Product information

ANQUAMINE® 721

Curing Agent

DESCRIPTION

Anquamine 721 is a waterborne curing agent for use with standard liquid epoxy resin. Anquamine 721 curing agent is specifically designed for cost effective concrete floor coatings at up to 300 micron applied film thickness. Anquamine 721 curing agent easily emulsifies standard liquid epoxy resins; the use of emulsifiable resins is not required.

TYPICAL PROPERTIES

Property	Value
Appearance	Amber Liquid
Colour[1] (Gardner)	max. 8
Viscosity[2] @ 25°C (mPa.s)	20000-35000
Solids Content (wt %)	48-52
Amine Value[3] (mg KOH/g)	140-170
Specific Gravity @ 25°C (g/cm³)	1,05
Equivalent Wt/{H}	300
Recommended use Level[4] (PHR)	140-180

(1) ASTM D 1544
(2) Brookfield RVTD, spindle 4
(3) Perchloric Acid Titration
(4) Cured with bisphenol-A based epoxy resin (EEW=190)
(5) Cured with Epires ER-8 epoxy resin (EEW195)
(6) ASTM D 5895 - BK Drying Recorder, Phase 3
(7) ASTM D 4366

ADVANTAGES

- Cost effective concrete protection
- Excellent adhesion to a wide range of substrates including damp concrete
- Excellent pigment acceptance and colour stability through pot-life
- Excellent scratch resistance
- Low colour and good yellowing resistance

EVONIK
Leading Beyond Chemistry

APPLICATIONS

• Concrete primers
• Pigmented concrete coatings (100-300 microns)

SHELF LIFE

At least 24 months from the date of manufacture in the original sealed container at ambient temperature.

PACKAGING AND HANDLING

Refer to the Safety Data Sheet for Anquamine 721 curing agent.

TYPICAL HANDLING PROPERTIES*

Property	Value
Pot Life @ 23°C[4], [h]	1-2
Thin Film Set Time[4, 5]	
Phase II @ 23°C, [h]	3.5
Phase III @ 23°C, [h]	5.5
Persoz Hardness[4]	
1 day @ 23°C	175
7 days @ 23°C	260

* All data generated using a use level of 150 PHR with Bisphenol A diglycidyl ether epoxy resin (EEW=190) at 40% mixed solids

TYPICAL PERFORMANCE PROPERTIES

Typical cure schedule: 2-7 days

SUPPLEMENTARY DATA

ANQUAMINE 721 CURING AGENT CHARACTERISTICS AND APPLICATION: Anquamine 721 curing agent has been designed specifically for concrete primer and concrete paint application (100-300µm). Systems based on Anquamine 721 curing agent provide superior adhesion particularly on damp concrete. It is most cost effective to provide epoxy concrete protection with regards to adhesion, abrasion resistance, surface appearance and cleanability.

FIRST CHOICE FOR A CONCRETE PRIMER ADHESION: The principal function of a concrete primer is to adhere to the substrate offering protection and a sound surface which can readily be coated with further coatings or flooring systems if required. Anquamine 721 curing agent provides excellent adhesion to all mineral substrates such as concrete, anhydrite, ceramic and old epoxy coatings. In addition to this Anquamine 721 curing agent would be the best choice for a system to provide adhesion on to damp concrete. The adhesion data clearly demonstrates that compared to traditional solvent free and solvent borne primer systems the adhesion to damp concrete is superior with the mode of failure with Anquamine 721 being cohesive, indicating that the adhesion to the concrete is greater than the strength of the concrete itself.

The following figure shows the pull-off adhesion testing of Anquamine 721 curing agent compared to a standard cycloaliphatic system when applied to damp concrete.

Curing Agent Technology	Standard Dry Concrete	Standard Damp Concrete
Anquamine 721	Anquamine 721	8 MPa – concrete failure
Solvent-free Cycloaliphatic	Solvent-free Cycloaliphatic	<1 MPa – adhesive failure
Solventborne Polyamide	Solventborne Polyamide	3 MPa – partial adhesive failure

Anquamine 721 Primer System | **Solvent-free Cycloaliphatic** | **Solventborne Polyamide**

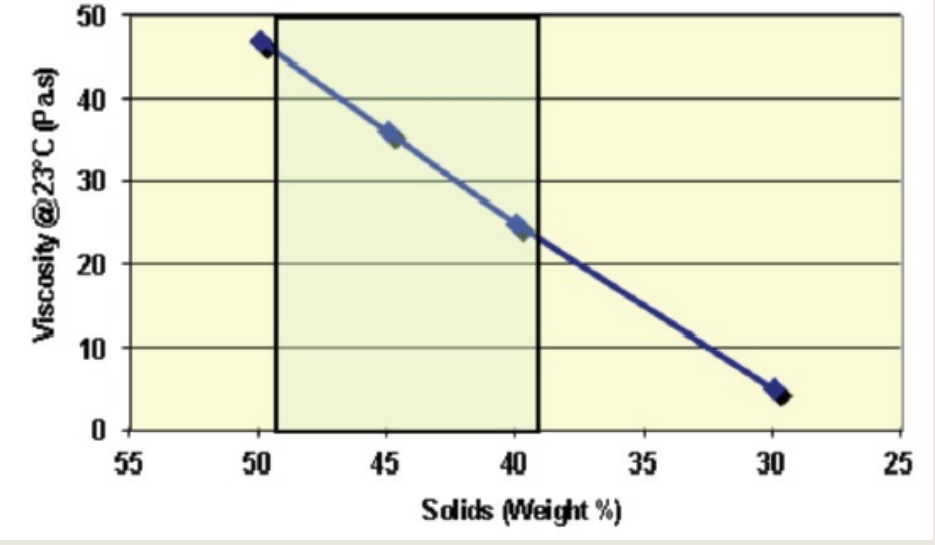
OVERCOATABILITY: Along with adhesion to the substrate one of the key requirements for a primer system is to provide a surface which can readily be overcoated with a further protective or aesthetic topcoat. Anquamine 721 curing agent exhibits excellent recoatability, with the surface presented offering the ability to recoat immediately or after several months with epoxy, polyurethane or other coating technologies. The intercoat adhesion data clearly demonstrates that there is no intercoat adhesion failure when overcoating the Anquamine 721 primer with a further coating of Anquamine 721system.

Curing Agent Technology	After 1 day	After 3 days	After 1 month
Anquamine 721	Cohesive failure	Cohesive failure	Cohesive failure
Solvent-free Cycloaliphatic	Cohesive failure	Partial intercoat failure	Intercoat failure
Solventborne Polyamide	Cohesive failure	Partial intercoat failure	Intercoat failure

A primer system based on Anquamine 721 curing agent will be touch dry after 3-5 hours, depending upon the resin base used and can be overcoated with the following topcoat or self-levelling flooring system. Also as the system is not susceptible to the formation of carbamation under any circumstances the intercoat adhesion is not adversely affected due to applications at low temperature or high humidity.

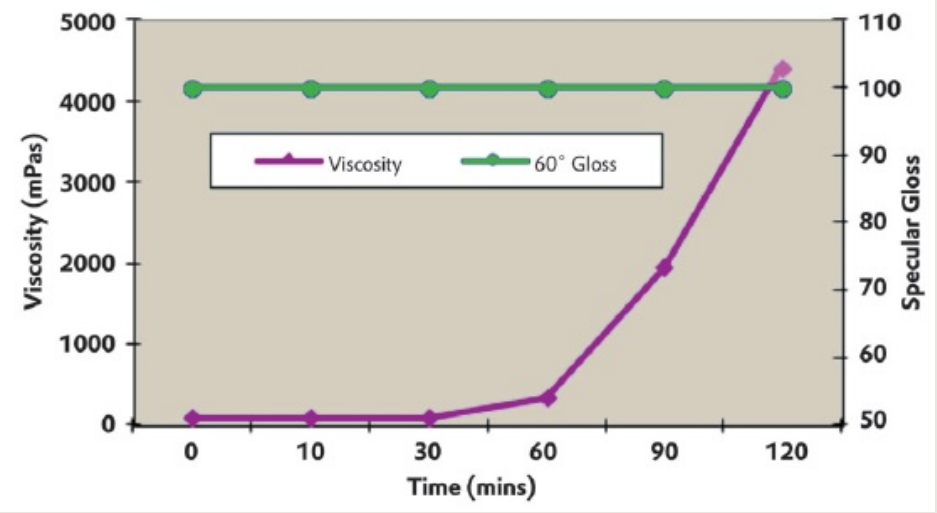
DILUTION PROFILE: Anquamine 721 curing agent shows good viscosity reduction upon dilution with water. Figure 1 represents the viscosity dilution profiles of Anquamine 721 curing agent to 30% solids. The system offers the benefit of a system which shows good viscosity on dilution with retention of viscosity at low solids for cost effective concrete primer and paint applications. This property is ideal to formulate and apply high body paint at low solids. In order to obtain the optimum emulsion with an unmodified liquid epoxy it is recommended to have a minimum solids content of 40% solids before mixing with the epoxy. When using within a coating formulation or with pre-emulsified liquid resins a lower solid content is applicable.

FIGURE 1: DILUTION PROFILE OF ANQUAMINE 721 CURING AGENT



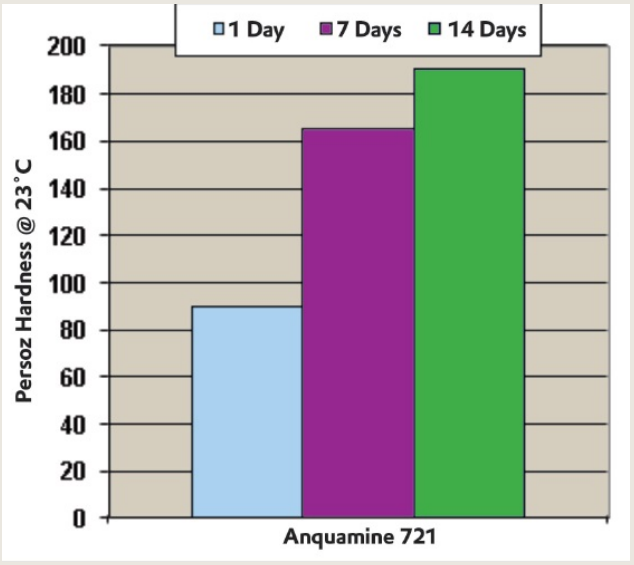
POT LIFE PROFILE: Anquamine 721 curing agent exhibits a stable viscosity profile when mixed with standard LER for at least 60 minutes to yield cured coatings with a high and constant gloss and hardness throughout the pot life, as shown in Figure 2. After 60-90 minutes a sharp increase in viscosity represents a visible end of pot-life.

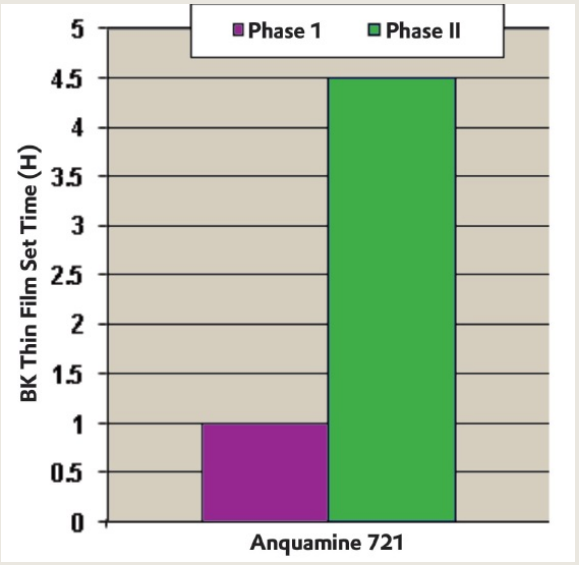
FIGURE 2: VISCOSITY PROFILE AND 60° GLOSS OF ANQUAMINE 721 CURING AGENT WITH LIQUID EPOXY RESIN



FAST AND EASY-TO-USE PAINT FORMULATIONS PROPERTY DEVELOPMENT: Figure 3 shows the hardness development and Beck Koller, Thin Film Set Times of Anquamine 721 matt grey paint formulation cured with a diluent modified Bisphenol A diglycidyl ether epoxy resin. Anquamine 721 paint formulations yield coatings with an ultimate hardness of approximately 190 as measured by Persoz pendulum hardness and a pencil hardness of 4-6H. The very high pencil hardness indicates that coatings formulated with Anquamine 721 will offer very good scratch resistance and give a high level of durability.

FIGURE 3: HARDNESS DEVELOPMENT AND DRY SPEED OF ANQUAMINE 721 GREY PAINT FORMULATION @ 23°C





It is recommended to use Anquamine 721 at advised stoichiometry of 150PHR (EEW=190). Anquamine 721 can be used at 10-15% above the recommended loading to accelerate hardness development and increase ultimate hardness by 25% without negatively impacting other properties.

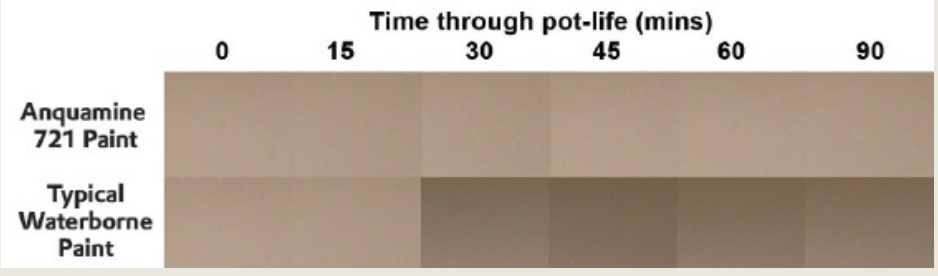
The coating formulation has a walk-on-time of approximately 4-6 hours and can be overcoated at this time allowing for twocoat application in a day.

PIGMENT ACCEPTANCE: Anquamine 721 curing agent is the ideal medium for formulating a paint system. The pigment acceptance of Anquamine 721 is excellent and the majority of both inorganic and organic pigment powders are readily dispersed to give high quality pigment dispersions. This is a very important property when formulating stable, high gloss coatings.

Good compatibility has been found with a number of universal tinting systems commonly used in waterborne acrylic systems and commercial pigment pastes. This compatibility allows for a wide colour pallet making systems based on Anquamine 721 very versatile and able to offer a highly decorative solution to concrete protection. A master formulation based on Anquamine 721 be used with standard tinting systems to give coatings of various colours for different applications.

In addition to the high pigment acceptance and ease of grinding the system is also ideal for using as the formulated side of paint due to ease of handling and cleaning. Unlike a solvent free or solventborne system the vessel used to make the paint formulation can easily be cleaned with water and detergent with no need for the use of solvents.

FIGURE 4: COLOUR STABILITY THROUGH POT-LIFE OF ANQUAMINE 721 GREY PAINT FORMULATIONCURING AGENT FOLLOWING AGBB TESTING SCHEME

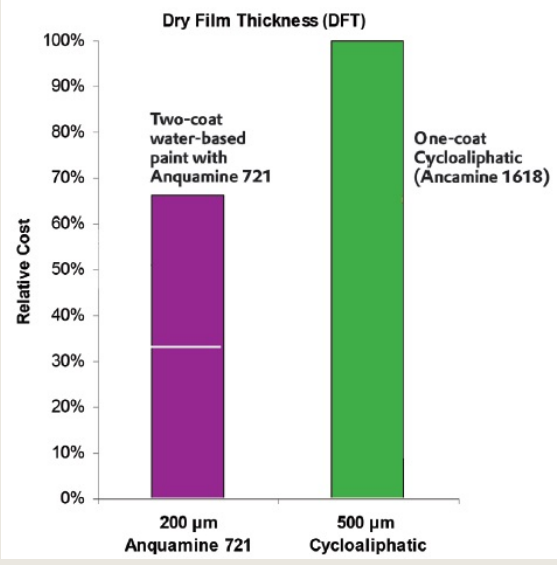


Pigmented formulations based on Anquamine 721 also show very good colour stability through pot-life without the requirement for special formulation techniques to stabilize colour. Figure 4 demonstrates the colour development through pot-life of the grey matt coating formulation compared to a standard waterborne coating without pigment stabilising additives.

PLASTICISER FREE COATINGS: Anquamine 721 coatings are low odour and can be formulated free of volatile organic compounds (VOC) offering VOC compliant systems. The application of coatings in confined spaces limits the use of solvents and other volatiles, due to odour and regulatory constraints. This is equally important for sensitive application areas such as schools, offices or hospitals which can stay occupied during painting. Increasingly stringent regulations will limit emissions from flooring systems after coating have been applied. Coating systems containing non-reactive components, such as plasticizers, have shown high emission levels above proposed limits. Concrete paints and concrete primers based on Anquamine 721 are fully reactive, are plasticiser-free and therefore offer a compliant system. Due to the fact that coatings are fully reactive there are fewer concerns of flame spread and smoke generation in the case of fire which has positive influence on health and safety and ultimately lower insurance costs.

COST-IN-USE COMPARISON — WATERBORNE CONCRETE: PAINTSystems based on Anquamine 721 curing agent provide a combination of optimum performance and cost effectiveness to offer the ideal systems for concrete protection. The application of a pigmented two coat system based on Anquamine 721 curing agent and applied at 200µ DFT exhibits a good combination of durability and chemical protection. This system offers a cost advantage over solvent free technology that cannot be applied at this low thickness due to viscosity constraints. The additional film thickness of the solvent free system can be viewed as being 'over engineered' and does not provide the performance benefits to justify the additional cost. Waterborne concrete paint (200µm) has proven performance capabilities and a long track record in a number of industrial applications. With this cost-in-use benefit, epoxy protection is now affordable for car show rooms or light traffic storage areas. As per Figure 5 up to a 30% cost saving can be achieved when compared to solvent free technology.

FIGURE 5: COST COMPARISON OF ANQUAMINE 721 COATING SYSTEM AND SOLVENT FREE COATING



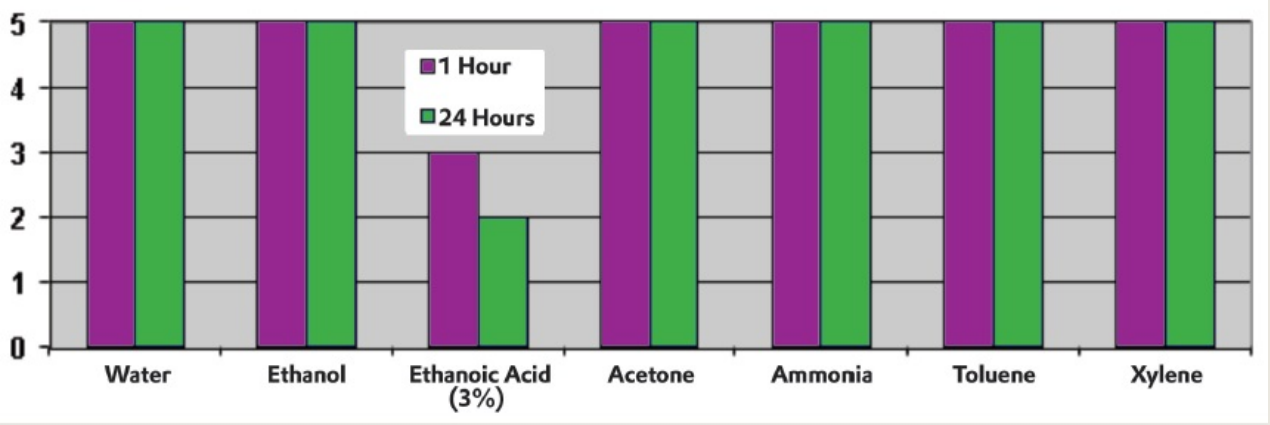
In addition to raw material cost savings, Anquamine 721 coatings provide further efficiency advantages. Coatings based on Anquamine 721 are easier and quicker to apply when compared to solvent free systems. There is no roller pick up or drag so that greater coverage rates are achieved at that save time and labour cost.

FIRST CHOICE FOR CONCRETE PROTECTION: Coatings formulated with Anquamine 721 curing agent have ideal properties for concrete primers and coatings. The systems offer fast property development for fast completion of jobs and are easy to use and formulate. The coatings formulations offer excellent protection of concrete substrates from light to medium traffic and also have good chemical resistance for resistance to chemical spills.

ABRASION RESISTANCE: Paint formulations with Anquamine 721 offer excellent scratch resistance with the pencil hardness of standard formulations showing hardness up to 6H. The abrasion resistance of the coating system also indicates that the system will offer highly durable and long lasting protection to the substrate with the Taber Abrasion (C17) Wear Index for the grey matt coating being 300mg/1000 cycles.

CHEMICAL RESISTANCE: Coatings formulated with Anquamine 721 offer excellent resistance to a variety of chemicals. The resistance to a few commonly used chemicals is listed below which demonstrates that for accidental spills and leaks Anquamine 721 based coatings will give very good protection of the concrete and can be cleaned without damage. The coating formulation based on Anquamine 721 was evaluated for chemical resistance using a spot test method. Approximately 0.1ml of reagent was applied onto the coating substrate and covered to prevent evaporation. The coating surface was then observed after 1 hour and 24 hours for surface degradation and given a grade from 0 to 5 with 5 indicating no damage and 0 indicating complete destruction.

FIGURE 6: CHEMICAL RESISTANCE OF ANQUAMINE 721 GREY COATING



FORMULATION GUIDELINES

DISPERSANTS / DEFOAMERS / WETTING: Defoamers such as Surfynol® DF62 are very suitable for use in coating formulations to give optimum air release and surface properties. ZetaSperse™ 1600 can be used to effectively aid in wetting out pigments and increasing flow and levelling properties to give a system which yields good surface and flow properties.

RHEOLOGY MODIFIERS: The Rheology of formulations with Anquamine 721 can be effectively controlled with the use of Thixotropic agents such as polyurethane thickeners and Bentonite clays. Tafigel® PUR-55 (Münzing-Chemie) has shown good Thixotropic properties in paint formulations with Anquamine 721, allowing for good application viscosity and anti-sag performance. However, due to the inherent thixotropy of Anquamine 721 systems can be formulated without the need of external thickeners.

RECOMMENDED EPOXY RESINS: Anquamine 721 exhibits good compatibility with standard liquid epoxy resins based on Bisphenol A or F. Reactive diluent modified epoxy resin will offer improved handling and formulating latitude within coating formulations. As with all systems, the inclusion of diluents will retard the hardness development and ultimate hardness of coated films. Resins modified with reactive diluents, such as Epodil® 748 or hexanediol diglycidyl ether, exhibit very good compatibility and produce films of high clarity and gloss. A modification level of approximately 10% to yield a resin viscosity of approx. 2,000mPa.s is ideal to give a good balance of handling and property development.

ANQUAMINE® 721 — GREY MATT PRIMER

This formulation is ideally suited as a primer or topcoat for concrete floor coatings at 100-300 micron applied film thickness. The highly filled paint provides a cost effective, fast touch dry and good hardness (4-6H) when cured.

MATT GREY COAT

A-Component			
1. Curing agent	Anquamine 721	Evonik	31.00
2. Defoamer	Surfynol® DF-62	Evonik	0.25
3. Levelling agent	Surfynol 420	Evonik	0.50
4. Pigment TiO_2	Kronos® 2160	Kronos	8.00
5. Pigment	Bayferrox 318	Bayer	0.10
6. Pigment	Bayferrox 1420	Bayer	0.40
7. Filler	Blanc Fix Micro	Sachtleben	16.00
8. Filler	Talc 10M2	Luzenac	11.00
9. Matting Agent	Deuteron MK	Deuteron	4.00
10. Diluent	Water	Local	28.75
			100.00

A-Component Manufacture Procedure:
- Charge components 1-3 and stir homogeneous at low shear
- Slowly add pigment and fillers while increasing speed to 10-20 m/s
- Grind with high speed disperser at approx. 10-20 m/s for 15min
- Add remaining components at low shear rate.

* Some of the water may be added during addition of pigments and fillers to adjust viscosity in order to achieve a uniform grind.

B-Component			
11. Epoxy resin	DGEBA		18.00
12. Reactive Diluent	Epodil 748	Evonik	2.00
Total			**120.00**

After mixing Part A and B approximately 10 – 15 parts of water may be required to adjust viscosity for application.

TECHNICAL DATA

Mixing ratio - A to B	by weight	5.0 :1
	by volume	4.0: 1
Density (g/ml)	Part-A	1.40
	Part-B	1.12
	Mix	1.35
20Solid Content (wt%)	Part-A	56.0
	Part-B	100.0
	Mix	63.0
Mix Viscosity @ 25°C	mPa.s	300
PVC	%	27.6
Pot-life	minutes	~90
Gloss (85°)		10 - 20
BK Dry time 23°C [h]	Phase I	0:30
	Phase II	1:00
	Phase III	4:30
Pencil Hardness — 7 days		6H

DESCRIPTION: This grey concrete primer system is prepared by mixing Component A with Component B for 2-3 minutes using hand mixing to produce a homogeneous mixture. Once mixed water may be slowly added to give the desired application viscosity and mixed for 1-3 minutes before application. To produce a coating with an initial application viscosity of 300-500 mPa.s, addition of 10 – 15% water is required. The viscosity of the coating system can be adjusted for application by brush, roller or spray.

ANQUAMINE® 721 — CLEAR-COAT PRIMER SYSTEM WITH LIQUID EPOXY RESIN

This formulation is ideally suited as a primer for concrete surfaces, including damp concrete, offering excellent adhesion and overcoatability.

A-Component (Primer)			
1. Curing agent	Anquamine 721	Evonik	60.0
2. Diluent	Water	Local	15.0
			100.00
B-Component			
3. Epoxy resin	DGEBA		40.0
Sub Total			**115.0**
Mix part A and B until emulsion is homogeneous			
C-Component — General Primer (40% solids)			
4. Diluent	Water	Local	**60.0**
After mixing Part A and B, water addition is required to adjust to application viscosity.			

TECHNICAL DATA

Mixing ratio - A to B to C	Weight	75 : 40 : 60
Density [g/ml]	- Part A / B / C	1.03 / 1.12 / 1.00
	- Mix	1.03
Solid Content [%]	- Part A / B / C	40 / 100 / 0
	- Mix	40
Pot-life	minutes	60 - 90
Mix Viscosity [mPa.s]	- Initial	200
	- 60 minutes	280
	- 90 minutes	1400
Dry-time (BK Recorder) [h]	- Phase II	3.5
	- Phase III	5.5
Persoz pendulum hardness	24 h	175
	7 day	260
	14 day	300

DESCRIPTION: This clear coating which is ideal as a concrete primer system is prepared by taking 60 parts of Anquamine 721 and diluting to 40% solids. This is then mixed with 40 parts of component B for 2-3 minutes using hand mixing to produce a homogeneous emulsion. Once the emulsion is formed, water is slowly added to give the desired application viscosity and mixed for 1-3 minutes before application. To produce a coating with 40% mixed solids 60 parts of water is required, this will give an initial application viscosity of 100 – 200 mPa.s. The viscosity of the coating system can be adjusted for application by brush, roller or spray.

EVONIK OPERATIONS GMBH
Business Line Crosslinkers
Paul-Baumann-Str. 1
45764 Marl
Germany

www.evonik.com/crosslinkers
Product Information: APCSE@evonik.com
Sample Request: APCSE@evonik.com

EVONIK CORPORATION
Business Line Crosslinkers
7001 Hamilton Boulevard
Trexlertown, PA 18087
USA

CrosslinkersProdinfo@evonik.com
Crosslinkers-Samples@evonik.com

EVONIK SPECIALTY CHEMICALS (SHANGHAI) CO., LTD.
Business Line Crosslinkers
55, Chundong Road
Xinzhuang Industry Park
Shanghai, 201108
China
CL-Asiainfo@evonik.com
CL-Asiainfo@evonik.com