INTRODUCTION

This booklet is intended to acquaint you with Aqueous Coatings. As with any aspect of the printing process, aqueous coatings are easy to understand once you are familiar with the basics. Most printers find it takes very little time to begin coating, and there are relatively few critical aspects to quality coating. This book was written primarily for the commercial or packaging sheetfed printer, but the principles discussed here are the same for aqueous coating with flexographic or gravure processes.

Water-based overprint varnishes—aqueous coatings—have been in use for nearly 30 years. The benefits of these coatings make them ideal, if not necessary, for high-end commercial and packaging printers. It is difficult to find a high-end, sheeted press installed today without an in-line coater unit. In fact, every major press manufacturer now offers an aqueous coating unit for their sheetfed presses.

Today, a wide selection of high performance aqueous coatings offer advantages over traditional press varnishes and are quickly approaching the standards set by UV coating. The benefits of aqueous coating vs. press varnish are higher gloss, better durability [rub resistance], smoother feel [elimination or reduction of spray powder], and faster handling of the printed work. The selection of a coating depends on which of these features are most important for each job particularly when a typical commercial printer may use two or three different coatings.

We feel that you will find this booklet interesting and helpful. If you have any questions, please feel free to contact us.

Technical Staff
Fuji Hunt Photographic Chemicals, Inc.
50 Industrial Loop North
Orange Park, Florida 32073
800.354.2300 or 904.264.3500
www.fujihuntusa.com | www.anchorlith.com

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Gloss

In general, the term "gloss" is used to express the ability of a surface to reflect directed light. Gloss meters [see picture at right] are available to aid in quantifying this subjective evaluation. These gloss meters measure reflected light from the surface at various angles, typically 20, 60 and 85. The number represents the percentage of light reflected from the printed surface. The higher the number, the glossier the surface.

Most printers measure lithographic printed and water-based coated gloss at 60 degrees. Typical values are tabulated below:

<table>
<thead>
<tr>
<th>60 Degree Gloss</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SBS Stock [unprinted]</td>
<td>10-20</td>
</tr>
<tr>
<td>Low Gloss [satin, matte, dull]</td>
<td>10-30</td>
</tr>
<tr>
<td>80# Text [unprinted]</td>
<td>30-40</td>
</tr>
<tr>
<td>Aqueous Coated Cereal Box</td>
<td>40-50</td>
</tr>
<tr>
<td>80# Text [aqueous coated]</td>
<td>60-80</td>
</tr>
<tr>
<td>UV Coating</td>
<td>90+</td>
</tr>
</tbody>
</table>

Because aqueous coatings "add" to the gloss of the paper, one cannot predict the gloss of the finished job without first knowing the gloss of the stock. Often you will find that the higher the stock's gloss, the higher the gloss of the finished coated job. Typically, fast-drying "work-n-turn" coatings increase the gloss by 20-30 points. Specialty one-sided, high-gloss coatings can increase gloss by 35-40 points.

Drying Speed

Aqueous coatings "dry" by removal of water and ammonia from the coating solids. This typically happens through evaporation and through absorption into the paper itself. Several factors affect the time it takes before the job is dry.

Drying Equipment

The drying equipment is perhaps the most important variable that affects drying time of the job. Heat and air are the two main components utilized to dry the water-based coating. Because water evaporates best in contact with low humidity air, successful printers emphasize maximum air flow rather than heat to achieve maximum dry speed of aqueous coatings. We recommends a load temperature of 95°F for the first side, and less than 90°F, or no heat, to the second side of a two-sided job.

Many presses today are sold with "extended delivery" dryers. This is a longer drying chamber that employs infrared [IR] emitters, hot air knives, cold air knives, and extractors to remove the moist exhaust air. The long chamber allows the stock to have more moisture exchange time. Printers who have extended deliveries at the end of their presses have far more drying latitude, especially on difficult, high ink coverage jobs.

It is important to remember that the ink/coating system still requires 24 to 48 hours to develop maximum hardness and resistance properties; but, it can be handled if "care" is taken.
**Drying Speed**

**Other Variables Affecting Drying Speed**

- Coating drying speed
- Film thickness of coating
- Aqueous coatings have a tradeoff between dry speed and gloss. This is why the glossiest coatings are not suitable for two-sided "work-n-turn" jobs, but work well for one-sided jobs.
- Wide difference in stock, like SBS board [very absorptive] to foil [non-absorptive]
- Desired coating weight to be applied and final gloss
- Ink coverage and setting speed

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**RUB RESISTANCE**

When printed materials rub against machinery during finishing operations or against each other during shipping or handling, the printed surface is subject to a rubbing action that tends to wear or scratch the printed surface. Water-based coatings applied over the printed surface help to improve the rub resistance.

Several tests are available to help quantify the measurement of rub resistance. The most widely used in the industry is the Sutherland Rub Tester [see picture at right]. The tester is a motor driven device that moves a weighted test specimen over the printed sample. Typically, a four-pound weight is used to provide a contact pressure. The rub resistance is then given as the number of rubs required to just break through the printed surface.

Due to the many variations in characteristics of printing substrates, inks used, and manner of application, it is impractical to establish a single standard number of rubs. Standards should be set for each individual application.

**Tech Tip**—Many jobs have poor rub resistance because too much anti-offset powder [spray powder] is used. While this material aids in block resistance of the job, it can cause excessive scratching! Always run powder to a minimum.
**Slipperiness [COF]**

The coefficient of friction (COF) is a measure of the frictional force resisting movement of the coated surface to the force applied. The Slide Angle Tester [see picture below] is used to measure COF.

This basic instrument consists of a variable inclined plane and a sliding weight. One piece of a coated sample is clamped to the sliding weight and another is clamped to the incline plane. The incline is then raised until the sample begins to slide. The angle at which this occurs is noted as the static COF. The dynamic COF is measured by determining the angle of the incline plane at which the sled continues to slide after having been given a slight push.

Coatings generally can be made to be as slippery or as skid-resistant as the printer desires. There are trade-offs, as you might imagine. Ultra-slippery coatings cannot be used as a UV primer. They also have less latitude for foil stamping and gluing. Some non-skid coatings have only average rub and block resistance.

**Viscosity**

Coating viscosity is thickness or resistance to flow. There are a number of ways to measure viscosity, but the most practical for the printer is using a #2, #3 or #4 Zahn Cup Flow Viscometer [see picture below right].

The Zahn Cup is an open-top, stainless steel cylinder that has a rounded bottom, holed cup. The number corresponds to the size of the hole at the bottom of the cup. The larger the number, the larger the hole.

The Zahn Cup holds one to three ounces of liquid. Each cup works best for fluids that fall within a certain viscosity range. Most sheetfed printers use a #3 Zahn Cup. Flexo printers can use either #2 or #3 Zahn Cups. Gravure printers usually use #2 Zahn Cups.

To properly measure coating viscosity using a Zahn Cup, stir the coating and record the coating temperature. Dip the Zahn Cup in the coating to fill the cup. Lift the cup completely out of the liquid, and start a stopwatch when the top edge of the cup breaks the surface. Stop the watch when the steady flow of the liquid from the hole in the cup suddenly "breaks." Record the viscosity in seconds. Thoroughly clean the cup after use. Any remaining residue will alter your next reading.
Variables Affecting Viscosity

Temperature

Temperature of the coating will affect the Zahn Cup viscosity reading. Note the viscosity varies inversely with temperature—the lower the temperature the higher the viscosity.

This chart illustrates the effect of temperature on the viscosity of three typical water-based coatings.

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Low Viscosity Coating</th>
<th>Medium Viscosity Coating</th>
<th>High Viscosity Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>50</td>
<td>72</td>
<td>85</td>
</tr>
<tr>
<td>60</td>
<td>28</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>70</td>
<td>20</td>
<td>27</td>
<td>35</td>
</tr>
<tr>
<td>80</td>
<td>17</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>90</td>
<td>14</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>100</td>
<td>12</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>

Viscosity readings done using a #3 Zahn Cup

Too Cold

Because the viscosity will be higher than expected, the coating may sling, not lay smoothly, or orange peel. At the higher viscosity, more coating will be applied with a given setting. We do not recommend adding water to cold coating to reduce viscosity, because on press the coating may warm up and then become too thin.

Viscosity

Temperature

Too Cold

Tech Tip—Stage coating inside the pressroom the night before you need it.

Too Warm

During summer months, pressroom conditions may raise the coating temperature significantly. At 90°F, a 25-second coating may only have a viscosity of 15 seconds. This reduced viscosity will lead to a lesser application rate and a thin coat, giving lower gloss and rub. Printers who have hot summer conditions can specify a higher viscosity coating to use during summer months. Consult with our technical staff for advice.
Variables Affecting Viscosity [continued]

Transfer Rate

Viscosity greatly affects coating transfer rate, except in anilox [gravure] systems. The higher the viscosity, the higher the transfer rate. Coatings too high in viscosity will transfer too much coating on the paper. Coatings too thin will not transfer enough coating to the paper.

Fast-drying coatings will have a tendency to lose water during the course of a production run. Keeping the lid on the drum can minimize this effect. The pressmen should check coating viscosity every few hours.

Tech Tip—if your pressman sees sheets with a "ridge" of coating at the tail end of the sheet, chances are that there is too much coating transfer. Check the viscosity. We recommend that coating be stored and used between 66°F to 78°F, to minimize any viscosity changes on-press. The viscosity of our coating products is measured at 70°F. To compare your reading, adjust a sample to 70°F, or consult the graph for the viscosity at your temperature.

Water Dilution

Water will greatly affect viscosity of aqueous coatings. A 1% dilution [e.g., 1/2 gallon in 55 gallons of coating] will reduce viscosity by 4 or 5 seconds in a #3 Zahn Cup.

Printing Over Aqueous Coatings

Print designers are continually creating new jobs that push the limits of aqueous coatings technology. Printers have known for a long time that some aqueous coatings make an excellent primer for offline UV jobs, but more and more "specialty" jobs require foil stamping, gluing [pocket folders], ink jet [address labels], or the ability to go through a laser printer.

Ultraviolet [UV] Coating

Almost every high-end commercial printer sends a few jobs out to an offline UV printer. While some inks are receptive to UV coating, many are not; and it is impractical to inventory and switch inks for the occasional UV job. A select number of aqueous coatings can be used as UV primer. Printers who use these aqueous coatings can use their normal inks to print a job. Not all aqueous coatings work for this application. Talk to your coating representative to make sure the coating you are using can be used as a UV primer. In most cases, it is a good idea to qualify your aqueous coating, ink, and UV coating as a package.

Tech Tip—Occasionally, the offline UV printer will call the sheetfed printer to tell him he ran a few sheets of the job to be UVd and found poor adhesion. This usually occurs when a heavy ink coverage job is rushed. If the aqueous coating was designed as a UV primer, simply allow the job to sit for 24 to 48 hours. This will allow the ink solvents to volatilize from the sheet, thus improving adhesion.
Printing Over Aqueous Coatings

Foil Stamping
Many aqueous coatings are foil-stampable. Check with your aqueous coating representative for coatings that are receptive to foil stamping. Again, it is wise to qualify the ink, coating and foil stamp as a package.

Ink Jet
Some printers choose not to "spare out" an area for ink jetting address labels. Usually, water-based ink jets will not penetrate the aqueous coating surface and will smudge. Alcohol-based ink jet usually works well for this application.

Laser Printing
Most aqueous coatings will not re-melt when subjected to a laser printer. In addition, most laser printer inks will not absorb through the aqueous coating and will eventually flake off.

Ink Over Coating
Occasionally, a printer may choose to print the same side of a sheet twice, inking atop aqueous coating. While not impossible, it is difficult. Ink applied over coating cannot absorb into the sheet and will remain wet for a much longer time. Extra precautions to avoid offsetting should be taken including running small loads and using spray powder.

Press Settings

Drying with Infrared [IR]
Short to medium wave IR lamps are most effective to speed ink setting and coating drying. These are a must for very heavy coverage and thicker coating films. A load temperature of about 95°F is ideal for the first side, and no heat is ideal for the second side. If the load is too hot, the coating will soften and blocking may occur. Don't forget that ink gives off considerable heat during oxidative drying, which will cause the load temperature to rise after delivery. Keep this in mind when working with heavy coverage.

Short Wave IR
This is the most efficient form of heat drying, since the energy is not absorbed by the atmosphere. The energy is very penetrative and can be reflected. The lamps heat up and cool down quickly, which is good from a safety and economic standpoint.

Medium Wave IR
The emitters generate considerable heat, but much of it is absorbed in the air, an inefficient heating method. Additionally, the heat-up and cool-down times are longer than Short Wave IR.
**Press Settings**

**Air Knives**
Some press manufacturers recommend 30% air velocity to their air knives upon a new press start-up. Almost all printers increase the amount of air to 100% after a short while. Air is the most important factor in drying aqueous coating. The more air that is blown over the sheet, the faster water evaporates from the sheet, and the faster the coating dries.

On rare occasions, the coating and ink package may "mud-crack." This phenomenon is due to the coating drying much faster than the ink. Only in this instance should the printer consider cutting back the air velocity of his air knives.

**Tech Tip**—It is important that the air knives are aimed correctly during press installation.

**Roller Pressure**
You should adjust roller pressures per the manufacturers’ recommendations. A good guideline is to utilize the "kiss" method when adjusting pressures. This means using just enough pressure to maintain an even pressure between coater rollers and also between the applicator roller and blanket. The applicator roller should make contact just prior to or at the same time as the unit goes on impression.

**Coating Blanket**
It is recommended that you clean your coating blanket regularly. You should also check and fix any low areas. Utilize the "kiss" method when adjusting the application roller to make contact with the blanket. Assure that the blanket packing is trimmed properly. Normally, the blanket packing should be at least 1/4” smaller on all sides than the sheet size. Increase the packing, if necessary.

**Coater Types**

**Tower Coaters**
Once a novelty, tower coaters have now become the industry standard for sheetfed aqueous coating. These coaters are located after the last ink unit and allow for no loss of a printing unit. Coating can be adjusted by varying the roller speeds and gap adjustments.

**Plate Coaters—Coater Dampeners**
Coater dampeners utilize the last print station. The ink train is disengaged, and coating is put in place of fountain solution. Coating transfers from the fountain onto the plate, to the blanket, then onto the sheet. The amount of coating applied is adjusted by the gap and roller speed.

**Blanket Coaters**
Blanket coaters also utilize the last print station. A roller, or series of rollers, is used to transfer the coating to the blanket surface and then onto the sheet. The amount of coating being applied to the sheet is adjusted by the speed of the last roller and the gap.

**Ink Train Coaters**
Coating is placed in the last print station’s ink train. The dampener roller is disengaged, and coating is transferred from the ink rollers to the plate, then onto the blanket. This is a different kind of coating than normal aqueous coating. The most important difference is coating viscosity. Because the ink train coating must transfer through many rollers, the viscosity is much higher than coatings designed to transfer through two or three rollers. Consequently, ink train coatings typically dry much slower than conventional aqueous coatings.
COATING TYPES

Aqueous or Water-Based Coatings
Formulations for water-based coatings will vary depending on the end use. However, most water-based coating formulations contain the following key components:

- Polymeric resin—This ingredient is the base of the formula and provides the gloss film. This is usually styrenated acrylic, acrylic or polyester.
- Wax and/or silicone—These ingredients provide properties such as rub resistance, slipperiness (or non-skid property).
- Surfactants—These materials are added to provide improved flow and leveling.
- Additives—A wide variety of additives are included in small amounts to enhance certain properties of the coating. These include solvents, defoamers and optical brighteners.

Advantages of Water-Based Coatings vs. Varnish
- Reduces or eliminates need for spray powder
- Reduces waiting time for cutting
- Excellent rub and scuff resistance
- Glueable, foil stampable, can be UV'd
- Full loads, no racking
- Better gloss
- Non-yellowing
- Non-flammable
- Available in dull, gloss, semi-gloss

Electron Beam [EB] Coatings
EB coatings contain a catalyst that crosslinks the coating under EB accelerators. These coatings generally provide a high gloss, durable coating that is water and solvent resistant. There are disadvantages to using EB coatings including more expensive raw materials and special coating equipment. In addition, there are stringent government regulations regarding radiation exposure and employee protection.

Ultraviolet [UV] Coatings
UV coatings are polymerized with UV energy and produce a highly crosslinked system. A major benefit of UV coatings is that they typically have the highest gloss and rub resistance of all coatings. Other benefits of UV coatings are low VOC (they are nearly 100% solids) and the complete, rapid cure that provides immediate drying. The limitations of UV coatings are the health hazards in handling uncured coating, poor adhesion to some inks, no FDA approval for food contact, and expensive waste disposal issues. On a per-sheet basis, UV is three to 10 times more expensive than water-based coating, depending on whether the UV coating is done in-line or off-line.
COATING TYPES

Catalytic Coatings
Catalytic coatings dry via heat-induced polymerization. These coatings have higher gloss than aqueous coatings, but lower gloss than UV coatings. Catalytic coatings are typically restricted to trapping over dry ink, and have found their way onto web presses that have two ovens. The disadvantages to using catalytic coatings are the solvent emissions and the trace levels of formaldehyde that pose a significant industrial health hazard. In addition, there is no FDA approval for food contact. Catalytic coatings tend to have a relatively short shelf life and because high heat is needed to polymerize the coating, drying is a sometimes a problem.

Common Coating Problems and Solutions

Here are some common coating problems with suggested solutions. For a more detailed list, please consult our Troubleshooting of Aqueous Coatings publication.

Alligating or Mudcracking of Coating During Drying

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating is drying too fast to flow out.</td>
<td>Reduce warm air supply.</td>
</tr>
<tr>
<td>Specify a medium drying speed coating.</td>
<td>Anti-cracking lever is broken.</td>
</tr>
</tbody>
</table>

Backtrapping or Ink on the Coating Blanket

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coater activating late allowing ink to transfer to blanket at start.</td>
<td>Adjust timing for coater start.</td>
</tr>
<tr>
<td>Excess pressure between coating blanket and back cylinder causing thin coating application.</td>
<td>Adjust contact to &quot;kiss&quot; pressure. Reduce pressure until coating does not transfer, then tighten 0.001.</td>
</tr>
<tr>
<td>Too little coating applied to protect wet ink.</td>
<td>Turn up coater or run at higher viscosity.</td>
</tr>
<tr>
<td>Ink does not set before coating.</td>
<td>Check ink density, decrease setting time, use stronger ink.</td>
</tr>
<tr>
<td>Ink is pulled from sheet.</td>
<td>Try increasing tack to provide better adhesion of ink.</td>
</tr>
<tr>
<td>Ink is over-emulsified, reducing body.</td>
<td>Run as dry as possible, decrease water pick-up of ink.</td>
</tr>
<tr>
<td>Coating does not wet ink properly.</td>
<td>Check with ink supplier about wax and discuss with coating supplier.</td>
</tr>
<tr>
<td>Blanket packing not trimmed correctly.</td>
<td>Cut packing sharply 1/4 inch smaller than sheet.</td>
</tr>
</tbody>
</table>

Catalytic Coatings
Catalytic coatings dry via heat-induced polymerization. These coatings have higher gloss than aqueous coatings, but lower gloss than UV coatings. Catalytic coatings are typically restricted to trapping over dry ink, and have found their way onto web presses that have two ovens. The disadvantages to using catalytic coatings are the solvent emissions and the trace levels of formaldehyde that pose a significant industrial health hazard. In addition, there is no FDA approval for food contact. Catalytic coatings tend to have a relatively short shelf life and because high heat is needed to polymerize the coating, drying is a sometimes a problem.
### Common Coating Problems and Solutions

#### Build-Up of Coating on Blanket Outside of Sheet

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper adjustment between blanket and back cylinder.</td>
<td>Adjust packing to proper height.</td>
</tr>
<tr>
<td>Applicator roller set too tight to blanket.</td>
<td>Adjust for roller to &quot;kiss&quot; setting—1 to 2 mm.</td>
</tr>
<tr>
<td>Too much coating being applied.</td>
<td>Turn down coater.</td>
</tr>
<tr>
<td>Packing is not trimmed correctly.</td>
<td>Cut sharply 1/4&quot; smaller than sheet.</td>
</tr>
</tbody>
</table>

#### Build-Up of Coating at Trailing Edge of Sheet

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicator roller is not at same speed as blanket.</td>
<td>Check roller speed and adjust packing to minimize speed difference.</td>
</tr>
<tr>
<td>Blanket and back cylinder are set too tight.</td>
<td>Adjust for &quot;kiss&quot; impression to sheet.</td>
</tr>
<tr>
<td>Thick ink film under coating is not stable.</td>
<td>Increase setting speed of ink, run dryer, use stronger, tighter body inks.</td>
</tr>
</tbody>
</table>

#### Crawling, Fish Eyes, or Pinholing Over Ink

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating is not wetting ink.</td>
<td>Coating does not contain adequate &quot;wetting agents.&quot; Consult with our lab.</td>
</tr>
<tr>
<td>Defoamers, silicones, etc. are migrating out of coating causing fish eyes.</td>
<td>Consult with our technical staff for lab test of coating.</td>
</tr>
</tbody>
</table>

### Common Coating Problems and Solutions

#### Foaming

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level in reservoir pan is too low.</td>
<td>Increase coating level in pan.</td>
</tr>
<tr>
<td>Air is being introduced into circulating system.</td>
<td>Check seals on pump and lines for air leaks. Eliminate &quot;free-fall&quot; return into drum.</td>
</tr>
<tr>
<td>Recirculating pump is running too fast.</td>
<td>Reduce pump speed to just keep pan full.</td>
</tr>
</tbody>
</table>

#### Orange Peel Appearance

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating is not &quot;wetting&quot; ink properly.</td>
<td>Reduce wax, use only PE wax, or use NO WAX inks.</td>
</tr>
</tbody>
</table>
Calculating Coating Usage

We have studied the "normal" coating usage for printers. The general rule of thumb is about 1.25 pounds of wet coating are used for every 1,000 square feet of paper/board that is coated. Printers with anilox rollers may use less; about 25%. Most printers will use less than this. Our calculation includes a 15% safety factor. Always better to overestimate than to underestimate.

As an example, suppose a printer has a sheet that is 100% coated—this is usually the case. Most printers coat the whole sheet; this is called "flood" coating. Suppose the size of the sheet is 18" x 36." To convert square inches into square feet, divide each number by 12. This would give you 1.5 x 3.0, or 4.5 square feet per sheet. You could just have easily multiplied 18 x 36 = 648, then divided by 144 to get 4.5.

Next, determine how many sheets you intend to coat. For example, if you intend to coat 10,000 sheets and coat on each side, you will have 20,000 impressions. The total square feet to coat will be:

\[
\text{Number of Impressions} \times \text{Sheet Size [Square Inches]} = \text{Total Square Feet of Coverage}
\]

Thus:

\[
\frac{20,000 \times [18 \times 36]}{144} = 90,000 \text{ Square Feet}
\]

Or:

\[
20,000 \times 4.5 = 90,000 \text{ square feet}
\]

Since you will probably use 1.25 pounds of wet coating per 1,000 sq. feet of impression, you can see that:

\[
\frac{1.25 \text{ lbs. of Coating}}{1,000 \text{ Square Feet}} \times 90,000 \text{ Square Feet} = 112.5 \text{ lbs. of Coating}
\]
Glossary of Terms

Abrasion Resistance—Ability to withstand the effects of repeated rubbing and scuffing. Also called scuff or rub resistance.

Abrasion Test—A test designed to determine the ability to withstand the effects of rubbing and scuffing, e.g., Sutherland Rub Tester.

Acrylic—A general chemical term of a particular family of resins based on acrylic acid.

Adhesion—The state in which two surfaces are held together by interfacial forces. The measure of the strength with which one material sticks to another.

Air Knife—A tube with slots that is placed on the press. It is used to aim forced air onto the sheets or the web. Its primary use is to remove moisture and to aid in the drying of ink and coating.

Alcohol—A group of organic solvents widely used in flexographic inks.

Alligatoring—A film defect that resembles an alligator's hide or the bottom of a dried lake because of hairline cracks in the ink under a coating. Also known as mudcracking, it is primarily caused when ink dries much slower than the coating, typically in heavy coverage dark inks.

Ambient Temperature—A term used to denote the temperature of the surrounding air.

Anilox Roll—Mechanically or laser-engraved steel and chrome-coated metering roll used to deliver a controlled film of ink or coating to the substrate. The shape and size of holes or "cells" within the roll affect the volume of material transferred.

Antifoaming Agent—An additive used in ink that prevents or eliminates foaming of a liquid or breaks foam already formed.

Anti-skid Coating—A coating formulated to retard slippage during handling and stacking.

Applicator Roll—Coating roll, print roll, lacquer or varnish roll.


Backup Roll—See impression cylinder.

Binder—The adhesive components of ink or coating, normally supplied by the resin or ink/coating vehicle.

Blister—Small raised area, caused by expansion of trapped gas or fluid beneath the surface.

Blocking—An undesired adhesion between touching layers of material such as might occur under moderate pressure and/or temperature in storage or use; to the extent that damage to at least one surface is visible upon separation.

Block Test—A test used in measuring the tendency of surface-to-surface sticking.

Bloom—Material migration to the surface. Term usually used in reference to solid materials.

Brightness—The quality of whiteness intensity as emitted from printed or unprinted surfaces.
Glossary of Terms

Catalyst—A substance that alters [initiates or accelerates] the time needed for two or more substances to react.

Coating—A continuous outer covering of an object [such as sheet or paper].

Coefficient of Friction [COF]—Measure of the slip properties between two surfaces.

Craters—A film defect [see pinholing].

Dispersion—A uniform distribution of solid particles in a vehicle.

Doctor Blade—A bar or plate affixed across a roller designed to remove excess coating from being transferred to the substrate.

Emulsion—A type of mixture where two or more unmixable materials are held together in a homogenous mixture by the action of a third agent.

Evaporation—The changing from a liquid to a gaseous or vapor state, as when the solvent leaves the printed ink film.

Extended Delivery—The delivery is the portion of the press after the last print unit or coating unit. In this case, the length of the delivery section has been extended so that the printed sheet spends more time under air knives and IR lamps to assist in drying the ink and coating.

Film Former—A type of resin with qualities of forming a continuous film.

Finish: Dull or Matte—A dull finish; very low in gloss or reflectance.

Finish: Satin—A type of dull finish, although a little higher gloss than Dull or Matte.

Fisheyes—See pinholing.

Gloss—In printing, a term that indicates the amount of light that is reflected back when looking at a printed sheet. The gloss characteristics of the printed sheet are a combination of the stock, the inks and coating.

Gloss Meter—An instrument used to determine the reflected light, or gloss, of a printed sheet. The unit sends a beam of light at a specified angle to the piece being tested, and the unit then reads the amount of light reflected back to it. The higher the reflection, the higher the gloss reading.

Nonvolatile—That portion of a material which does not evaporate.

Offsetting—Undesired transfer of ink and/or coating from one sheet to another in the delivery pile.

Orange Peel—Description of the texture of both inks and coating that have the uneven appearance of an orange peel.

pH—The degree of acidity, usually of an aqueous liquid. Measured on a scale from 1 to 14, with 7 as the neutral point. Values below 7 are considered "acidic" while values over 7 are considered "basic."

Picking—The lifting of any portion of a printed surface.

Piling—The build-up of ink on rollers, plate or blanket.
Glossary of Terms

Pinholing—Small holes, usually between 0.1 mm and 2 mm, in the printed or coated surface.

Polymer—A compound formed by the linking of many simple molecules.

Sutherland Rub Tester—The most widely used test for checking the abrasion resistance and durability of a coating. The unit consists of a stationary table with a moving arm that has a weight, usually 2 or 4 pounds attached to it.

Viscosity—As applied to water-based coatings, it is a number that describes the thickness of a material.

Zahn Cup—A metal cup with a standardized size of approximately 3 ounces which has a hole in the bottom. The cups have standardized hole diameters for different viscosities of coating. Usually, sheetfed printers use a #3 Zahn Cup. Gravure printers typically use a #2 Zahn Cup. Flexo printers can use either #2 or #3 Zahn Cups.