ACTEGA Kelstar Technical Bulletin
History of Aqueous Coatings

THE HISTORY OF AQUEOUS COATINGS

Aqueous coating technology was initially taken from the floor care industry which has been around for many years. An early pioneer in the floor care industry was SC Johnson. Johnson developed a polymeric technology that enabled a glossy yet durable abrasion resistant coating to be applied as a protective finish to flooring.

In the late 1970's, aqueous coatings were first introduced in the Graphic Arts. The initial polymers that were designed for the floor care and finishing were modified to have properties that could be more effectively used in the Graphic Arts. This new generation of polymers had a wider range of formulating compatibility. Shortly after introduction, these new polymers when combined with new coating application equipment began to be used and applied on press to aqueous coat and produce folding cartons. The use of aqueous coatings began to be widely accepted in folding carton, commercial label printing due to continuing improvements in raw materials, OEM coaters and press modifica-tions with drying systems used with aqueous coatings. Aqueous coatings offered significant advantages over traditionally formulated alkyd based overprint varnishes such as:

•Much Faster Drying
•Greatly Improved Work in Process
•Reduced Die Cutting & Finishing Times
•Improved Level of Protection For Finished Printed Products
•Greatly Reduced or Eliminated use of Spray Powder
•Non Yellowing
•Eliminate Gas Ghosting Commonly Associated with Alkyd Based Varnishes

In the early 1980's the market for aqueous coat-ings started to explode due the refinement of aqueous coating formulations, the wide acceptance and understanding of how aqueous coatings pro-vide the printers with the unique ability to print, aqueous coat in-line and go directly to finishing. This provided printers significantly more latitude and reduced the amount of racking of drying space previously needed because of the quick turn around times in the pressroom and finishing.

Commercial printers have many short run jobs that are required to be sent directly to the finish-ing department for cutting, folding and collating. Aqueous coating provides the printer the ability to reduce the amount of time needed to finish jobs and enables the printer to save valuable floor space in the pressroom. The commercial printers have a variety of jobs that require many different-ly formulated aqueous coatings such as primers, gloss, high gloss, satin, matte, heat resistant, along with many types of specialty coatings.

One of the most important developments with aqueous coatings was the introduction of Work & Turn coatings. Work & Turn coatings are formulat-ed for two sided printing and have additional block resistance built in. This extra block resistance is necessary when the printed and coated sheets that are exposed to the heat of Infrared lights (IR) generate during the second pass of printing and coating. Because Work &Turn coatings are formu-lated for two sided printing it has given the printer the ability to print, aqueous coat inline and then immediately turn the sheet over and print and aqueous coat the other side.

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Before the formulation of aqueous Work & Turn coatings the printers would have to wait anywhere from many hours to several days depending on the stock and ink coverage before the job would be dry enough to print the second side of the job. The printers now with the advanced aqueous coating formulas and coating/press drying equipment find it very easy to use aqueous coatings. The handling of aqueous coatings is very easy because most aqueous coatings are non-hazardous mixtures based on an acrylic water based polymers which are easy to handle and clean up with water. Washing up and changing over from one coating to another can be completed in a few minutes and is commercially accepted throughout the industry.

• **Chemical Composition** - Aqueous coatings are formulated from acrylic resin and styrenated acrylic copolymers. Polymers are synthesized by reacting acrylic acid with styrene, water and copolymers. Aqueous coatings generally contain 40% solids and 60% water. Because water represents the largest single constituent, these coatings are referred to as "Aqueous or Water Based Coatings".

• **Aqueous Coating Formulations** - Utilize select alkali soluble resin systems, and polymers with various additive packages, which are balanced to achieve specific performance characteristics of:

•Gloss
•Rub Resistance
•Runnability
•Low Odor
•Slide Angle / COF "Low VOC"

FEATURES & BENEFITS OF STARKOTE AQUEOUS COATINGS

ACTEGA Kelstar Starkote aqueous coatings offer several distinct advantages over traditional alkyd oil based varnishes.

• **Factors Affecting Gloss**

There are several factors, which greatly affect the gloss value of the finished product. To better control gloss values, it is important to understand the following variables:

Physical Characteristics	Aqueous Coatings	Oil Based Varnish
Gloss	Excellent	Good
Dry Speed	Excellent	Poor
Rub Resistance	Excellent	Good
Use of Spray Powder	Minimal to None	Significant
VOC Level	Low	Medium
Yellowing	None	Severe
Clean Up	Use Water	Use Solvent

• **Substrate Holdout** - The better the substrate holdout, the better the coating will hold out on the surface of the sheet thus providing the desired characteristics of gloss and rub resistance. Substrate holdout greatly affects gloss, rub resist-ance properties and drying speed.

• **Ink Formulation** - Ink formulation will also affect coating holdout and wetting characteristics. Inks should be wax free or limited to polyethylene wax so that they do not interfere with the ability of the coating to lay smoothly and provide a uniform glossy film.

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• **Coating Weight** - The coating weight applied will greatly affect the gloss value of the finished product. The more coating applied generally provides better gloss readings at the same coating settings. Running a higher viscosity of 25 seconds in #3 Zahn Cup versus 20 seconds, generally provides higher gloss readings. Coating roller speed and roller settings have a tremen-dous effect on coating weight.

• **Coating Selection** - The coating selection will have a significant impact on the gloss levels of the finished coating. It is important to select a product, which has good film formation charac-teristics, optical clarity and drying speed. Higher solid coatings generally provide higher gloss, but dry slower. The coating manufacturers should match the coating with the coater, drying system, and type of work.

• **Rub Resistance -** Rub resistance is a critical standard test method used to ensure that the coating on the printed sheets properly protects the sheets while in finishing operations, shipment, and later during product use. A coating, which provides adequate rub resistance, will resist scuffing and abrasion during these processes. Rub resistance is measured using a Sutherland Rub Tester, which is equipped with a standard four pound weight. Rub resistance is generally tested face to face, but can also be evaluated face to Kraft paper or face to back. Standard test methods require cutting two pre-measured samples. One sample is affixed to a test arm and the other is secured as the base sheet. The Sutherland Arm will then move back and forth to test rub & abrasion characteristics. A coating failure is recorded when the surface of the coating and ink are broken which result in a scratch or abrasion.

On a Sutherland Rub Test each cycle consists of two rubs or strokes. When a customer specification calls for 500 cycles this corresponds to 1000 rubs or strokes. Standard rub resistance specifica-tions range from 50-1000 cycles depending on the product requirements.

Contact ACTEGA Kelstar at 856 829 6300 or info.actega.kelstar@altana.com for additional information or technical assistance.