

Foil Coat-Weight Test - Comparative v1.1

Testing Method

Scope

This test is used to measure the amount of dry/cured coating film applied to aluminum foil pieces to determine the coating application rate of the coating system. This procedure is useful to confirm the actual coating application rate OR “coat-weight” as it relates to wet coating performance during the printing/coating process and dry/cured coating performance on the coated substrate/final product. This test is applicable for Waterbased and UV/EB products.

Test Measurement Instruments

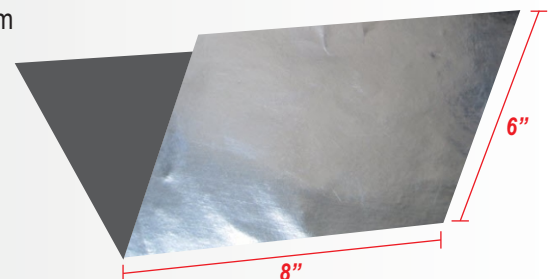
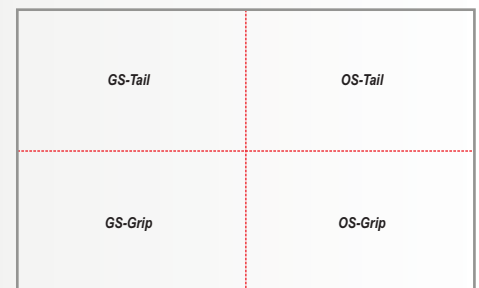
- Aluminum foil roll; “heavy duty” foil is recommended for easy-handling to avoid wrinkles
- Disposable gloves; powder-free
- Tape; 3M Scotch 810 recommended
- Measuring/cutting tools; example: table-top guillotine paper-trimmer with alignment grid/scale for precise cuts. For regular testing, it is recommended to have precisely sized cutting templates created.
- Analytical Balance; enclosed scale calibrated and capable of measuring 0.0001g

Testing Considerations

- Coating is mixed thoroughly prior to testing; temperature/viscosity is measured and documented
- No ink/varnish is applied to the foil pieces during testing; printing blankets are cleaned prior to testing
- No spray powder is applied to the foil pieces during testing
- Proper drying/curing is used during testing utilizing respective IR/HAK/Extraction or UV capabilities
- Test is conducted at a typical press production speed

Testing Procedure

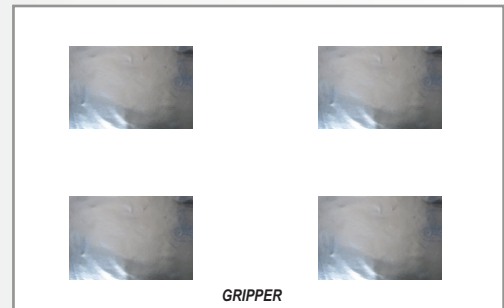
- 1.) Determine the substrate to be used for the test. Allocate enough substrate to allow for the press to reach a typical production speed prior to the foil test pieces reaching the coating unit. It is advised to coat multiple foil test pieces to create a large sample area for coat-weight testing. In sheetfed applications, this may require preparing multiple sheets with foil test pieces. In web applications, this may require affixing foil test pieces to multiple places on the web. For sheetfed applications, it is ideal to test each sheet with four foil pieces placed in sheet quadrants to comparatively measure “Operator v Gear” and “Gripper v Tail” sheet areas.
- 2.) Use powder-free gloves when handling the aluminum foil to avoid contamination with skin-oils. Remove a wrinkle-free piece of aluminum foil from the roll that is approximately 8x12” in dimension. Fold the foil piece in half with the “shiny” side out to achieve a 6x8” folded test piece. Avoid creating any wrinkles/creases in the foil test piece. Create enough folded foil test pieces to survey all test sheets



Testing Method - *continued*

Testing Procedure (*continued*)

- 3.) For sheetfed applications, mark the gripper edge of each sheet to be used for foil piece placement. Lay the folded foil pieces out on each sheet taking into account for any rollers and double-sheet detectors at the feeder/infeed, and sheet travel monitors within the press that may become disrupted by the foil placement. Be cautious of sheet cleaning devices that may tear or wrinkle the foil pieces and disable if needed. In the event that a patterned coating plate/blanket is being used, try and align the foil pieces in areas of significant solid coating areas for measurement.

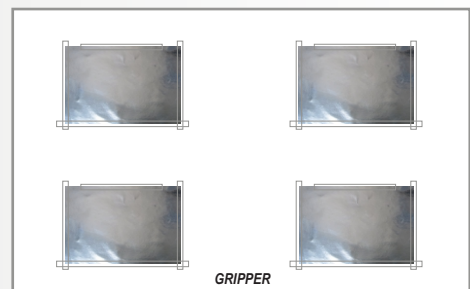


For web applications, find areas along the web path where the foil pieces can be easily placed. Allow enough web distance prior to the coating unit for a reasonable press speed to be achieved prior to coating application.

- 4.) Affix the foil pieces to the substrate using tape. Keep in mind to use a thin tape as not to smash the coating blanket/plate. A 3M Scotch tape product is suitable for keeping the foil piece attached to the substrate surface. When attaching the folded foil piece, place the folded edge in the direction of sheet travel/gripper or web direction. Tape securely across the entire folded edge and outer edges of the foil pieces. Since the foil piece has been folded over, there can be air trapped between the foil surfaces that needs to escape as it passes through the blanket/impression nip. Secure the open/rear edge with tape, however, leave openings on either end of the tape to allow for air to escape. If air is not allowed to escape due to all four sides being completely enclosed with tape, the foil piece can wrinkle and become unusable for measurement purposes.



- 5.) Insert foil affixed sheets into the feeder pile with 20-25 blank sheets on top to bring the press up to production speed prior to the foil sheets reaching the coating unit. If multiple foil test sheets are being used, separate each foil test sheet with 5 blank sheets. Leave 20-25 blank sheets beneath the last foil test sheet for continued feeding after the last foil test sheet has entered the press infeed.
- 6.) Make certain that all printing blankets are clean and free of ink/varnish/powder. Make certain all printing units are "off"; do not leave any printing units with impression "on". Make certain the spray powder device is "off". Coat all foil test sheets at a typical production speed with proper drying. Do not reduce press speed until the final foil test sheet has cleared the coating unit. DO NOT immediately remove the foil test sheets from the delivery-pile as this may result in scuffing/scratching if the coating film is not sufficiently dry. Allow foil test sheets to remain in the delivery-pile for >5 minutes before removing to ensure no defects in the applied coating film which may influence the final results.



Testing Method - *continued*

Testing Procedure (*continued*)

When removing the foil pieces from a web, it may be necessary to inch the press to an open position of the web path to access the foil pieces. A razor may be needed to cut the tape for foil piece removal to avoid damaging the foil or web. Be careful not to wrinkle the foil pieces during removal from the web.

- 7.) Once the foil test sheets/pieces have been removed from the delivery-pile or from the web, evaluate that there is even/complete coating coverage over the entire foil test pieces and that no voids in the coating film exist. Document the following information to accompany the test pieces for submission for coat-weight measurement:
 - Date
 - Coating product/batch number
 - Coating temperature/viscosity
 - Press manufacturer/model

Measurement/ Calculation Procedure

If performing coat-weight measurements internally, access to an analytical balance with values extending to 0.0001g is required. Additionally, a sized template will be helpful for precise cutting of coated foil samples prior to measurement to ensure accurate and repeatable results. Precise cutting of foil samples prior to measuring is imperative as small deviations in size can drastically effect the results when extrapolated out to 3000 ft².

When using waterbased products, make certain that the coating film is completely dry on the foil piece if coat-weight measurement will be conducted immediately. In this case, it is best to establish a process control procedure to determine adequate moisture removal/drying of the coating film. Use of an oven or hot-air drier with specific operational settings/time will ensure proper drying and accurate/repeatable results.

Foil Coat-Weight Calculation - Comparative Method

- 1.) Determine the measurement size based on available coating area on the foil samples, example 4x4". It is recommended to create a die for marking/tracing the sample area for cutting. If multiple foil samples are being cut/measured, the rounded tip of a Sharpie marker cap can be used to make a light impression in the foil piece for identification purposes taking care not to disturb the condition of the coating film on the foil surface.
- 2.) Cut each foil piece to size, and separate the pieces so that there is one piece with and one piece without coating from each sample. Keep the respective coated/uncoated samples together for measurement and coat-weight calculation. When measuring multiple samples, it may be necessary to create a chart to document results for coat-weight calculations.
- 3.) Separately weigh the coated foil piece and uncoated foil piece for each sample and document the weight results.
- 4.) Subtract the uncoated foil piece weight result from the coated foil piece weight result to calculate the actual coat-weight for the sample area.
- 5.) Calculate the coat-weight in g/in² by dividing the actual coat-weight result by the foil piece area in in².
- 6.) Use the following formula to convert to lb/3000 ft²: $g/in^2 \times 144 \times 3000 / 453.6 = lb/3000 ft^2$