

W2K[®] 2002

WATER REDUCIBLE POLYESTER POLYOL

INTRODUCTION

W2K[®]2002 is a 90.0% NV water reducible polyester polyol designed for the use with aliphatic isocyanate prepolymers in the formulation of high performance, two component, water based urethane coatings. This polyol represents the latest introduction to our line of cost-effective, low VOC polyester polyols for water based systems, and is the first to possess the formulating latitude to produce coatings with dry times and UV resistance comparable to conventional solvent based urethanes. In addition, this technology allows the formulator to achieve dry film thickness of 3-4 mils without any of the out-gassing observed with other water based polyol technologies.

W2K[®]2002 also offers excellent emulsification and compatibility with aliphatic isocyanate cross-linkers, thus eliminating the need for surfactant modified, or water dispersible isocyanates. Properly formulated systems based on W2K[®]2002 also require no induction prior to application, thus providing a longer usable pot life. The resulting films provide an excellent balance of properties ideally suited for both interior and exterior urethane applications, including excellent dry and cure rate, high gloss and good gloss retention, abrasion resistance, flexibility, and very good solvent, fluid, and stain resistance.

APPLICATIONS

Only water based polyester polyol for use with conventional isocyanates

TYPICAL PROPERTIES

Viscosity (Gardner-Holt)	Z3-Z6
Non-Volatile Content	90 ± 2
Color	3 Max
Pounds per Gallon	9.5 ± 0.15
Hydroxy Equivalent Weight	280
Acid Value	10 Max
Solids (+/- 2)	90
Solvent	7.5% Water / 2.0%DMM / 0.5% TEA

PERFORMANCE HIGHLIGHTS

- Low Odor
- Low VOC
- Non-HAPA
- Formulation of "Low Cost" High Performance Water Based Urethane Enamels
- No Induction Time
- Dry Film Thickness of 3.5-4.0 mils with no out-gassing
- Rapid Surface Dry *
- Excellent Early and Ultimate Hardness Development
- High Specular Gloss
- Excellent UV Resistance *
- Flexibility Comparable to Solvent based Polyester-Urethanes
- Excellent Taber Abrasion Resistance

* For improved through-dry and long term UV durability, refer to "Modified Polyol Compositions"

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W2K® 2002 (continued)

SUGGESTED END-USES

W2K®2002 Water Reducible Polyester Polyol was designed for use in two component, clear and pigmented enamels for a variety of interior and exterior applications. Examples would include:

- OEM Applications requiring Low VOC and UV Durability
- Industrial Maintenance Finishes
- Business Machine Appliances
- Transportation Coatings

FORMULATION GUIDELINES

The Key to the formulation of high quality, two component water based urethane enamels is in the judicious selection, and usage, of the raw materials employed in these coatings. It has been shown that slight variations in coating composition can result in significant changes in coating stability, usable pot life, and ultimate performance. Thus, some of the essential aspects of formulation are reviewed in the following briefs.

STOICHIOMETRY

W2K®2002 Water Reducible Polyester Polyol has been shown to offer the high degree of film aesthetics and performance when formulated at a stoichiometry of 1.5 : 1.0 NCO to OH based on equivalents. Higher NCO levels may be employed to achieve superior hardness, abrasion, and fluid resistance, although at the sacrifice of some gloss. NCO indexing of 1.2 has also shown promise and should be considered in the formulation of coatings for “cost-sensitive” markets.

PIGMENTATION

Studies have shown that while W2K®2002 possesses the stability to allow for direct pigmentation, optimum gloss development is achieved using a “resin-free” grind base wherein the pigment is dispersed in a combination of water, dispersant, defoamer, and pigment. Pigments should be incorporated utilizing a dispersant that will minimize the pigment demand which must be satisfied by the vehicle. In addition, the pigment dispersant selected should also impart good stability to the “resin-free” grind base, and to the finished coating, as well.

Pigment dispersants such as a combination Degussa’s Tego Dispers 750W and Tego Dispers 760W have been found to be impart all of the above criteria for most prime and extender pigments when utilized at a level of 5.0-10.0% based on total pigment weight. The Tego dispersants should be employed at a ratio of 3.5-4 parts of Tego Dispers 750W to 1 part of the Tego Dispers 760W, by weight.

Other pigment dispersants which have shown potential in this system include BYK-Chemie’s Disperbyk 190, and to a lesser degree, conventional dispersants such as Rohm & Haas’ Tamol 731.

SOLVENTS

The use of solvents in two component water based polyol-isocyanate based coatings is severely limited by the high reactivity of the isocyanate resins with many of the co-solvents commonly utilized in the formulation of water based coatings due to the hydroxyl functionality possessed by these solvents. This would include virtually all glycol ethers and alcohols commonly used in water based systems to impart the desired stability, viscosity, film coalescence, and flow and leveling.

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W2K® 2002 *(continued)*

In contrast to several of our previous offerings, W2K®2002 has been shown to respond well to a low level addition of an ester solvent, such as PM Acetate (PMA). PMA, at a level of 2-4% of total coating volume, has been shown to impart the desired viscosity reduction, pot life, and gloss development for the formulation of two components water based urethanes, resulting in properties that rival their high VOC, solvent based counterparts.

Other solvents known to be stable the formulation of coatings based on W2K®2002 include low levels of N-Methylpyrrolidone, Diacetone Alcohol, and Dipropylene Glycol Di-Methyl Ether.

Despite the nomenclature, diacetone alcohol, or 4-hydroxy, 4-methylpentanone, exhibits minimal reactivity with aliphatic isocyanates due to its' ketone characteristics and hindered hydroxyls. Its high degree of water solubility imparts a rapid reduction in coating viscosity. Unlike conventional glycol ethers, Dipropylene Glycol Di-Methyl Ether, is an aprotic solvent which possesses no active hydroxyl functionality. This solvent has been shown to result in moderate viscosity reduction, with minimal impact on water resistance of the cured coating.

STABILITY

Coatings based on the W2K®2002 Water Reducible Polyester Polyol exhibit superior stability when formulated coating have a near neutral pH. In some cases, it may be necessary to add a low level of ammonium hydroxide to achieve the desired coating stability and usable pot life. Should such be necessary, the amine should be added at a level of 0.2-0.4% on total polyol solids and care should be taken to assure that the amine/level employed does not adversely affect gloss. Higher amine levels and less volatile amines should be avoided to ensure that the cure rate of the applied coating and the ultimate water resistance of the coating is not adversely affected.

CATALYSTS or ACCELERATORS for the Polyol-Isocyanate Reaction

W2K®2002 Water Reducible Polyester Polyol offers a significant improvement in reactivity relative to W2K®2000 and W2K®2001, in that this polyester polyol responds very well to catalysis while still maintaining a good usable pot life for most applications. As a result, W2K®2002 provides significant improvements in speed of dry, hardness, and abrasion resistance, in addition to major enhancements insolvent, fluid, and stain resistance.

Based on lab studies, catalysis with butyltin mercaptide (Metacure T-120 supplied by Air Products) produces the optimum balance of good early dry, usable pot life, and overall coating performance. Test results in low VOC white enamels and a catalyst level of 0.05% revealed that the Metacure T-120 provides the performance achieved with dibutyltin dilaurate (DBTBDL), without a major sacrifice in usable pot life. This is typically an indication that the catalyst is somewhat selective in promoting the polyol-isocyanate reaction, rather than the water-isocyanate reaction. The 0.05% catalyst level, based on total resin solids, results in excellent early cure and a usable pot life of 2-3 hours.

However, there are other catalysts which may also be of interest. The following exhibits the dry times, hardness, and pot life of several potential catalysts in a 17.0% PVC Gloss White Enamel.

FLASH RUST INHIBITION

In cases where the application of W2K®2002 based coatings may include direct-to-metal applications, a flash rust inhibitor will be required. Studies indicate that Flash-X 150 (Halox Pigments) provides excellent performance in these coatings at a level of 0.5-1.0% on total formula weight.

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MODIFIED POLYOL COMPOSITIONS using W2K®2002 Water Reducible Polyester Polyol

The W2K®2002 Water Reducible Polyester Polyol exhibits good compatibility with many potential resinous modifiers. This compatibility, coupled with the strong emulsification characteristics of the W2K®2002, make it possible to enhance certain aspects of W2K®2002 coating performance without significant increases in the RMC. There are several hydroxyl functional water based polyols which have been found to impart notable improvements in the speed of dry and the exterior durability of W2K®2002 based enamels.

The selection of the proper modifier can have a notable impact on dry times of coatings based on the W2K®2002 Water Reducible Polyester Polyol. While the use of a catalyst has been shown to have a notable improvement on tack-free times of these systems, the use of a relatively high Tg hydroxyl functional modifier can reduce dry-through times by as much as 40%

For improved exterior durability, studies conducted using a 30% modification with selected polyols has resulted in two component, water based urethane enamels which exhibit virtually no loss of gloss or color change after 1350 hours of QUV exposure. In addition, the modifier identified will have little or no impact on the low formulated cost of un-modified coatings based on our W2K®2002 Water Reducible Polyester Polyol. For additional UV durability, the addition of Tinuvin 292 UV absorber and Tinuvin 1130 hindered amine light stabilizer is recommended.

It is also possible to utilize our W2K®2002 Water Reducible Polyester Polyol as a modifier for other water based polyols to improve cure rate, eliminate the need for hydrophilically modified isocyanates, and lower the formulated coating cost by as much as 10%. Effective use levels for W2K®2002 as a modifier for other polyols is typically in the range of 20-40% of existing polyol solids.

For the specific polyol modifier recommendations, please contact the Technical Service staff at US Polymers-Accurez.

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