Bericht Nr. 2497/11/02

KORROSIONSTECHNIK
Dipl.-Ing. Th. HEIM
Sachverständiger für Korrosion und Korrosionsschutz

vom 25.11.2002

Prüfung der PUR-Teer Beschichtung "Coropur TAR 21" nach DIN 30671, Juni 1992 Normalausführung

Zwischenbericht

Auftraggeber: Metallogal-Vertriebs GmbH
Sommerbergweg 28
77815 Bühl (Baden)

Auftrag: Schreiben vom 20.09.2002

Dieser Bericht enthält:

1 Deckblatt
4 Seiten Text
7 Tabellen

Expert Report N°. 2591/05/04

Dated: 10.05.2004

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Test of PUR-Tar Coating "Coropur TAR 21" according to DIN 30671 (June 1992) for Normal Applications (class N)

Principal:

Order N°.: order dated 20.09.2002

This expert report contains of:

1 cover sheet
4 pages text
6 tables

1 Introduction

The company Eclatin, placed an order with me for testing the PUR-Tar-Coating "**Coropur Tar 21**" according to DIN 30671, (June 1992) for normal applications (class N).

For this test I was provided with coated steel pipe DN 100 and a foil.

Following tests were carrying out:

- **Coating Thickness**
- **Holiday Detection**
- **Impact Resistance**
- **Indentation Resistance**
- **Elongation**
- **Specific Insulation Resistance**
- **Adhesion**
- **Cathodic Disbondment**

2 Test Results

Table 1 summarises the test conditions and the corresponding requirements. The test results are presented in column actual values of table 1.

Coating Thickness (4.2.1)

The examination was carried out on three pipes. The coating thickness was determined by a non-destructive measurement. From these values the arithmetic average and the standard deviation were calculated. All individual thickness values exceed the required value of 800 µm. The requirement is fulfilled.

Holiday Detection (4.2.2)

The test specimen were exposed to a test voltage of 0,01 kV/µm • 986 µm = 9,9 kV. No holidays were detected. The requirement is fulfilled.

Impact Resistance (4.2.3)

With 30 impacts carried out at a standard impact energy of
$E = \rho \cdot 3 = 0{,}85 \cdot 3 = 3$ N m
no holidays were detected. The requirement is fulfilled.

Indentation Resistance (4.2.4)

Test conditions:

- **Test medium:** **Deionate**
- **Pressure:** **10 N / mm²**
- **Pressure area:** **2,5 mm²**
- **Test temperature:** **(70 ± 2)°C**

After 48 h the penetration depth was (18 ± 1) % of the initial coating thickness. The penetration depth between 24h and 48 h was (0,5 ± 0,0).% (table 3).The requirement is fulfilled.

Elongation at Break (4.2.6)

Using a PUR-Tar-foil dumb-bell specimen N°. 3 were produce. At a test speed of 10 mm/min a elongation at break of (13 ± 1) % was determine (table 4). This fulfills the requirements.

Specific Insulation Resistance (4.2.7)

4.2.7.1
(at 23°C)

The pipes were mounted in a specially designed test basin.

Test conditions:

- **Test medium:** **0,1 M NaCl**
- **Test voltage:** **50 V**
- **Test area:** **0,1 m²**
- **Test temperature:** **(23 ± 2)°C**

Aft 100 days of testing the specific insulation resistance of the three tested pipes was $r_u = (1{,}0 \pm 0{,}1)10^{+8}$ Ωm². The requirement is fulfilled.
The ratio

$$\alpha = \frac{R_{s\ 100\ d}}{R_{s\ 70\ d}} \geq 0.8$$

fulfills also the standard requirement.

Adhesion Test (4.2.8)

After testing specific insulation resistance X-cuts with an angle of 30° in the intersection point were made in the coating through to the metal surface. When trying to lift off the coating by the tip of a knife, no complete loss of adhesion was was observed. The requirement is fulfilled.

Cathodic Disbondment (4.2.10)

Test conditions:

- **Radius of artificial defect:** **6 mm**
- **Test medium:** **c NaCl = 0,5 mol / L**
- **Test temperature:** **(23 ± 2)°C resp. (65 ± 2) °C**
- **Test potential:** **U_H = -1,26 V, $U_{Calomel\ sat.}$ = -1,50 mV**
- **Test period:** **30d resp. 2d**

The standard requirements for cathodic disbondment, $U_T \leq 12$ mm at (23 ± 2)°C and $U_T \leq 15$ mm at (65 ± 2)°C, are fulfilled. The specimen without artificial defect were free from blisters and showed good adhesion (Table 7).

3 Result

The tested PUR-Tar-Coating "Coropur TAR 21" fulfills for:

- **Coating Thickness**
- **Holiday Detection**
- **Impact Resistance**
- **Indentation Resistance**
- **Elongation**
- **Specific Insulation Resistance**
- **Adhesion**
- **Cathodic Disbondment**

the requirements of DIN 30671 (June 1992) for special applications (class N).

Korrosionstechnik Heim

Dipl. Ing. Th. Heim

Dipl.-Ing Th. Heim KORROSIONSTECHNIK

DIN 30 671, N

Test Method	Section	Test Condition	Section	Requirements		Actual Value	
Coating Thickness	5.3	non-destructive measuring	4.2.1	N: 800 µm		(974 ± 69) µm (986 ± 55) µm (959 ± 73) µm	see table 2
Holiday Detection	5.4	high voltage test 0,01 kV per µm coating thickness	4.2.2	no electrical breakdown		passed	-
Impact Resistance	5.5	30 impacts,(23 ± 2)°C, impact energy E =(φ • 3) Nm	4.2.3	DN	φ	passed	-
				100	0,85		
				no electrical breakdown; E = 3 N m			
Indentation Resistance	5.6	area: 2,5mm², weight: 2,5 kg, pressure: 10 N / mm², t_1 = (70 ± 2)°C, deionate	4.2.4	after 48 h the penetration depth shall be max. 30 % of the initial coating thickness		(18 ± 1) %	see table 3
				between 24 h and 48 h the penetration depth shall be 5 % of the initial coating thick-ness		(0,5 ± 0,0) %	
Elongation	5.8	dumb-bell specimen N°.3 v:10 mm / sect: (23 ± 2)°C	4.2.6	≥10 %		(13 ± 1) %	see tabee 4
Specific Insulation Resistance	5.9	c(NaCl) = 0,1 mol / L, U ≥ 50 V A ≥ 0,03 m²	4.2.7.1	(23±2)°C 100 d	≥ 10^{+8} Ω m²	(1,0 ± 0,1)10^{+8}Ωm²	see table 5
					α ≥ 0,8	0,9; 0,8	
Adhesion	5.10	after testing of specific coating resistance: qualitative examination → V-shaped cuts into the coating	4.2.8	(23±2)°C 100 d	no complete loss of adhesion	passed	-
Cathodic Dis-bondment	5.12	c(NaCl) : 0,5 mol/L, ø : 6 mm, $U_{ref.}$: -1500 mV, (23 ± 2)°C at 30 d, (65 ± 2)°C at 2d	4.2.10		average dis-bondment U_T in mm	average disbondment U_T in mm	see table 7
				(23 ±2)°C 30d	≤ 12 mm	6,0mm 6,0mm 4,8mm (5,6 ± 0,6)mm	
					$I_E \leq 1{,}5 I_A$	passed	
					no blisters	passed	
				(65 ± 2)°C 2d	≤ 15 mm	2,6mm 2,6mm 3,6mm (2,9 ± 0.5)	
					$I_E \leq 1{,}5 I_A$	passed	
					no blisters	passed	

Expert Report N°. 2591/05/04 **table 2**

Coating Thickness

Position of Values	Coating thickness in µm										
N°. 1											
12''	837	996	100	1001	983	957	903	861	775	806	1001
	838	889	957	970	1003	899	989	956	965	911	1006
15''	956	901	1025	937	968	968	944	958	915	871	992
	834	973	994	1082	1092	1106	1087	1013	1058	1027	1016
18''	1037	1018	1044	942	994	896	877	813	844	913	990
	1051	973	1006	958	959	980	953	911	937	1018	982
21''	989	1034	1070	1020	975	1058	1018	953	1046	1058	961
	1023	1027	1094	1044	1043	1001	1025	963	1013	987	1001
Arithmetic Average and (975 ± 67)											
N°. 2											
12''	1032	1034	1006	1025	1053	950	946	1018	1026	980	970
	1056	995	1035	1056	1052	1023	946	931	947	1003	992
15''	1084	1011	932	973	977	875	901	949	1065	1049	1013
	1015	963	887	1018	968	1070	1068	994	999	1042	931
18''	1051	992	943	987	963	1050	973	968	970	978	946
	1003	1013	951	1003	933	933	1077	1025	1068	1084	1018
21''	1006	1075	859	992	958	963	889	953	912	931	913
	968	1077	923	942	996	1053	890	915	901	956	906
Arithmetic Average and (986 ± 55)											
N°. 3											
12''	1120	1142	1125	1084	1049	1051	1082	1042	932	961	980
	931	1070	965	1018	1025	944	912	918	894	934	920
15''	987	875	885	992	903	973	1025	989	937	889	968
	1112	857	901	920	930	930	931	957	1061	1115	1109
18''	975	895	877	1032	1039	931	934	873	937	1046	984
	930	911	853	1001	906	811	868	844	970	963	918
21''	975	925	849	951	958	856	961	984	913	973	911
	942	1015	937	1001	859	899	1008	914	911	887	889
Arithmetic Average and (959 ± 73)											

Expert Report N°. 2591/05/04 **table 3**

Indentation Resistance

N°	between 24h and 48h Indentation Depth in %	Arithmetic Average and Standard Deviation in %
1	0,5	0,5 ± 0,0
2	0,5	
3	0,5	
4	0,5	
	after 48 h: Indentation Depth in %	
1	17	18 ± 1
2	18	
3	18	
4	19	

Expert Report N°. 2591/05/04 **table 4**

Elongation

N°	Individual Values	arithmetic average and standard deviation
	in %	
1	12	13 ± 1
2	13	
3	13	
4	14	
5	12	
6	13	
7	13	
8	12	
9	14	
10	12	

Expert Report N°. 2591/05/04 **table 5**

Specific Insulation Resistance

N°	Specific Insulation Resistance in Ω • m²			$\alpha = \frac{r_{u100}}{r_{u70}} \geq 0{,}8$
	Individual Values		arithmetic average and standard deviation after 100 d	
	70d	100d		
	(23 ± 2) °C			
1	1,3 10^{+8}	1,1 10^{+8}	(1,0 ± 0,1) 10^{+8}	0
2	1,2 10^{+8}	1,0 10^{+8}		0
3	1,1 10^{+8}	1,0 10^{+8}		0

Expert Report N°. 2591/05/04 **table 6**

Cathodic Disbondment

N°	Test Conditions	Blistering	I_E/I_A	Disbondment U_T in mm									
				Individual Values								arithmetic average	arithmetic average and standard deviation
1	2d; (65 ± 2)°C	no	0,9	2,5	3	1	3	3	3	3,5	2	2,6	2,9 ± 0,5
2			1	3	3	2,5	2,5	2	3	2,5	2,5	2,6	
3			0,9	2,5	3,5	3,5	4	3,5	4,5	4	3,5	3,6	
4			without damage										
1	30d; (23 ± 2)°C		1	6	6	5	9	4	7	6	5	6	5,6 ± 0,6
2			1	9	5	5	5	7	6	4	7	6	
3			1	8	4	5	4	4	4	4	5	4,8	
4			without damage										