temperature environment	:	23 ± 2 °C
Exposition angle	:	approx. 60 ° to the horizontal
Test duration	:	720 hours
Type of water	:	Demineralised water (< 1 µS) (COT_D108)

Immediately after the test, the panels have been examined for defects according to ISO 4628. After the assessments photos have been taken (see Annex).

3 REQUIREMENTS

Only one of the three panels shall be allowed not to comply with the requirements.

3.1 Reference adhesion before tests

Table 2: Adhesion before tests

Adhesion ISO 4624		**Requirements**
ISO 4624	Individual values Break Area	≥ 2.5 MPa No A/B Break, unless ≥ 5 MPa
ISO 4624		Individual values Break Area
ISO 4624	Individual values	≥ 2.5 MPa

3.2 Assessment after Neutral Salt Spray test

Table 3: Assessment after Neutral Salt Spray test

Neutral Salt Spray **ISO 9227- 5.2 NSS, 1440 hours** (ISO 17025 Scope number 4)		**Requirements**
ISO 4628-2 ISO 4628-3 ISO 4628-4 ISO 4628-5	Blistering Rusting Cracking Flaking	0(S0) Ri 0 0(S0) 0(S0)
Corrosion from scribe		≤ 1.5 mm
ISO 2409	Individual values	Class 0-2
ISO 4624	Individual values Break Area	≥ 2.5 MPa 0% A/B break, unless ≥ 5 MPa

3.3 Assessment after Condensation test

Table 4: Assessment after Condensation test

Condensation **ISO 6270-1, 720 hours** (ISO 17025 Scope number 6)		**Requirements**
ISO 4628-2 ISO 4628-3 ISO 4628-4 ISO 4628-5	Blistering Rusting Cracking Flaking	0(S0) Ri 0 0(S0) 0(S0)
ISO 2409	Individual values	Class 0-2
ISO 4624	Individual values Break Area	≥ 2.5 MPa 0% A/B break, unless ≥ 5 MPa

4 RESULTS

4.1 Dry film thickness

Table 5: Dry film thickness test panels (ISO 17025 Scope number 1)
Test date: 15th-11-2021

Q	Dry film thickness ISO 2808:2019-7B2 (C = 25 µm)	COT sample number 12-11-21/0552				
		Panel 1	**Panel 2**	**Panel 3**	**Panel 4**	**Panel 5**
	Readings (n=5)	299 375 272 212 256	273 224 258 324 306	285 265 282 301 269	304 305 316 298 246	247 252 300 325 348
	Min. - Max. (µm) Average, SD (µm)	212 - 375 283 ± 60	224 - 324 277 ± 39	265 - 301 280 ± 14	246 - 316 294 ± 27	247 - 348 294 ± 44
		Panel 6	**Panel 7**	**Panel 8**	**Panel 9**	
	Readings (n=5)	227 304 297 225 348	222 231 266 274 291	295 325 253 227 244	279 230 292 286 268	
	Min. - Max. (µm) Average, SD (µm)	225 - 348 280 ± 53	222 - 291 257 ± 29	227 - 325 269 ± 40	230 - 292 271 ± 25	

4.2 Assessment before tests

Table 6: Reference Assessment of coating adhesion (ISO 17025 scope No. 3)
Test date: 21st-01-2022

Q	Reference Adhesion ISO 4624 Pull-off test	COT sample number 12-11-21/0552		
		Panel 7	**Panel 8**	**Panel 9**
	ISO 4624 Adhesion (MPa), Break area (%)	5.4 100% B/C	6.5 90% B/C, 10% C/Y	5.3 100% B/C
		7.6 100% B/C	8.4 90% B/C, 10% C/Y	6.9 100% B/C
		4.6 100% B/C	5.3 90% B/C, 10% C/Y	5.4 100% B/C

4.3 Assessment after Neutral Salt Spray test

Table 7: Assessment after Neutral Salt Spray test (ISO 17025 scope No. 4)
Test date: 15th-11-2021 until 14th-01-2022, adhesion 21st-01-2022

Q	**Neutral Salt Spray ISO 9227-5.2 NSS Exposure 1440 hours**		**COT sample number 12-11-21/0552**		
			Panel 1	**Panel 2**	**Panel 3**
Q	ISO 4624-2	Blistering	0(S0)	0(S0)	0(S0)
Q	ISO 4624-3	Rusting	Ri 0	Ri 0	Ri 0
Q	ISO 4624-4	Cracking	0(S0)	0(S0)	0(S0)
Q	ISO 4624-5	Flaking	0(S0)	0(S0)	0(S0)
	Corrosion from scribe (mm)		0.5	0.2	0.4
	ISO 4624 Adhesion	(MPa)	7.9	5.0	5.4
	Break area	(%)	100% B/C	90% B/C, 10% C/Y	100% B/C
			8.2	5.8	4.9
			100% B/C	90% B/C, 10% C/Y	100% B/C
			5.9	5.9	4.7
			100% B/C	90% B/C, 10% C/Y	100% B/C

4.4 Assessment after Condensation test

Table 8: Assessment after Condensation test (ISO 17025 scope No. 6)
Test date: 14th-12-2021 till 13th-01-2022, adhesion 20-01-2022

Q	**Condensation ISO 6270-1 Exposure 720 hours**		**COT sample number 12-11-21/0552**		
			Panel 4	**Panel 5**	**Panel 6**
Q	ISO 4624-2	Blistering	0(S0)	0(S0)	0(S0)
Q	ISO 4624-3	Rusting	Ri 0	Ri 0	Ri 0
Q	ISO 4624-4	Cracking	0(S0)	0(S0)	0(S0)
Q	ISO 4624-5	Flaking	0(S0)	0(S0)	0(S0)
	ISO 4624 Adhesion	(MPa)	5.9	5.5	4.8
	Break area	(%)	90% B/C, 10% C/Y	100% B/C	50% B/C, 10% C, 40% C/Y
			7.9	8.7	9.5
			90% B/C, 10% C/Y	100% B/C	80% B/C, 20% C
			5.8	6.8	6.7
			100% B/C	100% B/C	80% B/C, 20% C

5 SUMMARY

Table 9: Summary of the test results of samples with COT sample number 12-11-21/0552

Test method	Test duration	Pass / Fail
Reference adhesion ISO 2409 (ISO 17025 Scope number 3)	N.A.	Pass
Neutral Salt Spray ISO 9227 (ISO 17025 scope number 4)	1440 hours	Pass
Condensation test ISO 6270-1 (ISO 17025 scope number 6)	720 hours	Pass

6 CONCLUSION

The coated test panels with COT sample number 12-11-21/0552 meet the requirements of ISO 12944-6 C5 High, test regime 1.

IFO-COT b.v.

F.F. Sudarso
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ANNEX

Photographs

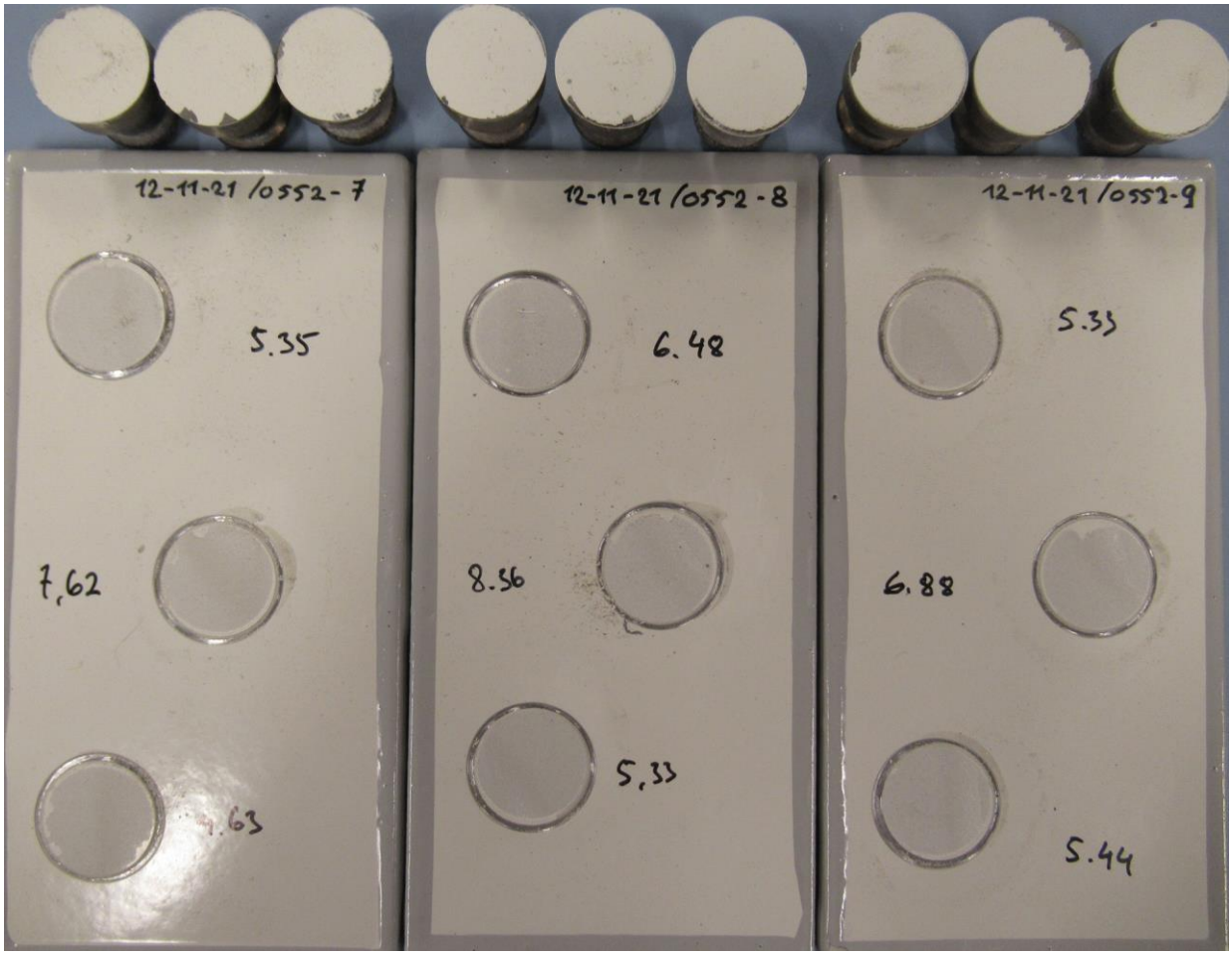


Photo 1: Pull off adhesion, panels 7, 8 and 9 reference adhesion

Photo 2: Pull off adhesion. Panels 4, 5 and 6 after 720 hours Condensation test

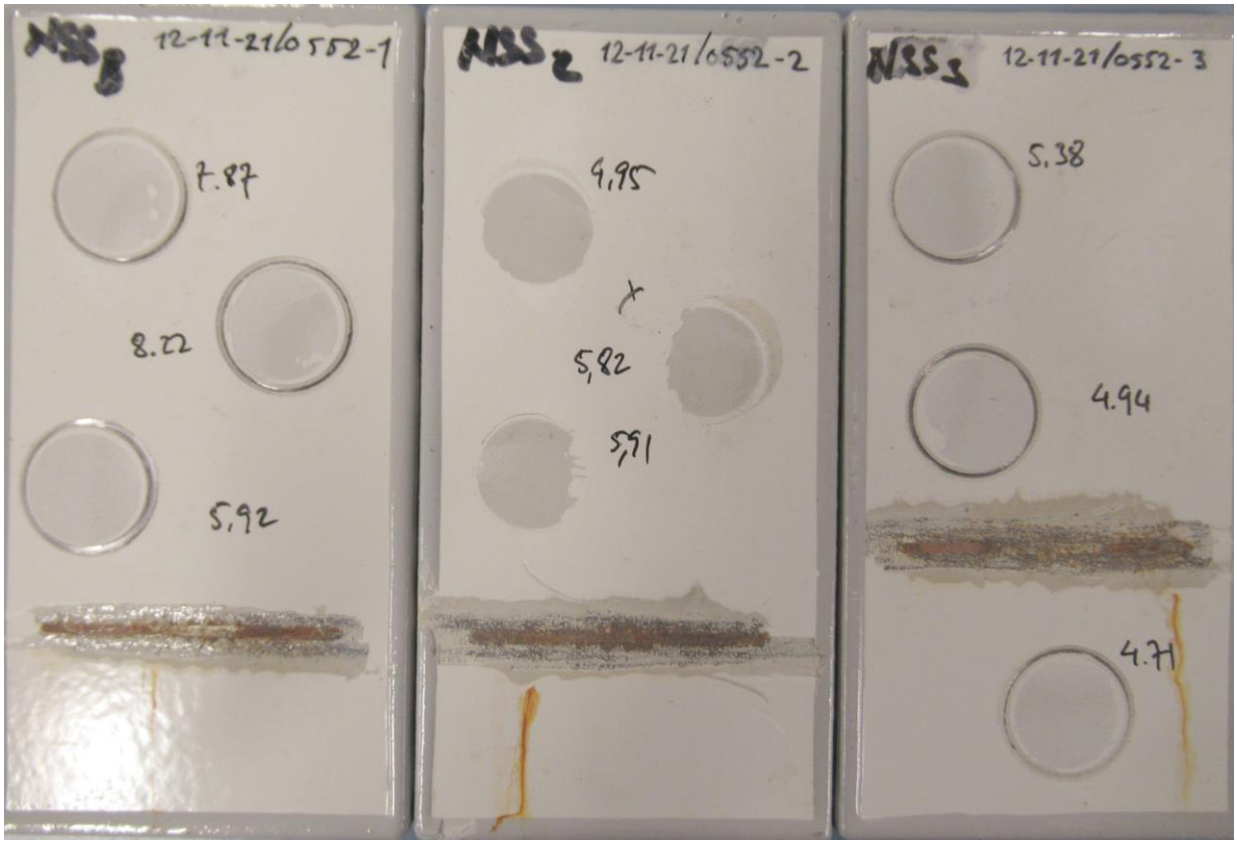
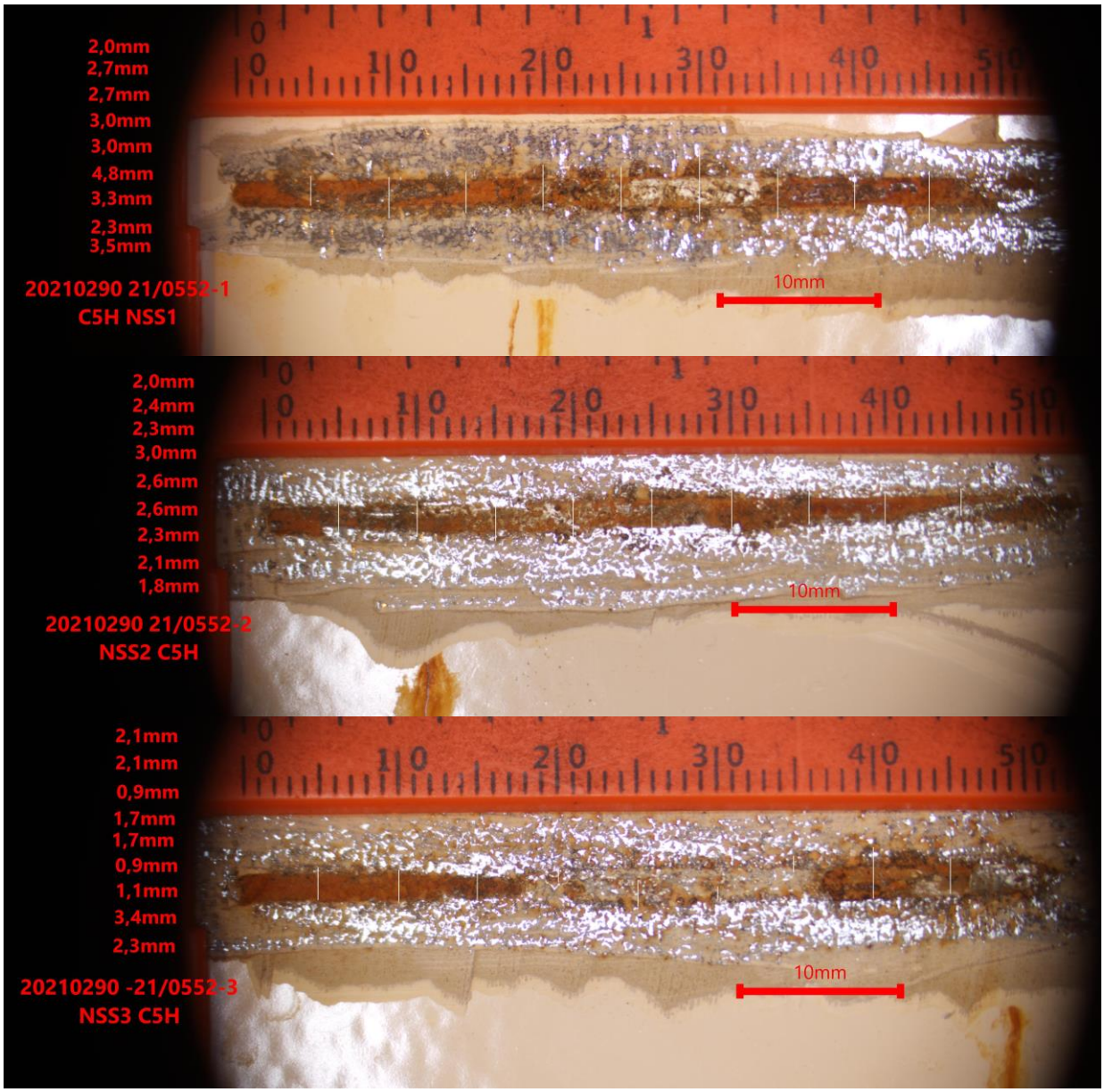


Photo 3a: Pull off adhesion. Panels 3, 2 and 1 after 1440 hours Neutral Salt Spray test



Photos 3b: Detail corrosion creep measurements