Waterborne Epoxy Curatives

HIGH PERFORMANCE. LOW EMISSIONS. COST-EFFECTIVE.

EVONIK
POWER TO CREATE

WATERBORNE SYSTEMS: OFFER CONSIDERABLE ADVANTAGES

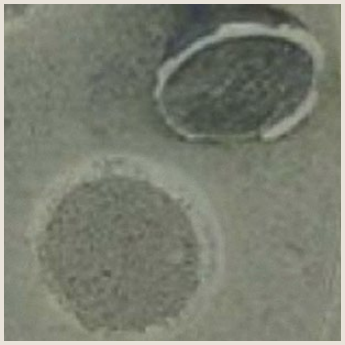
Waterborne epoxy coatings are fast becoming the first choice for concrete protection. They offer high performance, are environmentally friendly and provide cost-effective coating systems for all traditional civil engineering applications. Furthermore, they give the end user unique technical solutions in new application areas. Waterborne epoxy coatings can be applied at temperatures between 40 °F to 95 °F and at humidity less than 85%, therefore giving end users a wide option of possible working environments and conditions. A rapid cure speed of 1-3 hours meets the industry demand for fast return-to-service coatings and floor systems. Evonik's waterborne curing agents are designed to meet the great variety of industrial coating applications and requirements for concrete and metal protection. High performance, cost-effective and environmentally friendly are the key benefits that are widely recognized.

DAMP CONCRETE ADHESION

Anquamine® 721 Curing Agent

PICTURE 1
1190 psi concrete failure

Cycloaliphatic Curing Agent



PICTURE 2
60 psi delamination

Polyamide Curing Agent

PICTURE 3
145 psi delamination

ADHESION — FIRST CHOICE ON ALL SUBSTRATES

Even under tough conditions, waterborne epoxy technology will adhere to the substrate and the following coat. Waterborne epoxy coatings offer optimum adhesion and combat the possibility of delamination and subsequent loss of the protective properties of the coating. Performance data and track record prove that adhesion to standard concrete and difficult substrates is unsurpassed. Damp concrete, commonly encountered in the industry, can only be effectively coated with waterborne epoxy technology.

The three pictures above illustrate adhesion on damp standard concrete for epoxy systems. In Picture 1, the waterborne system offers a surface which can be recoated, giving excellent intercoat adhesion. When used as a primer, it can be overcoated with either waterborne or any other coating technology, a property that is maintained over time. In contrast, in Picture 2, the coating surface shows a white appearance which demonstrates the carbamation tendency of 100% solids systems when applied on damp concrete. The carbamate will negatively influence adhesion of the following coat.

The overcoatability of waterborne epoxy systems provides project flexibility and the ability to patch repair at low cost with minimal preparation.

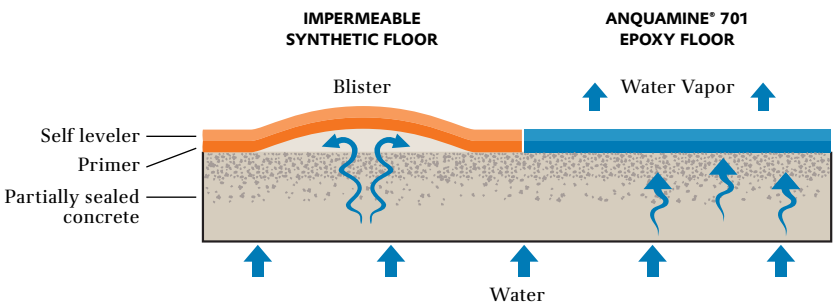
Picture 3 illustrates the comparison with solvent-based polyamides that are known for their good adhesion. Under damp concrete conditions, however, the polyamide delivers adhesion 145 psi and delamination from the concrete, thus confirming superior performance of the waterborne system.

LOW EMISSIONS — BUILT-IN SAFETY

Waterborne systems are low-odor and offer systems free of volatile organic compounds (VOC). The application of coatings in confined spaces limits the use of solvents and other volatiles, due to odor 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, particularly in Europe, will limit emissions from flooring systems. Coating systems containing nonreactive components, such as plasticizers, have shown high emission levels above proposed European limits. Waterborne epoxy coatings are fully reactive and plasticiser-free and therefore offer a compliant system. This benefit is also important in sensitive manufacturing areas like electronics. In the case of fire they are less hazardous through reducing flame spread and smoke generation.

FIGURE 1



PERMEABILITY — A COATING THAT BREATHES AND LASTS LONGER

Waterborne epoxy coatings overcome the problems of osmotic blistering often encountered when protecting concrete substrates. This problem arises from osmotic pressure build under the coating. This force exceeds the adhesion strength, resulting in delamination. This is a particular problem when dealing with high water table conditions, underground areas, or the repair of floors without a damp-proof membrane. Waterborne epoxy coatings offer a convenient and reliable solution accepted by the industry. In comparison to conventionally used coatings, waterborne epoxy coatings are able to breathe.

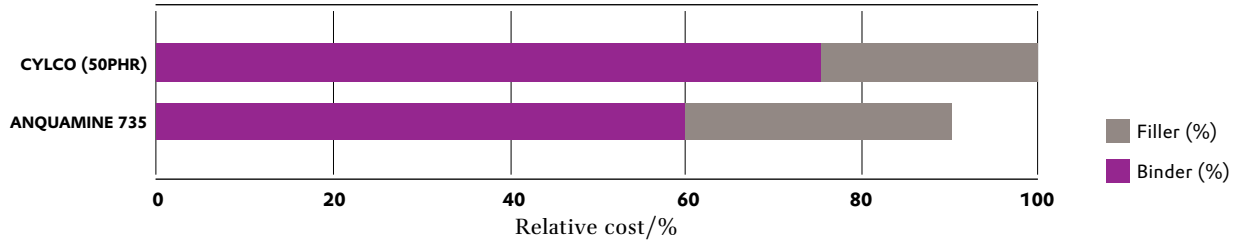
This water vapor permeability alleviates pressure buildup, thus eliminating blister formation and coating delamination.

By proactively using waterborne self-leveling coatings, the expensive repair cost for failed conventional coatings has been successfully eliminated.

Figure 1 highlights why waterborne epoxy systems are used in this problematic application. The permeability of the waterborne coating also allows for the application on fresh concrete (less than 28 days old), allowing a faster return-to-service. This advantage has been successfully implemented in practice.

FIGURE 2

Relative cost savings of waterborne technology versus traditional systems



COST SAVINGS THROUGH EFFICIENCY AND EFFECTIVENESS

Waterborne systems provide a combination of optimum performance and cost-effective concrete protection. For instance, the application of a 1/8-inch-thick waterborne self-leveling system based on Anquamine 735 curing agent offers a cost benefit over 100% solids technology due to the formulating advantages of the waterborne system.

In 100% solids systems, an excess amount of binder is required to offer self-leveling properties, which contributes to high material cost. In contrast, as shown in Figure 2, up to a 20% cost savings can be achieved through reduced resin demand and higher filler content. Flow characteristics are adjusted by incorporating water. With waterborne self-leveling systems, wet film thickness equals dry film thickness, allowing you to formulate to optimal protection with minimal use of binder.

A better cost performance is also evident in thin film applications with the use of Anquamine 721 curing agent. Waterborne epoxy coatings not only perform better but are easier and quicker to apply because they have no roller pickup or drag. With film thickness as low as 5 mils dry film thickness, faster coverage rates are achieved, saving time, material and labor costs.

With this cost-in-use benefit, epoxy protection is now more affordable.

A RANGE OF PRODUCTS TO MEET YOUR NEEDS

WATERBORNE SELECTION GRID

		CURING AGENTS FOR USE WITH LIQUID EPOXY RESIN							
		Anquamine 287	Anquamine 360	Anquamine 401	Anquamine 701	Anquamine 721	Anquamine 725	Anquamine 735	Aquawhite 100
Primer	Standard Primer	+	+	+	+	+++	+	+	
	Penetrating Primer	+++							
Thin Film	Standard Concrete Paint		+		+	+++	+		+
	Transparent Sealer								+++
	Institutional								+++
Thick Film	Self Leveling				+			+++	
	Tile Grout/ Adhesive				+			+++	
	Thermal Shock Flooring	+++							
Metal	OEM Primer				+	+++			
	PC/Marine				+	+++			

+++ Primary Recommendation + Alternative Recommendation (Blank) May or may not be acceptable

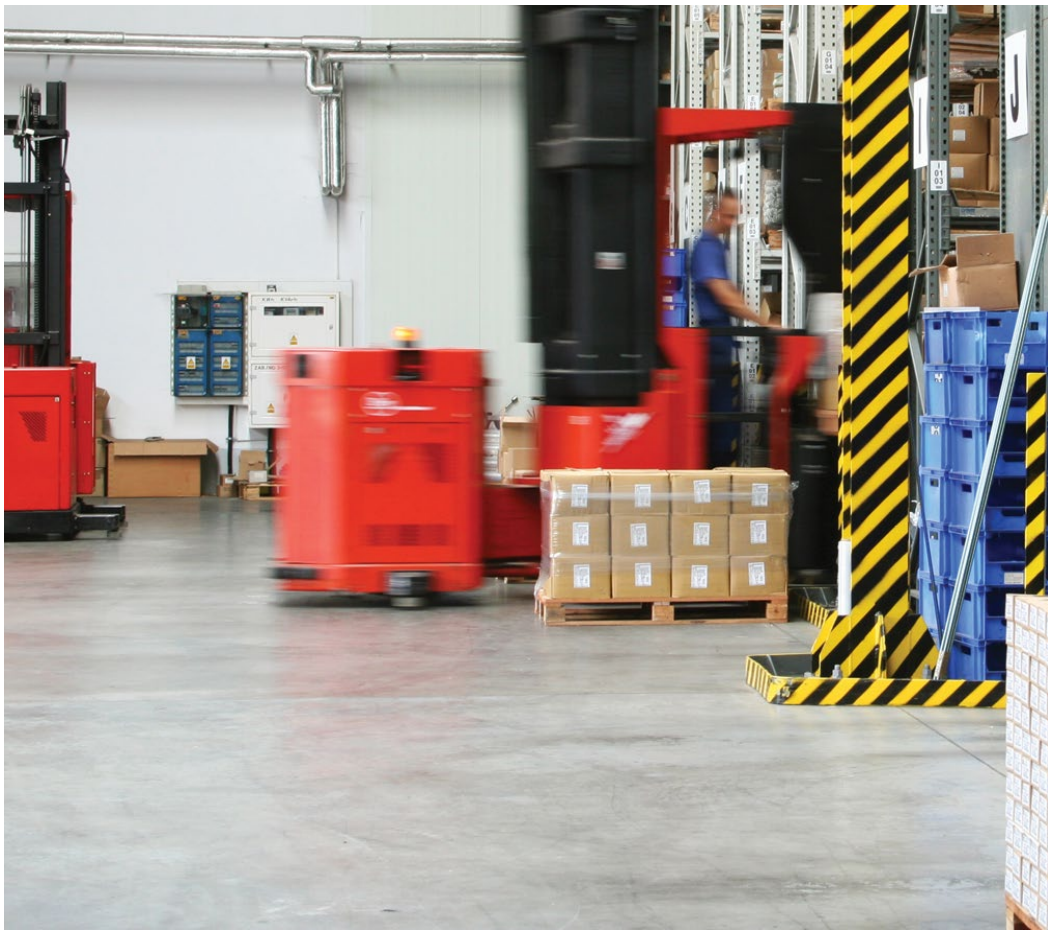
WATERBORNE PRODUCT OVERVIEW

CURING	% SOLIDS	VISCOSITY CPS @ 77°F	EQUIVALENT WEIGHT	COLOR GARDNER
Anquamine 735	55	5,000 –15,000	200	5
Anquamine 725	50	8,400	250	11
Anquamine 721	50	30,000	300	5
Anquamine 701	55	7,000	300	EMUSION
Anquamine 419	60	11,000	284	7
Anquamine 401	70	35,000	166	12
Anquamine 360	50	40,000	210	14
Anquamine 287	50	1,000	240	12
Anquawhite® 100	55	200	350	DISPERSION
Ancarez® AR555 & Ancarez AR550	55	200	1,300	DISPERSION

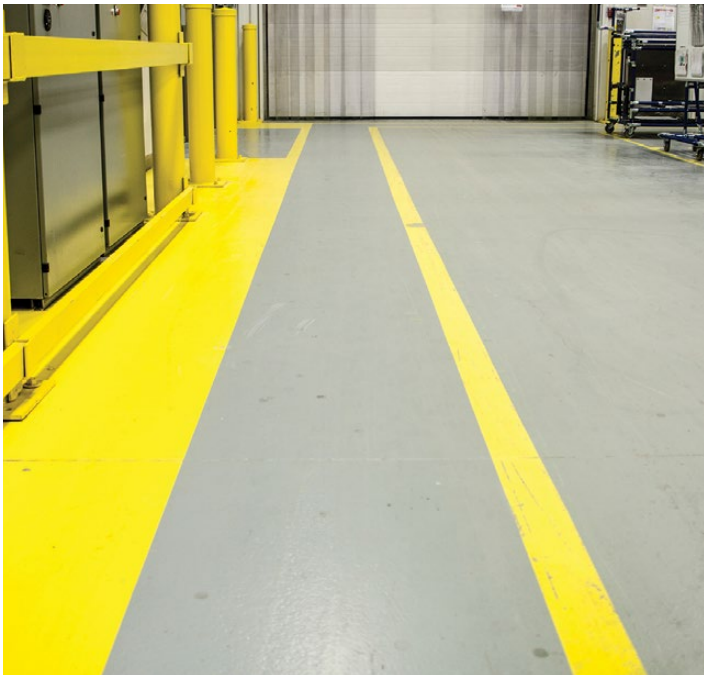
CURING AGENTS FOR USE WITH SOLID RESIN DISPERSION*

Anquamine 401	Anquamine 419	Aquawhite 100
+		
+		+
		+++
		+++
+++	+++	
	+++	

*for example, Ancarez AR555 and AR550



WATERBORNE EPOXY COATINGS IN ACTION



SCENARIO 1

A multistory parking garage will be refurbished and requires a primer. Further coats can be epoxy, polyurethane or another binder.

The key requirements for a standard primer are to fill the porosity of substrate and provide good adhesion to substrate and subsequent coatings (topcoats). In addition, this primer will seal the concrete to reduce the ingress of liquids, thereby increasing the coverage of the following coat. There is no need for good aesthetics, and nonpigmented systems are used.

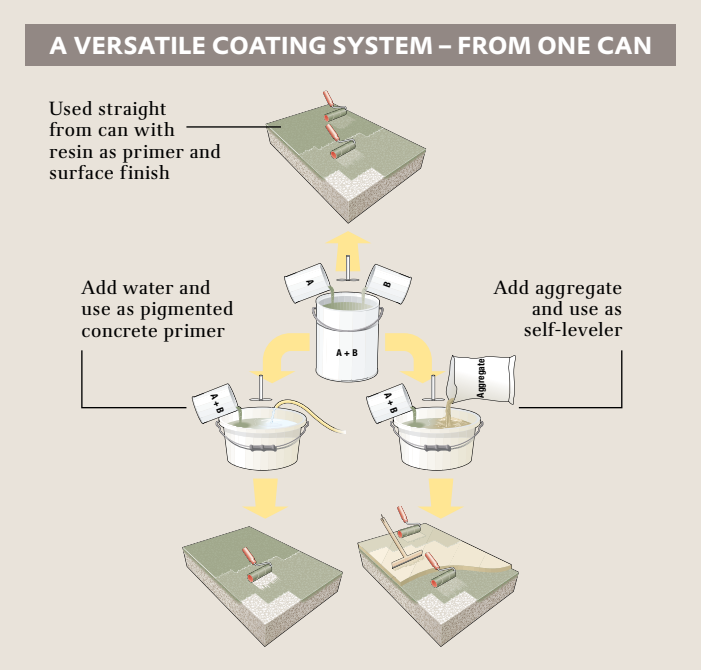
The first choice for a standard concrete primer is Anquamine 721 curing agent. This can be used with a standard liquid epoxy resin for best cost performance. Anquamine 721 curing agent offers excellent adhesion to both dry and damp concrete. This feature is particularly relevant to multistory parking garages, where damp concrete may be encountered and 100% solids technology could lead to adhesion failure. This primer provides a sound foundation, offering excellent intercoat adhesion to any further coating system, such as waterborne epoxy, 100% solid epoxy or other binder types, such as polyurethane. For all concrete substrates, a waterborne primer is the best technical solution and provides excellent results for any industrial or semi-industrial floor protection such as factory floors, supermarkets, showrooms or airports.

SCENARIO 2

A warehouse has a 1/4-inch screed applied floor that requires a fast return-to-service, high aesthetics, and low-color protective topcoat with good cleaning properties.

While heavy-duty functionality is provided by the existing screed system, an additional coating is used to provide the required aesthetics and cleanability. A waterborne epoxy topcoat provides a standard of surface finish and cost-effectiveness not met by alternative resin coatings.

You can choose from a number of waterborne epoxy systems, depending on your priorities. Anquawhite® 100 curing agent and Ancarez AR555 epoxy resin offer very fast dry speed of less than an hour with high gloss, low color and no carbamation issues. This coating will also provide high stain resistance and good cleanability. Alternatively, a waterborne paint system based on Anquamine 721 curing agent, as described in Scenario 3, could be used.



SCENARIO 3

A car showroom requires a medium-duty, cost-effective surface finish with good adhesion and return-to-service over the weekend.

Waterborne epoxy paints offer the best cost-performance solution for medium-duty flooring applications where appearance, easy cleaning, and good wear and tear under light traffic conditions are key requirements.

The use of a solvent-based paint is prohibitive in order to keep surrounding areas in operation. Alternatively, the installation of a 100% solids system would be too costly. Due to significantly higher film thickness, such coatings would be over-specified for the intended application. The waterborne concrete paint is easily applied 5 mils, providing optimum performance at a lower cost.

A concrete paint based on Anquamine 721 and standard liquid epoxy resin offers the required performance at significantly lower cost. Waterborne paint offers the greatest formulation flexibility, with the ability to produce a consistent matte, satin, nonslip or high-gloss surface finish as specified, which is problematic with 100% solids coatings Throughout the lifetime of the floor, damaged areas can be easily patch repaired/overcoated to maintain the high aesthetics at minimal cost. This cannot be done with 100% solids systems.

SCENARIO 4

For supply-chain optimization, a versatile coating system is required. Such a system is also attractive for small- to medium-size coating projects.

For smaller coating projects, a versatile system providing simplified logistics and waste reduction is a key requirement. The basis for this concept is a concrete paint formulation based on Anquamine 701 curing agent and standard liquid epoxy resin. This system can be used unmodified, as a standard concrete paint, or can be further modified via addition of aggregates to yield a high film build self-leveler. With the addition of water, the formulation can also be used as a pigmented concrete primer.

With this multipurpose coating, maximum versatility is achieved to save costs and reduce supply-chain and handling complexity.

WATERBORNE EPOXY COATINGS IN ACTION (continued)

SCENARIO 5

In a food processing area, a coating with high durability, chemical resistance and steam cleanability is required. The system must be installed over the weekend.

In hygienic areas such as food processing or pharmaceutical production, regular cleaning and repeated decontamination are required. Commonly used flooring for this type of application is a cementitious polyurethane system.

Waterborne epoxy flooring based on Anquamine 287 curing agent provides thermal shock and chemical resistance required for steam and chemical cleaning. In addition, it offers a cost-effective solution with a number of advantages. No carbon dioxide is generated during application, thereby reducing the required film thickness and cost of the flooring. The waterborne epoxy system also provides easy handling and favorable health and safety properties. Extremely rapid property development yields walk-on time within 4 hours, enabling a fast return-to-service and job completion within a day. This rapid cure is also highly sought after for fast turnaround repair jobs.

SCENARIO 6

A high-traffic factory floor requires a high abrasion and impact resistant coating.

For heavy traffic areas, such as forklift use, a film thickness of 1/8-1/4 inch is required to provide the necessary durability. Systems with self-spreading properties are an established technology to offer easy application and a smooth surface with high aesthetics. These are traditionally based on 100% solids technology. Now Anquamine 731 curing agent and a standard liquid epoxy resin provide all the necessary performance criteria at a truly competitive price. In addition, no plasticizer or solvents are required to obtain the necessary flow characteristics. The formulation provides low-emission floor protection with low flame spread and smoke generation to meet industrial standards.

Also, Anquamine 735 curing agent self-leveling coatings can absorb high impacts, such as impacts from falling objects, while maintaining surface integrity. As with conventional systems, the application of a primer is recommended, as described in Scenario 1. This coating provides a uniform matte surface which is ideal for high-traffic areas. For more decorative applications, such as reception areas, airports, or light industrial areas, the coating can be further modified to produce a variety of surface finishes.

Broadcasting of decorative fillers after application and subsequent sealing with a transparent topcoat produces highly aesthetic durable floor protection. A topcoat based on Anquawhite 100 curing agent and Ancarez AR555 epoxy resin will offer ideal performance and appearance. The same topcoat can be applied directly onto the self-leveling coating to produce a high-gloss finish.

SCENARIO 7

A manufacturer of OEM parts for commercial vehicles requires a VOC-compliant, highly corrosion resistant primer.

The primer will be spray applied in a factory with stringent VOC regulations where the use of solvents will be restricted. In addition, the coated parts require being stacked shortly after the coating process. Systems based on solventborne polyamide technology have an established track record for this application, offering high corrosion protection. An anticorrosive primer based on Anquamine 419 curing agent and Ancarez AR555 epoxy resin will offer similarly high corrosion resistance in excess of 2000 hours salt spray and a similar pot life of 6–8 hours. The fast drying time of 15 minutes at ambient temperatures allows for fast stackability of the coated parts. In addition, the primer based on Anquamine 419 curing agent and Ancarez AR555 epoxy resin exhibits high impact resistance to give long-lasting protection and formulations with low VOC content.

The formulations at right are a basic representation of a variety of application examples. More detailed formulations and performance data are available in Evonik's technical product literature.

BASIC FORMULATIONS

Concrete Paint	By wt.
Anquamine 721	31.0
Defoamer	0.3
Leveling agent	0.5
Pigment	8.5
Fillers	30.7
Water	29.0
Total	100.0
LIQUID EPOXY RESIN	**20.0**

Self-Leveler	By wt.
Anquamine 735	10.0
Defoamer	0.5
Pigment	3.8
Barium sulfate	13.0
Quartz powder	16.0
Quartz sand	45.0
Water	11.5
Thixotrope	0.2
Total	100.0
LIQUID EPOXY RESIN	**9.0**
Epodil 748	1.0

Thermal Shock Flooring	By wt.
Anquamine 287	42.0
LIQUID EPOXY RESIN	**33.5**
Quartz sand and powder	135.0
Portland cement type 1	34.0

Anticorrosive Primer	By wt.
Anquamine 419	180.0
Co-solvent	45.0
Water	45.0
Total	270.0

Ancarez AR555	660.0
Dispersant	20.0
Defoamer	5.0
Thickener	50.0
Red iron oxide	110.0
Strontium phosphosilicate	150.0
Zinc phosphate	100.0
Fillers	210.0
Water	195.0
Total	1500.0

MULTIPURPOSE COATING

Pigmented Concrete Primer	By wt.
Multipurpose base	120.0
Water	20.0

Filler/Self-Leveler	By wt.
Multipurpose base	120.0
Quartz sand and powder	120.0

Multipurpose Base	By wt.
Anquamine 701	31.0
Defoamer	0.3
Leveling agent	0.5
Pigment	8.5
Fillers	30.7
Water	29.0
Total	100.0
LIQUID EPOXY RESIN	**20.0**

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