

### PUD Heat-Seal/Blister Coating - Materials/Consumables

#### Paperboard

- Special paperboard is recommended for heat-seal/blister applications which has a multi-grain direction to support the adhesion of the plastic shell/'blister' to the paperboard – typical substrate thickness range: 0.016” to 0.024”.
- Paperboard for heat-seal/blister applications are manufactured with a specialized clay coating on the board surface to allow for penetration of the blister coating to bond with the fiber-layer of the substrate – it is recommended to only use certified heat-seal/blister grade paperboard.
- Use of non-blister grade paperboard can result in clay-coating 'split' and no fiber-tear following sealing.
- If a single-directional paperboard is used, caution should be taken with respect to the grain-direction of the paperboard and the hanging direction of the finished product as the package will exhibit directional fiber-tear when the blister is removed:
  - Paper fibers will exhibit positive fiber tear in the grain-direction of the paperboard and negative fiber tear in the perpendicular/cross-grain direction.

#### Blister Shells

- 'Blisters' are thermo-formed plastic shells used to contain the product that will be heat-sealed/bonded to a blister-card (hang-card) or enclosed in a clamshell/fold-over blister package (trapped blister).
- Types of films used to create blister shells include: PVC, PETG, CAP, CAB, RPET, PET and APET.
- Attributes that are considered when selecting the type of plastic being used for a blister application include: transparency/clarity, flexibility/rigidity, heat sensitivity and adhesion potential.
- Heat-seal coating product compatibility should be confirmed/qualified for each plastic/film material type and sealing conditions prior to use for production to avoid sealing/bond failures.

#### Heat-Seal/Blister Coating

- INXCAC heat-seal/blister coating products are specialized polyurethane dispersion (PUD) waterbased coating formulations that use polyurethane polymers to create an adhesive bond between a blister shell and paperboard, or paperboard to paperboard.
- The advantages of urethane heat-seal/blister coatings are a more durable adhesive/seal result with excellent aging characteristics and is the current industry standard for running blister coatings in-line over inks.
- **Certain heat-seal coatings may not be applicable for all film types and should be confirmed/qualified prior to use – for heat-seal/blister coating product recommendations, please consult your INXCAC Technical Sales Representative.**

#### Inks

- Blister-grade ink types are recommended for heat-seal/blister applications.
- Wax and silicone-free inks are recommended for use with heat-seal/blister applications as any slip agents contained in the ink can negatively impact the adhesion/bond performance of the blister coating.
- Ink heat tolerance/exposure should also be a consideration for the sealing process – inks with a high-heat tolerance are recommended.
- The ink supplier/manufacturer should be consulted, and any ink system should be tested for performance prior to production use.
- Use of ink additives that can affect the drying-rate of inks or impact the adhesion of coating such as tack reducers and anti-skin/stay-open sprays should be avoided.
- Metallic/leafing pigment inks should be avoided in the sealing areas of the package – if necessary, metallic inks containing non-leafing pigments should be tested prior to production.

#### Fountain Solution

- Glycol-free fountain solution chemistries suitable for use with non-absorbent substrates are recommended to improve ink drying performance to avoid adhesion failures.
- If possible, alcohol should be used in place of alcohol replacements containing slow-evaporating glycols.
- Fountain solution parameters should be optimized and checked/monitored as they relate to print performance – pH, conductivity, Brix%.
- It is recommended to re-batch fountain solution prior to producing heat-seal/blister jobs to optimize ink/fount emulsion and resulting ink drying performance.

## Spray Powder

- Minimum spray powder application should be used to avoid sheet surface contamination that may interfere with sealing and contribute to sealing failures resulting in a poor bond/fiber-tear being achieved.
- Coated spray powders are not recommended for this application.
- Powder applications should be observed/monitored for jobs using a heat-seal/blister coating.
- 'Powder-crushing/removal' should be considered when excessive powder application is necessary during the printing process.

## PUD Heat-Seal/Blister Coating - Considerations

### Viscosity

- Coating viscosity is critical to ensure that the correct coating solids and resulting coat-weight is applied to the sheet to produce a sufficient bond/fiber-tear during the sealing process – don't dilute the coating during use.
- Coating viscosity should be paired with the anilox volume/engraving to ensure the correct transfer-efficiency and avoid circumstances of over-application which can cause flooding/beading and sheet-sticking in the press-load.
- Consult the INXCAC 'Waterbased Coating Viscosity Guide' for the viscosity measurement procedure and the coating product TDS for recommended viscosity range.

### Drying

- Good drying techniques/conditions should be employed to ensure that the inks/coating are properly 'set' during the printing process to avoid sticking/picking/bricking and quality-issues in the press delivery-pile.
- The use of infrared energy (IR), hot-air knives (HAK) and air-extraction (EXT) should be used to achieve a measured captive pile temperature of 90-95F using a stem thermometer or pyrometer.
- Press-speed and drying-system settings/operation should achieve adequate moisture removal from the applied coating-film and stimulate proper ink setting/drying to optimize coating performance.
- Drying systems that are not in good operational condition or lack any of the previously mentioned components/capabilities are not recommended for use with heat-seal/blister coating products.

### Drying-Time

- To ensure successful results when using heat-seal/blister coating products, adequate drying-time should always be allocated – a minimum of 24-hours of drying-time is recommended to ensure sufficient coating-film drying on printed/coated sheets prior to additional coating applications, second-side printing or finishing/sealing processes.
- Other variables in the printing process may require additional drying-time beyond the recommended 24-hours, including: ink drying rate, fountain solution dissipation rate, substrate absorbency, press drying-system condition/capabilities, drying system operation/exposure, press-load heat dissipation rate and ambient conditions for temp/RH.
- In cases where insufficient drying-time is allotted, quality-issues such as offsetting, sticking/picking, bricking/blocking, scratching/rub, coating-transfer to machine parts on finishing equipment and heat-seal adhesion/bond failures can occur.
- Based on all printing process variables, determination of proper drying-time should be identified and employed as part of a Standard Operating Procedure (SOP) when using heat-seal/blister coating products to ensure success.

### Coat-Weight

- Heat-seal/blister coating products typically require a dry coat-weight of 1.5 - 2.5 dry/lb 3000 ft<sup>2</sup> (substrate dependent) applied for paperboard – this amount is considerably more than is suggested for a general purpose waterbased coating and may require sourcing a larger anilox engraving/volume specific for heat-seal applications.
- Coat-weight testing is recommended to determine the capability of a press to apply and dry the necessary amount of coating for successful/repeatable sealing results.
- It is recommended to conduct coat-weight tests for each printing job and during a production run to monitor that proper coating film thickness is being achieved – it is common for coat-weight testing to be conducted at the start, middle and end of a production run to 'bracket' the pressrun with documented results.
- An insufficient amount of dry coating-film being applied can result in unpredictable bond/fiber-tear results during the sealing process and potential failures being achieved.
- In circumstances where an adequate amount of coating cannot be applied in a single application, a second application/'hit' can be applied to achieve the desired dry coat-weight results – in this case, it is recommended to allow the first application of heat-seal/blister coating to dry completely prior to the second application.

### Anilox Roll Recommendations

- Due to the required coat-weight to achieve successful sealing results, the anilox roll engraving specifications will be much higher than a general-use waterbased coating product.
- A typical anilox volume of 14-15 bcm/150-180 lpi is necessary to achieve the necessary coat-weight results.

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| <p><b>Wet vs Dry-trap</b></p>                | <ul style="list-style-type: none"> <li>- Heat-seal/blister coatings can be applied in an in-line/wet-trap application or off-line/dry-trap application depending on the production requirements and available equipment.</li> <li>- In cases where a single in-line application is unable to achieve the desired coat-weight, an additional dry-trap application/'hit' can be used to increase the overall coat-weight results.</li> </ul>   |
| <p><b>Coating Activation Temperature</b></p> | <ul style="list-style-type: none"> <li>- Depending on the specific heat-seal/blister coating product being used, an interfacial coating temperature of 170-200F is necessary to achieve sealing/bond of the desired surfaces.</li> <li>- This is not the same as the die/platen temperatures which are generally &gt;300F.</li> <li>- If additional finishing processes are required for the heat-seal/blister coated sheets prior to the sealing process, temperature exposure should be taken into consideration with the activation temperature taken into account.</li> </ul>  |
| <p><b>Heat-Seal Conditions</b></p>           | <ul style="list-style-type: none"> <li>- In addition to variables such as paperboard, ink and coat-weight, the variables of the sealing process include:             <ul style="list-style-type: none"> <li>• Die/platen temperature</li> <li>• Interfacial coating temperature</li> <li>• Dwell time</li> <li>• Pressure</li> </ul> </li> <li>- Establishing sealing parameters in conjunction with press/printing conditions helps to ensure that the sealing results become predictable and repeatable.</li> <li>- Typical sealing conditions for waterbased heat-seal/blister coating products are: 300-375F/60-80psi/2-3 seconds.</li> <li>- Sealing conditions are dependent on the package configuration, paperboard thickness/density, blister film heat sensitivity and coating product activation temperature.</li> </ul>  |
| <p><b>Contamination</b></p>                  | <ul style="list-style-type: none"> <li>- Polyurethane coating products are not compatible with acrylic coating products and will have a negative reaction when cross-contaminated – the result is typically the coating becoming congealed/solidified.</li> <li>- Cross-contamination can result in clogging of coating hoses, pumps and anilox cells which can require significant clean-up.</li> <li>- To avoid problems of cross-contamination, good cleaning/change-over procedures should be employed when switching to/from heat-seal/blister coating products – consult the INXCAC 'Heat-Seal/Blister Coating Change-over Procedure' technical document for best-practices.</li> <li>- <b>THOROUGHLY clean the coating circuit of all coating residue with ammonia/water mixture or INXCAC 501 Cleaner. Acrylic coating chemistry is NOT COMPATIBLE with polyurethane coating chemistry. The conventional acrylic coating, when exposed to blister coating, may create severe contamination of the coating circuit requiring additional cleaning. Residual blister coating remaining in the coating circuit can impair the functionality of acrylic coatings when contamination occurs. This can cause the acrylic coating to become unusable.</b></li> </ul> |
| <p><b>Shelf Life of Printed Sheets</b></p>   | <ul style="list-style-type: none"> <li>- Printed/coated sheets using a heat-seal/blister coating can have a shelf-life for sealing of (12) months or greater – this is dependent on the use of proper inks and paperboard as well as achieving the desired coat-weight during application.</li> <li>- It is advisable to use a shelf-life of (3) months until your process is qualified and aged.</li> <li>- Consult the INXCAC 'Blister Card Storage Guidelines' technical document for best practices and recommended storage conditions.</li> </ul>   |