COATINGS & ADHESIVES CORPORATION

Non-Absorbent Substrates 1.1

The use of a waterbased coating on non-absorbent substrates such as plastic, foil and poly-coated paperboard has many visual and functional advantages, however, proper planning and practices should be employed to ensure that results are positive, predictable and repeatable. The use of specially a formulated coating product designed for use on non-absorbent substrates can provide a fast-drying protective coating film while promoting the continued oxidative drying of beneath ink film layers. While waterbased coating product selection is a very important element in the overall success of printing on non-absorbent substrates, the entire printing process and consumables selection should be monitored to optimize performance and provide the most desirable results.

Consumable Considerations

Waterbased Coating - Non-Absorbent Substrates

Waterbased coatings formulated for non-absorbent substrates are fast-drying products that provide the necessary film porosity to allow beneath ink layers to oxidatively dry in the press-load. While waterbased coating products developed for use on paper dry by a combination of evaporation and absorption, the inability for a non-absorbent substrate to absorb moisture from the applied wet coating film makes the evaporation process the only means for drying. Waterbased coatings for non-absorbent substrates are therefore formulated with characteristics to promote evaporation of contained moisture in the applied wet film with the aid of the press drying system. While a coating product intended for a non-absorbent substrate can help provide successful results, other material and process related variables that need to be monitored and controlled:

- Substrate conditioning
- Ambient conditions
- Ink selection
- Fount selection
- Spray Powder Selection
- Coating application rate
- Press drying capabilities

Substrate Conditioning

Non-absorbent substrates should always be conditioned to ambient pressroom temperature prior to opening. As a general practice, the received substrate should be acclimated to the pressroom temperature in the supplied manufacturer packaging for at least 24 hours, or until the substrate has achieved the same temperature as the pressroom; this may require extended acclimation time depending on the temperature difference of the incoming substrate and the pressroom temperature. This conditioning for temperature is particularly important if the substrate is delivered or pulled from storage in a cold state. If the substrate is significantly colder than the pressroom conditions when opened, condensation can occur on the perimeter edges of the load and on the exposed substrate surface, resulting in impaired drying of applied inks/coating, poor print quality, and poor sheet separation. A probe thermometer can be used to pierce the packaging and measure the actual temperature of captive sheets in the load. Once the substrate temperature matches the ambient temperature of the pressroom, the manufacturer packaging can be removed.

General guidelines for substrate acclimation:

- Ideal storage/press-room conditions: 72°F, 45-50% RH; low RH can contribute to static, high RH can contribute to condensation development
- Paper acclimation time: 24-72 hours, ***actual temperature should be confirmed prior to un-wrapping

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Consumable Considerations - *continued*

Ambient Conditions

Pressroom conditions for temperature and relative humidity can influence the condition of the substrate in terms of static and printability, as well as ink/damp stability on presses without inking-unit temporization and ink/coating drying capabilities. Ideal pressroom conditions are considered 72°F, 45-50% RH. Conditions with the following characteristics can contribute to material and print-related issues:

- **High Temperature/RH**
  Condensation on the substrate surface is a consideration when the ambient conditions for temperature are significantly higher than that of the substrate, in particular when the RH is high. This can contribute to "vapor-lock" contributing to sheet separation issues at the feeder and infeed, as well as print-ability issues as excess moisture exists on the substrate surface prior to the printing process and ink/coating application. Excess moisture on the substrate surface that is absorbed by the applied ink/coating films can contribute to impaired drying. High humidity air that is used as the source air for Hot-Air-Knives(HAK) as well as high humidity air contained in the drying tunnel can inhibit moisture removal from the applied ink/coating films and impair the drying capabilities prior to the substrate reaching the press delivery-pile. In addition, high humidity ambient air that is trapped between the sheets and captive in the press-load will negatively impact the continued evaporative drying of the applied coating film and oxidative drying of the applied ink films.
- **Low Temperature/RH**
  Substrate static can develop in conditions with low humidity, <40%, which can contribute to sheet separation/feeding issues. Low temperature/humidity air trapped between sheets in the press-load can contribute to static development and "bricking" which can slow the oxidative and evaporative drying processes for applied ink/coating films and can cause ink-transfer/set-off to occur.

Ink

Inks selected for non-absorbent substrates should be high-solids formulations designed to achieve a color-match at a minimal film thickness while maintaining ink/dampening stability. Water pick-up of the selected ink should be minimal to improve drying performance on a non-absorbent substrate where evaporation is the only means for moisture loss. The selected inks should be formulated with the necessary drying oils to promote oxidative drying and polymerization in conditions where absorption and evaporation are minimized. Additional drying simulator additives for ink and fountain solution can be employed, however, the ink manufacturer should be consulted prior to use. Other ink considerations include:

- Inking rollers need to be in good condition and should be adjusted/set to press manufacturer's specifications.
- Overall ink density or Total Area of Coverage(TAC) threshold should be established at 240%. Under-Color-Removal(UCR) and Gray Component Replacement(GCR) can be employed to minimize TAC and improve drying performance
- On jobs using light ink coverage areas, the use of "take-off bars" added to the image area may be necessary to increase ink consumption to maintain ink/dampening stability and prevent excessive dampening emulsion into the ink which can impair drying.
- Presses equipped with temperization of the ink-fountain and inking-unit can enhance ink/dampening stability by maintaining the ink viscosity throughout a press-run.
- Ink additives such as tack-reducer and anti-skin sprays should be avoided to prevent impairment in drying performance.

Fountain Solution

Fountain solution selection should be qualified by a fountain chemistry supplier/manufacturer for use on non-absorbent substrates. Single-step fountain solution systems should always be avoided. Alcohol substitutes should not contain slow evaporating ingredients such as ethylene glycol/glycol ether. If available, the use of alcohol in conjunction with an etch to achieve a clean, non-image area plate surface with minimal dampening application is most desirable. Other fountain solution considerations:

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Consumable Considerations - *continued*

Fountain Solution *(continued)*

- Dampening system rollers need to be in good condition and should be adjusted/set to press manufacturer's specifications
- Fountain solution system should be completely cleaned; lines flushed, filters changed
- Fountain solution components should be dosed per supplier's recommendations; when using an automated dosing system, calibrate system prior to use
- Fountain solution pH target range should be 4.8 - 5.2
- Wetting agent concentration should measure 1.5 - 2.0% using a Brix Refractometer
- Fountain solution temperature should be set at 60°F when ambient pressroom temperature conditions are at or below 80°F. If ambient pressroom temperature is >80°F, the fountain solution temperature should be set at 20°F below the pressroom temperature.
- Pre-dampening and post-dampening settings should be minimal to avoid over-dampening the printing plate and inking rollers during start-up
- Dampening application rate should be minimum to achieve a clean printing plate; printing plate scum -line can be observed to monitor dampening application

Spray Powder Selection

Powder selection will be dependent on factors related to:

- Substrate thickness
- Ink coverage, ink product setting/drying capabilities
- Coating product setting/drying capabilies
- Press drying system capabilities
- Singe-side vs two-side applications

For light-weight substrates, 25-35 micron size spray powder particles are generally recommended to provide sufficient sheet separation in the press-load for ventilation to promote continued oxidative/evaporative drying of ink/coating films and temperature loss. For heavy/thick substrate types, it may be necessary to use spray powder particles >40 micron. The amount of powder application is a judgement based on the quality of powder coverage/distribution on the printed/coated sheet, ink coverage/saturation and drying system capabilities. For single-side applications, the use of a coated spray powder is recommended, particularly when using heavy/thick substrate types, to create the necessary separation of sheets within the press-load; care must be taken with coated powders as not to create a "gritty" feel to the final sheet surface by over-application. For two-side applications, un-coated powder is recommended to prevent contamination of printing plates/blankets during second-side printing which may contribute to reduced print quality/defects or loss of production due to frequent cleaning. It is always recommended to observe powder application by testing the system prior to use on non-absorbent substrates. Visual inspection of the powdered sheet by side-illumination will show the powder amount and coverage/distribution on the sheet surface.

Application Considerations

Coating Application Rate

Due to the non-absorbent nature of the substrate, it may be necessary to apply less coating compared to an absorbent paper or paperboard substrate. Since evaporation is the only means for drying, excessive coating application can result in slow setting/drying of the applied coating film, dependent on the capabilities of the press drying system. However, in cases where the beneath ink layers are heavy/saturated and slow setting, insufficient wet/dry coating application rate can cause crazing to occur. Additionally, issues such as ink transfer/back-trap onto the coating plate/blanket should be monitored when reducing the wet coating application rate with non-absorbent substrates using conventional printing inks.

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Application Considerations - *continued*

Drying System Capabilities	The press drying system capabilities must include Infrared Lamps(IR), Hot-Air-Knives(HAK) and Air-Extraction to facilitate evaporation of moisture contained in all ink/coating films to promote setting/drying prior to sheets entering the delivery-pile. The redundancy of drying system components contained in an extended-delivery configuration for progressive drying will provide the most favorable results for drying. Short-delivery presses with limited drying capabilities and sheet dwell in the drying tunnel may require heightened awareness of drying system settings and press speed to achieve sufficient drying results. Drying system operational considerations include: - **Infrared Lamps(IR)** need to be in good operational condition. IR lamps with operational hours >5000 should not be used for drying inks/coating on non-absorbent substrates due to loss of effectiveness and should be replaced. IR lamps should be cleaned prior to use on non-absorbent substrates to optimize performance. - **Hot-Air-Knives(HAK)** need to be in good operational condition. Heating elements and supply pumps should be functioning properly and supply hoses and HAK outlet/nozzles should be open and free of obstructions. - **Air-Extraction** needs to be in good operational condition and free of obstructions that may minimize exhaust capabilities of the system. Air-extraction volume must exceed the incoming HAK air-volume to ensure proper evacuation of high humidity air created during the drying process; exhaust air should exceed incoming air by 50%.
Drying System Operation	Operational settings of the press drying system must ensure proper setting/drying of applied ink and coating films by promoting evaporation of all contained moisture. The use of IR, HAK and Air-Extraction in combination will be used for setting/drying ink/coating films while not over-heating the substrate which can contribute to sheet distortion and excessive temperature of captive sheets in the press-load. The use of spray powder in conjunction with drying system operation will ensure continued drying in the press-load while also managing internal load temperatures.
Delivery-Pile Temperature	Pile heights should be kept small to prevent excessive weight of the pile which may impair continued oxidative drying of inks and evaporative drying of the coating as well as contribute to ink-transfer/set-off. In cases of light-weight substrates, this may include racking/traying sheets into small lifts, or for heavy/thick substrates, frequent load changes to keep the press-load heights small. Careful inspection of first loads off-press should be conducted to determine any quality defects so that the appropriate action can be made.
Winding/Handling Press-Loads	If careful inspection of the press-loads after printing shows that the ink/coating films are not drying at a reasonable rate, it may be necessary to “wind” the loads carefully and re-pile to ventilate the sheets and introduce air to stimulate oxidative/evaporative drying. Care should be taken as not to cause quality defects. When winding and re-piling, keep the rack/tray/pile heights the same, do not consolidate into larger piles.
Substrate Supplier/ Manufacturer Recommendations	Always take non-absorbent substrate Manufacturer/Supplier recommendations into consideration.

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