

Product information

ANQUAMINE[®] 721

Curing Agent

DESCRIPTION

Anquamine 721 waterborne curing agent is a modified amine curing agent designed for use in waterborne epoxy coatings where cost effectiveness and high performance are key requirements.

Anquamine 721 curing agent can be formulated to low or zero VOC. It offers good pot life, good dry speed, and good emulsion stability even at low solids. Cured coatings exhibit high gloss, a balance of hardness and flexibility, and very good adhesion to concrete.

TYPICAL PROPERTIES

| Property | Value | Unit | Method |
|-------------------------|--------------|----------|----------------------------|
| Appearance | Amber Liquid | | |
| Color | 4 | Gardner | ASTM D 1544-80 |
| Viscosity @ 77°F | 40,000 | cPs | Brookfield RVTD, spindle 4 |
| Amine Value | 150-190 | mg KOH/g | Perchloric acid titration |
| Specific Gravity @ 77°F | 1.05 | | |
| Weight per Gallon | 8.74 | | |
| Flash Point | >200 | °F | Seta CC |
| Total Solids Content | 50 | wt% | |
| Equivalent Wt/{H} | 275 | | |
| Recommended Use Level | 140-180 | phr | EEW 190 |

BENEFITS

- Cost Effective
- Low Color
- High Gloss
- Good Hardness Development
- Good Flexibility
- Excellent Adhesion to Concrete
- Zero VOC

APPLICATIONS

- Concrete Primers
- Topcoats
- Wall Coatings

SHELF LIFE

At least 12 months from date of manufacture in original sealed container at ambient temperature. Store away from excessive heat and humidity in tightly closed containers.

STORAGE AND HANDLING

Refer to the Safety Data Sheet on Anquamine 721 curing Agent.

TYPICAL CURE SCHEDULE

**2 to 7 days at ambient temperature.
Gel at ambient temperature plus 2 hours at 212°F**

TYPICAL HANDLING PROPERTIES

| Property | Value | Unit | Method |
|---------------------------|-------|------|-------------------------|
| Potlife | 60-90 | min | * |
| Thin Film Set Time (23°C) | 5.5 | h | ASTM D 5895 Stage III * |

TYPICAL PERFORMANCE

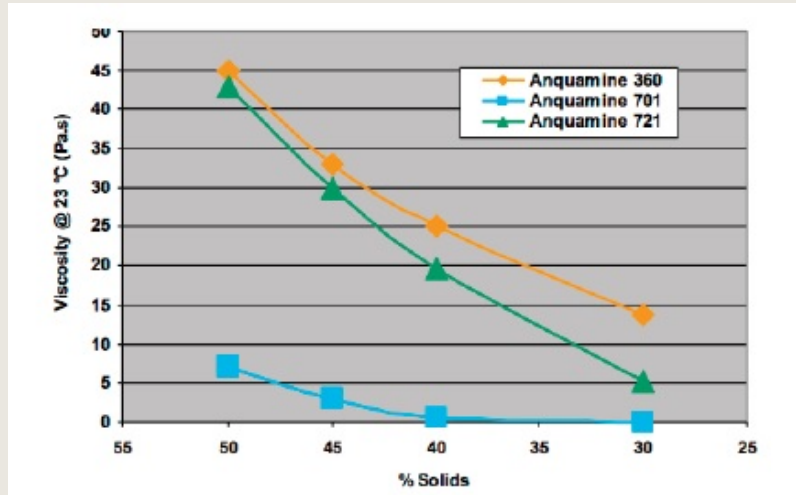
| Property | Value | Unit | Method |
|--------------------------------|-------|------|--------|
| Persoz Hardness 1 day @ 23°C | 175 | | * |
| Persoz Hardness 7 days @ 23°C | 260 | | * |
| Persoz Hardness 14 days @ 23°C | 300 | | * |

* Cured with liquid Bisphenol-A based epoxy resin (EEW=190)
Use level 150 phr, 40% weight solids in water.

DILUTION

Anquamine 721 waterborne curing agent exhibits good viscosity reduction upon dilution with water. Figure 1 represents the viscosity dilution profiles of Anquamine 721 curative compared to Anquamine 360 and Anquamine 701 curing agents. Anquamine 360 is an industrial standard water soluble polyamide and exhibits high viscosity retention on dilution. Anquamine 721 curing agent retains viscosity at low solids for cost effective concrete primer and paint applications. This property is beneficial to formulate and apply paint with high body at low solids.

FIGURE 1: DILUTION PROFILE ANQUAMINE 360, ANQUAMINE 701 AND ANQUAMINE 721 CURING AGENTS



POT LIFE

The viscosity profile of Anquamine 721 curing agent exhibits a stable viscosity for at least 60 minutes to yield cured coatings with a high and constant gloss throughout the pot life. 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 STANDARD LER EEW = 190, 150 PHR, 40% SOLIDS)

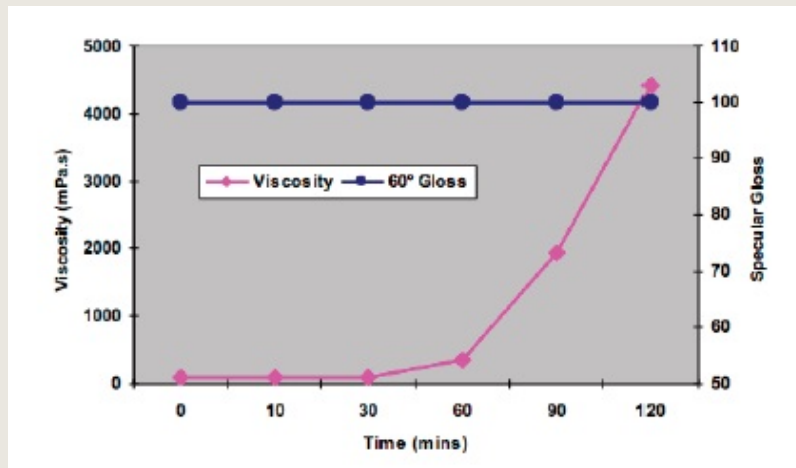
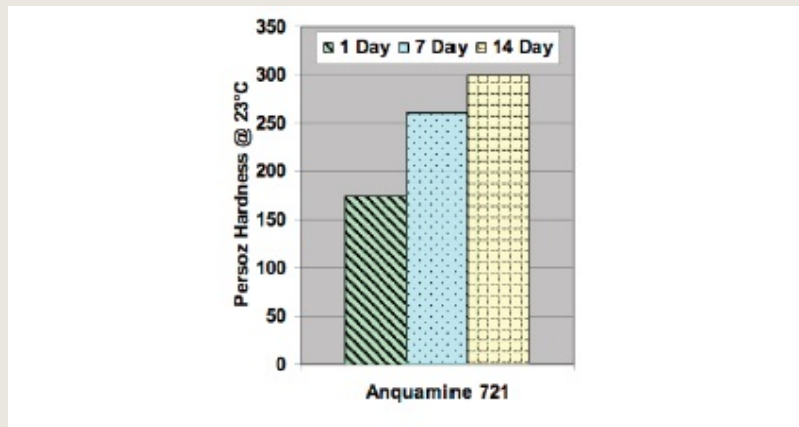


FIGURE 3: HARDNESS DEVELOPMENT AND DRY SPEED OF ANQUAMINE 721 CURING AGENT WITH LIQUID EPOXY RESIN @ 23°C



COATING PROPERTIES

Figure 3 shows the hardness development of unmodified Bisphenol A diglycidyl ether epoxy resin cured with Anquamine 721 curing agent using a mix ratio of 150 PHR. Anquamine 721 curing agent yields coatings with an ultimate hardness of approximately 300 as measured by Persoz pendulum hardness with undiluted liquid epoxy resin.

It is recommended to use Anquamine 721 curing agent at advised stoichiometry of 150 PHR (EEW=190). Anquamine 721 curing agent 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.

RECOMMENDED EPOXY RESINS

Anquamine 721 curing agent exhibits good compatibility with standard liquid epoxy resins based on Bisphenol A or F.

Reactive diluents 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 cured coatings.

When using diluent modified epoxy resins, it is advisable to add additional emulsifier to the epoxy resin. 5% emulsifier (based on epoxy resin weight) will improve epoxy diluent emulsification and avoid poor incorporation of the diluent into the coating.

A diluent level of 10% (based on epoxy resin weight) will yield a resin viscosity of approx. 2,000 cPs and deliver a good balance of handling and property development.

EMULSIFIERS

Additional emulsifiers are recommended for formulations such as DIY products which may be hand mixed with low shear.

The typical use level is 5% emulsifier based on epoxy resin weight. Emulsifiers are most effective when added to the epoxy resin component of the formulation rather than the curing agent component.

EO-PO block copolymers such as Pluronic® P123 co-polymer have been effective.

Nonyl Phenol Ethoxylates such as Igepal® CO-897 and Hydropalat® 65 surfactants have also been effective. If using Hydropalat® 65 surfactant, increase use level to 7.5% to account for the lower solids content.

DISPERSANTS / DEFOAMERS / WETTING AGENTS

Defoamers such as Surfynol® DF62, Dee Fo® P-I4, Tego® Foamex 822, and BYK® 045 are very suitable for use in coating formulations to give optimum air release and surface properties.

Pigment dispersants such as Surfynol® CT-131 and Disperbyk® 190 dispersants can be used to effectively aid in wetting pigments and increasing flow and leveling properties to give a system which yields good surface and flow properties.

Pigment dispersants should be pre-mixed with pigments before adding Anquamine 721 to avoid wetting pigment surfaces with Anquamine 721.

RHEOLOGY MODIFIERS

The Rheology of formulations with Anquamine 721 curing agent can be effectively controlled with the use of thixotropic agents such as polyurethane thickeners, hydroxyethylcellulose, and Bentonite clays.

Tafigel® PUR-55 and Natrosol® 250MHR modifiers have shown good thixotropic properties in paint formulations with Anquamine 721 curing agent, allowing for good application viscosity and anti-sag performance. However, due to the inherent thixotropy of Anquamine 721 curing agent Systems can be formulated without the need of external thickeners.

COLORANTS

Anquamine 721 is compatible with a variety of tint bases such as COLORTREND® PLUS, COLORTREND®, COVON® and TYNT-AYD® WD and UL tint bases. In general waterborne epoxies are most compatible with non-ionically stabilized tint bases.

STARTING POINT FORMULATION – 2K CLEAR CONCRETE PRIMER

This clear coating is ideal as a concrete primer to seal the pores in the concrete and to provide excellent adhesion to the substrate and the following coat. This formulation is designed for all types of cementitious substrates including damp concrete. This primer can be overcoated with all types of systems including other waterborne or solvent free coatings. The primer formulation has 100 g/l VOC.

The primer is prepared by mixing Component-A and Component-B for 2 minutes to produce a homogeneous emulsion (mechanical or hand mixing is acceptable). Once the emulsion is formed, the formulation is ready to use.

| Nb. | A-Component | | | BY WT. | BY VOL. |
|-----|--------------------|---------------------------|---------|--------------|-------------|
| 1. | Liquid Epoxy Resin | EEW = 190 | Various | 24.35 | 4.05 |
| 2. | Solid Epoxy Resin | EPON™ Resin 1001-H-75 | Hexion | 6.09 | 1.06 |
| 3. | Benzyl Alcohol | Various | Various | 1.24 | 0.23 |
| 4. | PM Solvent | Various | Various | 2.17 | 0.46 |
| 5. | Emulsifier | Pluronic® P123 emulsifier | BASF | 1.43 | 0.27 |
| | | | | 35.28 | 6.07 |

A-Component Manufacture Procedure:

- Charge components 1-2 and stir until homogeneous at low shear rate.
- Add remaining components at low shear rate.

| B-Component | | | | | |
|-------------|--------------|-----------------------------|-----------------|--------------|--------------|
| 6. | Curing Agent | Anquamine® 721 curing agent | Evonik | 37.27 | 6.85 |
| 7. | Defoamer | Dee Fo® PI-4 defoamer | Ultra Additives | 0.19 | 0.04 |
| 8. | Defoamer | Surfynol® 420 surfactant | Evonik | 0.37 | 0.08 |
| 9. | Diluent | DI Water | Local | 26.27 | 5.07 |
| 10. | Acetic Acid | Glacial | Various | 0.62 | 0.11 |
| | | | | 64.72 | 12.14 |

B-Component Manufacture Procedure:

- Charge components 6-8 and stir until homogeneous at low shear rate.
- Add remaining components at low shear rate.

| | | | | | |
|--|--|--|--|---------------|--------------|
| | | | | 100.00 | 18.21 |
|--|--|--|--|---------------|--------------|

Notes:

Removing Solid Epoxy Resin will reduce VOC and moderately increase dry times
 Benzyl Alcohol is considered 100% volatile for VOC and Solids calculations
 Acetic Acid is added to extend pot life. Removing Acetic Acid will reduce VOC, shorten pot life and increase cure speed.
 Hardness development can be improved by adding Ancamine K.54 accelerator (typical level: 1% based on curing agent weight) to the curing agent side of the formulation.

TECHNICAL DATA

| Property | Unit | Value |
|------------------------|---------|----------------|
| Mixing ratio - A to B | vol | 1:2 |
| Solid Content - Mix | % | 47 wt / 50 vol |
| Pot life | minutes | 60 |
| Mix Viscosity | | |
| Initial | cPs | 665 |
| 60 minutes | cPs | 900 |
| 90 minutes | cPs | 3300 |
| Dry Time (BK Recorder) | | |
| Thin film set time | hours | 8.5 |

STARTING POINT FORMULATION – 3K CLEAR CONCRETE PRIMER

This clear coating which is ideal as a concrete primer system is prepared by taking 60 parts of Anquamine 721 curative and diluting to 40% solids. This is then mixed with 40 parts of component A 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 cPs.

| Nb. | A-Component | | | BY WT. |
|---|--------------------|-----------------------------|---------|--------------|
| 1. | Liquid Epoxy Resin | EEW = 190 | Various | 40.0 |
| B-Component | | | | |
| 2. | Curing Agent | Anquamine® 721 curing agent | Evonik | 60.0 |
| 3. | Diluent | DI Water | Local | 15.0 |
| | 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

| Property | Unit | Value |
|----------------------------|---------|--------------|
| Mixing ratio - A to B to C | weight | 40 : 75 : 60 |
| Density - Mix | lb/gal | 8.5 |
| Solid Content - Mix | Wt % | 40 |
| Pot life | minutes | 60-90 |
| Mix Viscosity | | |
| Initial | cPs | 200 |
| 60 minutes | cPs | 280 |
| 90 minutes | cPs | 1400 |
| Dry Time (BK Recorder) | | |
| Thin film set time | hours | 5.5 |
| Persoz Hardness | 1 day | 175 |
| | 7 day | 260 |
| | 14 day | 300 |

STARTING POINT FORMULATION – SEMI-GLOSS WHITE CONCRETE PAINT

This semi-gloss enamel is designed to produce tintable high aesthetic topcoats. Anquamine 721 curing agent exhibits exceptional pigment paste compatibility so that a variety of custom colors can be produced from one base formulation.

The paint formulation has 112 g/l VOC and can be readily modified to meet lower VOC targets.

The paint is prepared by mixing Component-A and Component-B for 2 minutes to produce a homogeneous mixture (mechanical or hand mixing is acceptable). Once mixed, the formulation is ready to use, no induction time is required.



| Nb. | A-Component | | | BY WT. | BY VOL. |
|-----|-------------------------|---------------------------|-----------------|--------------|-------------|
| 1. | Liquid Epoxy Resin | EEW = 190 | Various | 141.8 | 14.7 |
| 2. | Emulsifier | Pluronic® P123 emulsifier | BASF | 8.5 | 1.0 |
| 3. | Microcrystalline Silica | Imsil® A-10 silica | Unimin | 73.6 | 3.3 |
| 4. | DI Water | | Local | 48.7 | 5.8 |
| 5. | Defoamer | Dee Fo® PI-4 | Ultra Additives | 1.6 | 0.2 |
| | | | | 274.3 | 25.0 |

A-Component Manufacture Procedure:

- Charge components 1-2 and stir until homogeneous at low shear.
- Slowly component 3 while increasing speed to 10-20 ft/sec.
- Grind with high speed disperser at approx. 70 ft/sec to a Hegman of 6.
- Add remaining component at low shear rate

| B-Component | | | | | |
|-------------|-------------------|-----------------------------|----------------------|--------------|-------------|
| 6. | Curing Agent | Anquamine® 721 curing agent | Evonik | 226.3 | 25.9 |
| 7. | Benzyl Alcohol | Various | Various | 32.7 | 3.8 |
| 8. | Acetic Acid | Glacial | Various | 9.9 | 1.1 |
| 9. | Defoamer | Tego® Foamex 822 defoamer | Degussa | 2.0 | 0.2 |
| 10. | Diluent | DI Water | Local | 62.6 | 7.5 |
| 11. | Dispersant | Surfynol® CT-131 surfactant | Evonik | 4.9 | 0.5 |
| 12. | TiO2 | Ti-Pure® R-960 TiO2 | DuPont | 143.5 | 4.4 |
| 13. | Talc | Talc WCD 399 | Brenntag Specialties | 81.0 | 3.4 |
| 14. | Defoamer | Surfynol® 440 surfactant | Evonik | 4.0 | 0.5 |
| 15. | Thixotropic agent | 2 % Natrosol® 250MHR | Hercules | 214.5 | 25.6 |
| 16. | Diluent | DI Water | Local | 19.0 | 2.3 |
| | | | | 797.1 | 75.0 |

B-Component Manufacture Procedure:

- Charge components 6-8 and stir until homogeneous at low shear.
- Slowly add components 9-11 at low shear.
- Slowly add components 12-13 while increasing speed to 10-20 ft/sec.
- Grind with high speed disperser at approx. 70 ft/sec to a Hegman of 6.
- Add remaining components at low shear rate.

| | | | | | |
|--|--------------|--|--|---------------|--------------|
| | Total | | | 1072.5 | 100.0 |
|--|--------------|--|--|---------------|--------------|

Notes:

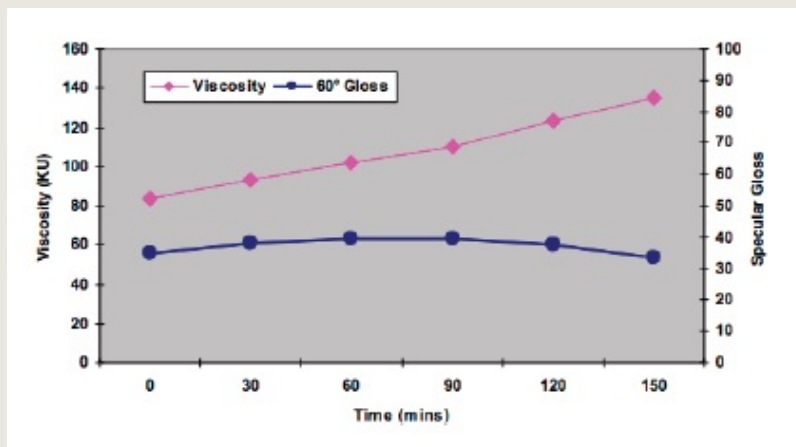
Benzyl Alcohol is considered 100% volatile for VOC and Solids calculations
 Acetic Acid extends pot life. Removing Acetic Acid reduces VOC, shortens pot life and increases cure speed. Hardness development can be improved by adding Ancamine® K.54 accelerator (typical level: 1% based on curing agent weight) to the curing Agent side of the formulation, in this formulation, 1-3 lb. Tint base such as COLORTREND® PLUS base from Degussa can be added to the B-Component; in this formulation 10 – 25 lb is acceptable.



TECHNICAL DATA

| Property | Unit | Value |
|--|---------------------|----------------|
| Mixing ratio - A to B | vol | 1:3 |
| Density - Mix | lb/gal | 10.73 |
| Solid Content - Mix | Wt % | 54 wt / 40 vol |
| Pot life | minutes | 2.5 |
| Mix Viscosity | | |
| Initial | KU | 85 |
| 1 hr | KU | 100 |
| 2 hr | KU | 125 |
| 3 hr | KU | >140 |
| Dry Time (BK Recorder) | | |
| Thin film set time | hours | 8.5 |
| Persoz Hardness | 14 day | 184 |
| Pencil Hardness | 14 day | 3H |
| Chemical Resistance | IPA rubs | Pass at 200 |
| | Toluene rubs | Pass at 200 |
| | MEK rubs | Fails at 62 |
| Chemical Resistance 24 hr spot test | Vinegar | Pass |
| | Lemon juice | Slight Stain |
| | Ketchup | Slight Stain |
| | Mustard | Stain |
| | 10% acetic acid | Softens, stain |
| | 30% nitric acid | Fails |
| | 60% perchloric acid | Fails |
| | Lactic acid | Fails |

FIGURE 4: VISCOSITY PROFILE AND 60° GLOSS OF ANQUAMINE® 721 CURING AGENT (SEMI-GLOSS CONCRETE PAINT STARTING POINT FORMULATION)



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