

3M™ Scotchkote™ Abrasion Resistance Epoxy Coating 328

Information, Properties and Test Result



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3M™ Scotchkote™ Abrasion Resistant Coating 328

1.0 Introduction

3M™ Scotchkote™ liquid epoxy coatings have been used for field applied joint coating and patch material for FBE. Current technologies have seen growth in the pipe rehabilitation market and off shore projects. These liquid coating have been designed to protect steel from the harsh effect of corrosion. 3M Scotchkote liquid epoxy coatings have been used in the following applications:

- Field applied girthwelds
- Patch material for FBE
- As stand alone in pipe rehabilitation
- Off shore projects with “S” and “J” lay
- Internal lining of steel pipes
- Other field application where ever corrosion protection is needed

2.0 Description

3M Scotchkote Abrasion Resistant 328 is a two part, 100% solids, ambient cured liquid coating designed to protect steel pipes from the harsh effect of corrosion. This technology can be hand applied with brush or roller and it can be spray applied using HSS 450 or plural component sprayer. Above and beyond typical liquid epoxy, Scotchkote 328 is extremely flexible.

- Outstanding Flexibility
- 2 part ambient cured
- Outstanding adhesion to steel and FBE
- Outstanding Cathodic Disbondment resistance
- Applied by brush and roller or sprayed by HSS and Plural Component

3.0 Process and Quality Control

Process control is essential to the quality of the finished product. 3M maintains rigid incoming inspection of raw materials, precise measurement and metering of critical components, controlled environmental conditions and processing temperature of the chemical consistency, and a discerning outgoing inspection of finished coating

4.0 Packaging and Storage

3M™ Scotchkote™ Abrasion Resistant 328 comes in various packaging to satisfy your project needs and should be stored at temperatures 41°F/5°C – 100°F/38°C.

5.0 Coating Properties

Property	Results
Color	Blue-Green
Mix Ratio	3A/1B By Volume 72.3/27.7 By Weight
Viscosity 70°F/20°C (cps)	Part A = 22,000 Part B = 14,000
Shelf Life (unopened)	24 months
Specific Gravity (g/cc)	
Part A	1.34
Part B	1.48
Part A & B Mixed	1.38
Coverage (ft ² /lb/mil)/(m ² /kg/mm)	145/0.81
Minimum/Maximum Coating Thickness (mils - microns)	20/60 - 500/1500
ARO Coating Thickness	40/100 mils (1000/2500 microns)
Gel Time 70°F/20°C (minutes)	38
Dry to Touch Time 68°F/20°C (minutes)	155
Hard Dry Time 68°F/20°C (Shore D>70) (minutes)	255

6.0 Test Performance

6.1 Cathodic Disbondment: (CSA Z245.20-10, AS4822)

Panel #	Film Thickness (mils)	Duration	Temperature (°C)	Volts	AVG Disbondment
1	13-17	48 hrs	65	-3.5	2.6
2	21-25	48 hrs	65	-3.5	2.9
3	18-24	48 hrs	65	-3.5	3.0
1*	21-26	28 days	20	-1.5	4.8
2*	21-24	28 days	20	-1.5	4.6
3*	18-21	28 days	20	-1.5	4.6
4	12-17	28 days	20	-1.5	3.3
5	23-25	28 days	20	-1.5	3.1
6	31-36	28 days	20	-1.5	3.3
1	24-26	28 days	65	-1.5	4.5
2	24-27	28 days	65	-1.5	3.9
3	24-25	28 days	65	-1.5	4.1
4	18-21	28 days	65	-1.5	6.6
5	21-22	28 days	65	-1.5	6.8
1	23-27	28 days	80	-1.5	4.9
2	23-25	28 days	80	-1.5	4.7
3	23-25	28 days	80	-1.5	4.4
4	14-18	28 days	80	-1.5	6.9
5	19-22	28 days	80	-1.5	6.3
1	25-27	28 days	95	-1.5	3.7
2	26-30	28 days	95	-1.5	3.4
3	27-30	28 days	95	-1.5	3.5
4	21-23	28 days	95	-1.5	4.2
5	18-20	28 days	95	-1.5	4.1
6**	29-35	28 days	95	-1.5	7.0
7**	28-31	28 days	95	-1.5	7.0

*These test panels were test per AS-48822

**These test panels were mechanically prepped per SSPC SP-11.

6.2 Post Hot Water Soak Adhesion: (CSA Z245.20-10, AS4822)

Panel #	Film Thickness (mils)	Duration	Temperature (°C)	Adhesion Rating
1	20-23	48 hrs	95	1
2	22-24	48 hrs	95	1
3	16-19	48 hrs	95	1
4	18-22	48 hrs	95	1
1	25-28	28 days	75	1
2	24-25	28 days	75	1
3	23-24	28 days	75	1
4	19-23	28 days	75	1
5	20-22	28 days	72	1
1	33-36	28 days	95	1
2	29-33	28 days	95	1
3	30-35	28 days	95	2
4	20-23	28 days	95	1
5	21-22	28 days	95	1
1*	14/26	28 days	95	1
2*	14/28	28 days	95	1
3*	14/25	28 days	95	1

*Test panels had FBE with Scotchkote 328 as patch material. Film thickness is FBE/328.

6.3 Pull-Off Adhesion Strength (ASTM D4541)

Panel #	Layering	Thickness(mils)	Pull-Off Strength (psi)	Failure Mode
1	328/steel	16	6116	328 Cohesive
2	328/steel	22	7238	328 Cohesive
3	328/steel	23	7340	328 Cohesive
4	328/steel	20	4891	328 Cohesive
5	328/steel	22	4789	328 to Substrate
6	328/steel	22	4993	328 Cohesive
7	328/FBE	21/16	7851	328 Cohesive
8	328/FBE	25/15	7238	328 Cohesive
9	328/FBE	23/16	7340	328 Cohesive
10	328/FBE	22/16	7136	FBE to Substrate
11	328/FBE	19/16	7544	328 Cohesive
12	328/FBE	21/15	7544	FBE to Substrate

- Panels 1,2,3 are Scotchkote 328 applied over blasted steel (SSPC SP-10)
- Panels 4, 5, 6 are Scotchkote 328 over mechanically prepped surface (SSPC SP-11)
- Panels 7,8,9 are Scotchkote 328 applied over FBE
- Panels 10,11,12 are Scotchkote 328 applied over sand paper scuffed FBE

6.4 Flexibility: (CSA Z245.20-10)

Bar #	FB (mils)	Bar+Coating Thickness(in)	Mandrel Radius	Temperature (°C)	°/PD	%Elongation	Result
1	24.9	0.3999	11.38	23	1.98	1.73	Pass
2	25.2	0.4002	8.00	23	2.80	2.44	Pass
3	23.6	0.408	5.62	23	4.08	3.5	Pass
4	23.8	0.405	5.18	23	4.31	3.76	Pass

Bar #	FB (mils)	Bar+Coating Thickness(in)	Mandrel Radius	Temperature (°C)	°/PD	%Elongation	Result
6	25.9	0.404	19.06	-30	1.2	1.05	Pass
7	26.6	0.405	17.30	-30	1.33	1.15	Pass

6.5 Gouge Resistance

Gouge at 75° F/23° C with SL-1 smooth blank bit.

Gouge #	Coating Thickness (mils)	Wieght (gk)	Gouge Depth (mils)			Ave. Gouge (mils)	Gouge % Coating Thickness	Holiday Test
1	25-30	40	8.0	9.0	9.0	8.67	32%	Pass
2	25-30	50	14	15.0	15.0	14.67	54%	Pass
3	25-30	60	17	18	18.0	17.67	65%	Pass
4	40-50	50	12	13	13	12.67	28%	Pass
5	40-50	60	15.0	17.0	17.0	16.33	36%	Pass
6	40-50	70	22	24.0	24.0	23.33	52%	Pass

Gouge at 75° F/23° C with R-33 double cut burr bit.

Gouge #	Coating Thickness (mils)	Wieght (gk)	Gouge Depth (mils)			Ave. Gouge (mils)	Gouge % Coating Thickness	Holiday Test
1	25-30	20	7.0	8.0	8.0	7.67	28%	Pass
2	25-30	30	10.0	11.0	11.0	10.67	40%	Pass
3	25-30	40	15.0	17.0	17.0	16.33	60%	Pass
4	40-50	30	9.0	10.0	10.0	9.67	19%	Pass
5	40-50	40	14.0	14.0	15.0	14.33	29%	Pass
6	40-50	50	22.0	24.0	24.0	23.33	47%	Pass

6.6 Impact Resistance (Test Method ASTM G14)

Bar #	Thickness(mil)	Temperature (°C)	Impact (Joules)	Holiday Testing
1	24.0	20	6.0	Pass
2	24.0	20	8.0	Pass
3	24.0	20	10.0	Pass
4	45.0	20	10.0	Pass
5	45.0	20	12.0	Pass
6	45.0	20	14.0	Pass
7	26.0	-30	2.0	Pass
8	26.0	-30	3.0	Pass
9	26.0	-30	4.0	Pass
10	42.0	-30	6.0	Pass
11	42.0	-30	7.0	Pass
12	42.0	-30	8.0	Pass

6.7 Abrasion Resistance (Test Method ASTM D4060-95)

Panel #	# of Cycles	Initial Wt. (g)	Final Wt. (g)	Weight Loss (mg)
1	1000	75.04	74.94	100
	5000	75.04	74.66	380
2	1000	76.83	76.74	90
	5000	76.83	76.47	360
3	1000	74.98	74.89	90
	5000	74.98	74.61	370

- 1000 g load
- 5000 cycles
- clean wheel after every 1000 cycles

6.8 Indentation Resistance (Test Method AS 4822-2008 Appendix E)

- T0 = This is the bit without weight placed on uncoated steel then read dial.
- T1 = This is the bit without weight on coating then read dial.
- T2 = After 24 hours at 23°C the bit with weight on coating read dial.
- T3 = This is the difference between T1 & T0 which gives coating thickness.
- T4 = The difference between T2 and T0 is the residual thickness of coating.
- T5 = The difference between T1 and T2 is the indentation into coating.
- T3 = T1 - T0 = 28.0
- T4 = T2 - T0 = 27.0
- T5 = T1 - T2 = 1.0
- T0 = 0.0
- T1 = 28.0
- T2 = 27.0

6.9 Dielectric Strength

Property	Test Method	Results
Dielectric Strength	ASTM D149	850 V/mil
		35 kV/mm

6.10 Chemical Resistance of Pipeline Coating (ASTM G-20)

Duration (Days)	Temperature (°C)	Results
30, 60, 90	20	Pass

- 6.1.1 Acetic Acid (5 %) (4.4.2).
- 6.1.2 Acetone (4.4.3).
- 6.1.3 Carbon Disulfide.
- 6.1.4 Gasoline.
- 6.1.5 Hydrochloric Acid (10 %) (4.4.23).
- 6.1.6 Kerosine (4.4.28).
- 6.1.7 Lime Water, Saturated.
- 6.1.8 Methyl Alcohol (4.4.29).
- 6.1.9 Methyl Ethyl Ketone.
- 6.1.10 Nitric Acid (10 %) (4.4.33).
- 6.1.11 Sodium Carbonate Solution (20 %) (4.4.38).
- 6.1.12 Sodium Chloride Solution (10 %) (4.4.40).
- 6.1.13 Sodium Hydroxide Solution (10 %) (4.4.42).
- 6.1.14 Sulfuric Acid (30 %) (4.4.46).
- 6.1.15 Toluene (4.4.48).
- 6.1.16 Transformer Oil (4.4.49).
- 6.1.17 Trichlorethylene.

Scotchkote Abrasion Resistant Epoxy Coating 328
Tensile Strangth/Elongation testing per ASTM D2370

Sample #	Thickness (in)	Max Load (lb)	Max Displace (in)	Tensile Strength (psi)	% Elongation
1	0.0325	102.85	0.04907	6329.23	3.27
2	0.03620	114.85	0.05718	6345.30	3.81
3	0.04910	130.84	0.03593	5329.53	2.40
4	0.05190	151.48	0.05519	5837.38	3.68
5	0.05620	164.30	0.06958	5846.98	4.64
6	0.05210	146.63	0.05115	5628.79	3.41
7	0.05130	145.32	0.0404	5665.50	2.69
8	0.0409	136.76	0.05448	6687.53	3.63

Instrument: Instron
 Pull Rate (in/min): 0.1
 Sample Width (in): 0.5
 Sample Length (in): 1.5

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