

Product information

ANCAMINE[®] 2726

Curing Agent

DESCRIPTION

Ancamine 2726 curing agent is a modified cycloaliphatic amine adduct intended for use at ambient temperatures with liquid epoxy resins. Ancamine 2726 curing agent provides an excellent balance of properties in terms of handling, cure speed and UV durability.

TYPICAL PROPERTIES

Property	Value	Unit	Method
Appearance	Clear Light Yellow Liquid		
Colour (Gardner)	max 2	Gardner	ASTM D 1544-80
Viscosity @ 25°C	300-600	mPa.s	Brookfield RVTD, Spindle 4
Amine Value	240-290	mg KOH/g	Perchloric Acid Titration
Specific Gravity	1.03		
Equivalent	115	Wt/{H}	
Recommended use Level	60	PHR	With Bisphenol A diglycidyl ether (EEW=190)

ADVANTAGES

- Excellent colour and colour stability
- Non-blushing
- High gloss films
- Improved chemical and abrasion resistance compared to standard cycloaliphatic amine curing agents

APPLICATIONS

- Decorative and performance self-levelling and screed floorings
- Solvent-free and high solid floor and wall coatings
- High solid coatings for Metal Protection
- Tile grouts

SHELF LIFE

At least 24 months from the date of manufacture in the original sealed container at ambient temperature. Store away from excessive heat and humidity in tightly closed containers.

HANDLING PRECAUTIONS

Refer to the Safety Data Sheet for Ancamine 2726 curing agent.

TYPICAL HANDLING PROPERTIES*

Property	Value	Unit	Method
Gel Time (150g mix @ 25°C)	40-50	mins	Techne GT-3 Gelation Timer
Thin Film Set Time 23°C	7.5	h	BK Drying Recorder Phase III
Hardness 23°C (24h)	85	Shore D	DIN 53505
Hardness 15°C (24h)	78	Shore D	DIN 53505
Typical cure schedule	2-7	days	

SUPPLEMENTARY DATA

Ancamine 2726 curing agent is a modified cycloaliphatic curing agent that can be used in the civil engineering (CE) market for industrial epoxy flooring applications as well as in corrosion resistant coatings for the protection of steel. Ancamine 2726 curing agent provides good cure speed at ambient conditions; high resistance to carbamation under adverse conditions; high mechanical and chemical resistance and excellent resistance to UV exposure.

In addition, Ancamine 2726 curing agent exhibits excellent compatibility with liquid epoxy resins and therefore high solid, solvent based coatings can be formulated using this product, which can then be used for a wide variety of industrial maintenance and marine applications.

The supplementary data outlines several product features of Ancamine 2726 curing agent in combination with (diluted) epoxy resin. As a point of reference, the performance of Ancamine 2726 is benchmarked against incumbent cycloaliphatic amine curing agent technology, "Cyclo-A". Cyclo-A is an industrial standard cycloaliphatic curing agent for ambient temperature conditions. Starting point formulations using Ancamine 2726 curing agent are included at the end of the technical datasheet. Table 1 and 2 summarizes the basic properties of the curing agents evaluated in this technical datasheet.

Handling and Cure Speed Properties

Clear coatings based on Ancamine 2726 curing agent provide good cure at both ambient and sub ambient conditions (15°C) and are comparable to Cyclo-A. This is supported by cure speed results using a BK Drying Time Recorder as shown in Table 1. In addition, the cure speed also results in rapid mechanical property build in both coatings and thick castings. This is demonstrated by the Persoz pendulum hardness development and Shore D build compared to Cyclo-A.

* With Bisphenol A diglycidyl ether (EEW=190)

TABLE 1: HANDLING AND CURE SPEED PROPERTIES OF ANCAMINE 2726 CURING AGENT MIXED UNDILUTED DGEBA EPOXY RESIN

DGEBA, EEW190, η 10-12 Pa.s		Ancamine 2726 curing agent		Cyclo-A
AHEW/[H]			115	115
Ambient Temperature (23°C)				
Gelation time, 150g mix		minutes	50	51
Mix Viscosity		mPa.s	2,200	2,300
Thin Film Set Time	Phase 2 / Phase 3	h	6.0 / 7.5	6.0 / 7.5
Persoz Pendulum	Day 1 / Day 7	s	260 / 340	270 / 350
Shore D Build	16h / 24h / Day 7	Shore D	80D/85D/86D	80D/83D/84D
Sub Ambient Temperature (15°C)				
Thin Film Set Time	Phase 2 / Phase 3	h	10 / 12	9 / 11
Persoz Pendulum	Day 2 / Day 7	s	210 / 270	220 / 270
Shore D Build	24h / 48h / Day 7	Shore D	79D/83D/85D	76D/83D/84D

TABLE 2: HANDLING AND CURE SPEED PROPERTIES OF ANCAMINE 2726 CURING AGENT IN COMBINATION WITH EPODIL 748 REACTIVE DILUENT DILUTED A/F EPOXY RESIN

DGEBA/F / Epodil 748, EEW195, Average η 10-12 Pa.s		Ancamine 2726 curing agent		Cyclo-A
AHEW/[H]			115	115
Ambient Temperature (23°C)				
Gelation time, 150g mix		Min	75	85
Mix Viscosity		mPa.s	600	650
Thin Film Set Time	Phase 2 / Phase 3	H	9.0 / 12	8.5 / 11
Persoz Pendulum	Day 1 / Day 7	S	95 / 260	135 / 275
Shore D Build	16h / 24h / Day 7	Shore D	45D/66D/82D	30D/50D/81D
Sub Ambient Temperature (15°C)				
Thin Film Set Time	Phase 2 / Phase 3	H	16 / 21	16 / 21
Persoz Pendulum	Day 2 / Day 7	S	20 / 220	25 / 250
Shore D Build	24h / 48h / Day 7	Shore D	80D/72D/81D	60D/66D/80D

Mechanical properties

Mechanical strength properties of epoxy castings were determined using a dual column material testing machine (Instron, model 4206) equipped with 104 kN load cell. Tests were conducted according to ISO 604. For recording compressive strength data of cubes of 25x25x25 mm, the machine was equipped with compressive plates and a Dynamic 25/50 mm GL Extensometer and operated at 2.5 mm/min cross-head speed. All epoxy castings were prepared at 23°C and left to cure for 14 days prior to testing.

High compressive strength is paramount for epoxy systems used in industrial floorings in order to protect the concrete structure and avoid structural damages. Epoxy castings based on Ancamine 2726 curing agent and (diluted) epoxy resins provide excellent compressive strength as shown in Table 3.

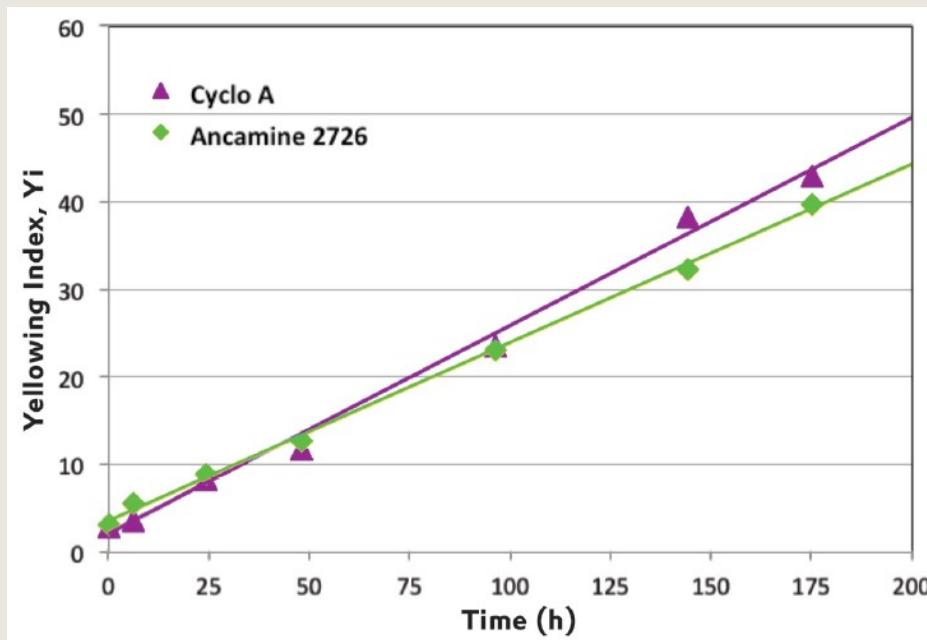
TABLE 3: COMPRESSIVE STRENGTH DATA OF ANCAMINE 2726 CURING AGENT IN COMBINATION WITH UNDILUTED DGEBA EPOXY RESIN (STANDARD DEVIATION IN BRACKETS)

DGEBA, EEW190, η 10-12 Pa.s		Ancamine 2726	Cyclo-A
Compressive strength	MPa	84 (3)	78 (2)
Compressive modulus	MPa	1,650 (60)	1,630 (60)

UV DURABILITY PROPERTIES

Coatings based on Ancamine 2726 curing agent provide comparable UV stability over time, when compared to incumbent cycloaliphatic amine curing agents. This is demonstrated in Figure 1 where the yellowing index was measured as a function of exposure time. Yellowing was determined following ASTM E313, which describes the yellowing index as a 1-dimensional evaluation of the lightness/yellowness of the material colour. Further, yellowing of the coatings was determined following ASTM G154 and D4587-05, with main difference that no condensation cycle was applied (UV mode only). Clear coats were applied onto S-36i panels (Q Panel Lab Products) at using a 100 μ wire-bar and left to cure for 14 days prior to testing.

FIGURE 1: YELLOWING INDEX OVER TIME OF COATINGS BASED ON ANCAMINE 2726 CURING AGENT MIXED WITH EPODIL 748 REACTIVE DILUENT DILUTED BIS-A/F EPOXY RESIN (UV MODE ONLY).



CORROSION RESISTANCE

Ancamine 2726 curing agent can readily be formulated into a wide range of anti-corrosive primers and top coats depending upon the epoxy resin system required. General handling properties of the formulated coatings are comparable to those of Cyclo A and coatings can easily be applied using a range of application methods such as brush, roller, and spray application.

Appendix 1 contains an example start point formulation (A2726P1) based on Ancamine 2726 curing agent for an anti-corrosive primer. Formulation A2726P1 is a high volume solids (76%), anti-corrosive primer, based on a combination of liquid bisphenol A diglycidyl ether (EEW 190) and solid epoxy resin (EEW=550). The formulation has a 1:1 mix ratio by volume. The initial viscosity of the formulated system is 2,000mPa.s with a total VOC of 210 g/l. The primer formulation is compatible with a variety of different let down solvents (including xylene, n-butanol, MIBK, methoxy-propanol, etc) and can be further let down if required for additional spray applications. The coating formulation can be applied with conventional spray equipment or brush applied to the steel substrate and has a pot life of 3h.

This primer was applied to grit blasted, hot rolled steel (SA2.5), using conventional spray equipment, in double coats to give coatings with a 75-100 μ (3-4 mils) dry film thickness (DFT). In salt spray, (ASTM B-117) panels were scribed and evaluated for field blisters using the US Federal Standard Test Method 141a, Method 6461 and the scribe creep was rated in accordance with ASTM D-1654. After 2,000 hrs exposure, coatings exhibit excellent corrosion resistance. For comparative purposes, Cycloaliphatic curing agent A was also included in the test study as a standard reference. In all the corrosion resistance tests carried out, both Ancamine 2726 and Cyclo A demonstrated comparable performance delivering the high level of corrosion resistance typically observed for this class of curing agents. Resistance in Cleveland Humidity tester up to 2,000h was easily achieved with no failures. The results obtained are presented in Table 4 and Table 5.

TABLE 4: SALT SPRAY RESISTANCE — ANCAMINE 2726 AND CYCLO A

Formulation	Scribe Creep		Field Blistering	
	1,000h	2,000h	1,000h	2,000h
Ancamine 2726	10	8	10	10
Cyclo A	10	8	10	10

5% salt spray, cabinet temperature 35°C - ASTM B-117, film thickness 75-100µ Rating: ASTM D714: 10 = Best (no blisters), 0 = Worst

TABLE 5: CLEVELAND HUMIDITY — ANCAMINE 2726 AND CYCLO A

Formulation	Field Blistering	Appearance
Ancamine 2726	10	No defects
Cyclo A	10	NO DEFECTS

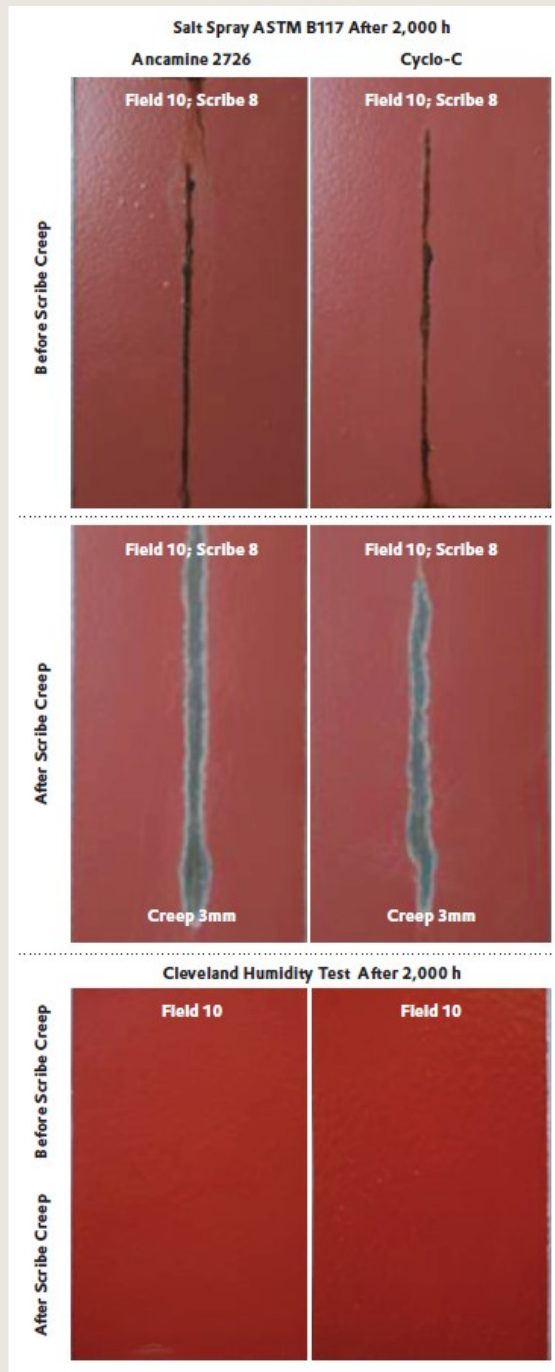
Continuous 100% humidity exposure - ASTM D-2247, cabinet temperature 50°C

Film thickness 75-100µ. Rating: 10 = Best, 0 = Worst

For blister size, rating 10 = no blisters observed



ANTI-CORROSIVE PRIMER BASED ON ANCAMINE 2726 (A2726P1) AND CYCLO-C



Note: Coatings applied using conventional spray equipment.
2 coats applied to achieve total dry film thickness of 75-100 μ

START PONIT FORMULATION 1: SOLVENT-FREE, GREY TOPCOAT

A-Component		Grey Topcoat	
1. Epoxy resin	Bisphenol-A/F epoxy resin, Epodil 748 diluted, EEW195, η 900 mPa.s	Various	100.0
2. Defoamer additive	BYK® 320	Byk Chemie	0.8
3. Titanium dioxide	Tlona® 696	Millennium Chemicals	48.7
4. Carbon black	Lamp Black	Various	0.5
5. Filler	Blanc Fix Micro®	Sachtleben Chemie	25.0

A-Component Manufacturing Procedure

- Charge component 1-2 and mix at low shear until homogeneous
- Charge components 3-5, mix until homogeneous at low shear; then grind pigments at high speed (10-20 m/s) to yield particle size less than 25 μ m. Ensure temperature during grinding is kept < 50°C

B-Component

6. Amine curing agent	Ancamine 22726 curing agent	Evonik	60.0
TOTAL			235.0

Application Procedure

- After mixing part A and B, the formulation is ready to apply

TECHNICAL DATA

Mix Ratio A/B (wgt)	74:26	Potlife by Viscosity (min.)	~45
Mix Ratio A/B (volume)	66:34 (~2:1)		
Density Mixture (kg/l)	1.4	Gloss 20°/60°	95/99
PVC (%)	11.5	Persoz Hardness	275
Viscosity Part A (mPa.s), 23°C	2,800	Walk-on Time (h)	<16
Mix Viscosity (mPa.s), 23°C	1,250	by Thumb-Twist Dry Time	
		Carbamation Resistance (Scale 1-5, 5=best) Day 1, 23°C (wet patch)	5

START FORMULATION 2: SOLVENT-FREE, GREY SELF LEVELING FLOOR (SLF)

A-Component			Grey SLF
1. Epoxy resin	Bisphenol-A/F epoxy resin, Epodil 748 diluted, EEW 195, η 900 mPa.s	Various	20.0
2. Defoamer additive	Surfynol® DF-62	Evonik	0.5
3. Wetting additive	Dynol™ 604	Evonik	0.5
4. Titanium dioxide	Kronos® 2160	Kronos International	2.9
5. Carbon black	Lamp Black	Various	0.1
6. Filler	Barytmehl F	Sachtleben Chemie	24.0

A-Component Manufacturing Procedure

- Charge components 1-3 and mix at low shear until homogeneous
- Charge components 4-6, mix until homogeneous at low shear; then grind pigments at high speed (10-20 m/s) to yield particle size less than 25 μ m. Ensure temperature during grinding is kept < 50°C

B-Component

7. Amine curing agent	Ancamine 2726 curing agent	Evonik	12.0
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C-Component

8. Quartz Sand 0.1-0.3 mm	Local	Various	48.0
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TOTAL			108.0
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Application Procedure

- After mixing part A, B and C, the formulation is ready to apply

TECHNICAL DATA

Mix Ratio A/B (wgt)	80:20	Gloss 20°/60°	90/100
Mix Ratio A/B (volume)	67:33 (~2:1)		
Density Mixture (kg/l)	2.0	Persoz Hardness Walk-on Time (h)	
Pigment: Binder Ratio (wt:wt)	2.3 : 1	- by Shore D (5 mm, 23°C)	16
Viscosity Part A (mPa.s), 23°C	3,000	- by Shore D (5 mm, 10°C)	24
		Carbamation Resistance (Scale 1-5, 5=best)	
		- Day 1, 23°C (wet patch)	5
		- Day 2, 15°C (wet patch)	4

START FORMULATION 3 ANTICORROSIVE PRIMER FORMULATION A2726P1

A-Component			ACP-A2726P1
1. Epoxy resin	Bis A diglycidyl ether (EEW550)	Various	9.58
2. Epoxy Resin	Bis A diglycidyl ether (EEW190)	Various	19.66
3. Reactive Diluent	Epodil® 742	Evonik	2.95
4. Additive	Anti-Terra U80	BYK	0.49
5. Additive	Bentone SD2	Elementis	0.79
6. Additive	Aerosil 200	Evonik	0.20
7. Pigment	Heucophos ZP10	Heubach	4.86
8. Filler	Bayferrox 130M	Bayer	7.86
9. Filler	Quartz # 400 mesh	Various	45.50
10. Additive	Epodil® LV5	Evonik	2.95
11. Solvent	PM Solvent	Various	2.95
12. Solvent	Xylene	Various	2.21
B-Component			
1. Curing Agent	Ancamine® 2726 Curing Agent	Evonik	15.21
2. Additive	Anti-Terra U80	BYK	0.36
3. Additive	Bentone SD2	Elementis	2.40
4. Additive	Cymel 303	Cytec Industries	2.60
5. Filler	Quartz # 400 mesh	Various	55.28
6. Additive	Aerosil 200	Evonik	0.36
7. Solvent	PM Solvent	Various	9.01
8. Additive	Epodil® LV5	Evonik	3.03
9. Additive	Ancamine® K54	Evonik	0.36
10. Solvent	Xylene	Various	11.39
Total (A+B)			200.0

For conventional spray application 10 to 15 % dilution is required

TECHNICAL DATA

Mixing ratio	Weight Volume	100 A : 83 B 1:1	Solid Content (Volume %)	- Part A - Part B - Mix	90.21 66.11 76.48
			Mix Viscosity ¹ @ 25°C	mPa.s	2,000
Density (g/ml)	- Part A	1.61	VOC	g/L	210
	- Part B	1.35	PVC	%	49.50
	- Mix	1.35	PVC	%	49.50
Solid Content (Weight %)	- Part A	92.35			
	- Part B	77.93			
	- Mix	85.80			

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