Evaluation of Available ISO 13655 Backing Materials and Measurement Differences for the Packaging Industry

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Project goal

Current common status in the industry
- ISO 13655 Annex A – Good approach
- Reality from various aspects of the industry?

Content overview

- Project Goal
- Standard Guideline and DOE
- Understanding the Variances

Project goal

We need to identify some ISO 13655 compliant backers that are easy to obtain with cost in mind...

Example 1

Litho sheet-fed press console with a dark grey, glossy, metal surface backing that came from press manufacture
Example 2
Litho sheet-fed press console with a laminated melamine white board. Also used as a cutting table.

Example 3
From an offset printer’s ink room. Ink technician mixing base inks on a glass surface with white sheet underneath. The same surface are used as measurement backer.

Example 4
At a flexible packaging printer QC room. Translucent film are measured with a contrast card as backing for color and opacity.

Example 5
An in-line Spectro device mounted on a flexo or continuous-fed printing press, which has a specially painted white backer.

Standard guideline
- ISO 13655 (2017) – Spectral measurement and colorimetric computation for graphic arts images
  - Annex A – Sample backing
    - Standard Black Backing (BB)
    - Standard White Backing (WB)
Standard guideline

1.1. General

1.2. Measurement

1.3. Testing

1.4. Reporting

Experiment configuration

*Measurement devices:

+ TECHKON SpectroDens 4
  - Geometry – 0.45 optics according to ISO 5-4
  - Light source – LED, provides M0, M1, M2, M3 measurement conditions according to ISO 13655
+ 3NH Gloss meter YS60S
  - Geometry – 60° gloss meter according to ISO 2813 and GB/T 9754

+ Software

+ TECHKON SpectroConnect software for measurement data export

+ Backing samples

3NT-1 Ink Test (Black surface)
3NT-35 Ink Test (Black surface)
3NT-41 Ink Test (Black surface)
3B – Opacity (Black surface)
N2C-3 Opacity (White surface)
3NT-1 Ink Test (White surface)
3NT-35 Ink Test (White surface)
3NT-41 Ink Test (White surface)
3B – Opacity (White surface)
ISO Backer (Black surface)
Measurement Backer (Black surface)
Substrate Inspector Backer (White surface)
Gliden Onyx Black GLN62
BEHR Silky White PPU7-12U
PPG Snow Storm PPG1172-1
CGS PearlProof Super
CGS PearlProof Super Glossy
CGS PearlProof Super V
CGS PearlProof Super V NEU
Legion Semi-Matte 195 GSM
Legion Semi-Matte 240 GSM
Cromanet UltraPlus SM
Cromanet UltraPlus GL
Anonymous Semi-Matte
Leneta cards

Special request

- Not for sale
- Lunch price varies

$ 0.07 – $0.35 /sheet
$ 22 – $45 /Gal.
$ 125 /large, $ 15 /small
Standard Black Backing

- Standard Black Backing (BB)
  - Spectrally non-selective.
  - Diffusely reflecting
  - Opaque
  - ISO visual reflection density between 1.30 to 1.60

Standard Black Backing

- Spectrally non-selective
  - The total range of spectral diffuse reflection density throughout the wavelength interval from 400nm to 700nm does not exceed 5% of the average density obtained over the same interval

\[ \text{Reflection Density}(D) = -\log_{10} \left( \frac{\sum_{400}^{700} R \times w}{\sum_{400}^{700} w} \right) \]

Where:
- \( R \) = Measured reflection value
- \( w \) = spectral product of Status T weighted wavelengths
Standard Black Backing

• Opaque
  • No clear description from ISO 13655 but ISO 5-4 requires the following:
  d) The backing shall be essentially opaque (one whose own reflection density does not depend on the presence of or type of backing material used in its measurement)

Standard Black Backing

• ISO visual reflection density between 1.30 to 1.60

Standard Black Backing

• Diffusely reflecting
  • Little or no perceptible specular reflection when viewed at any angle less than 45° from the normal (ISO 8254-75* gloss less than 40GU)
  • Note 1 The same tolerance can be used with angles of 60° or 85° as used with inks and coatings.

Note: If sample’s average WB density is in its self-backing density range, this sample is considered opaque.

White Backing
Standard White Backing

- Standard White Backing (WB)
  - Opaque
  - Diffusely reflecting
  - CIELAB $C^*$ value shall not exceed 3
  - Non-fluorescing
  - Spectral reflectance factor values shall lie within defined range

Standard White Backing

- Opaque
  \[ O_b = \left( \frac{Y_b}{Y_w} \right) \times 100 \]

where

- $O_b$ is opacity (0°, 45°, D50, 0°, 2°, Y) of the backing material
- $Y_b$ is the CIE Y value computed from measurements made using black backing
- $Y_w$ is the CIE Y value computed from measurements made using a stack of at least three sheets of the material to be used for backing

Standard White Backing

- CIELAB $C^*$ value shall not exceed 3

ISO 13655 states:

“This is equivalent to reading the backing sheet with M1 and M2 modes and the differences at any wavelength greater than 410nm shall be less than or equal to 3σ... of 5 readings of the backing sheet using only the M2 mode”
ISO 15397 identified ΔB as a method to represent OBA levels:

\[ \Delta B = \text{CIE } b^* (M1) - \text{CIE } b^* (M2) \]

<table>
<thead>
<tr>
<th>OBA Level</th>
<th>Faint</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔB&lt;6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&lt;ΔB≤8</td>
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<tr>
<td>8&lt;ΔB≤14</td>
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</tr>
<tr>
<td>14&lt;ΔB</td>
<td></td>
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</tbody>
</table>

Spectral reflectance factor values shall lie within defined range:

Here comes the result...

What now?
To understand the variance in opacity measurement when different BB/WB are used, two BB and two WB are selected with three white ink on film with varying pigment load.

- **WB**: Munsell ISO Backer & ChromaChecker Measurement Backer
- **BB**: Leneta N2C-3 Contrast Card & ChromaChecker Substrate Inspector
- **White ink pigment load**: 200%, 100%, 50%

### Understanding the Variance

<table>
<thead>
<tr>
<th>200% Ink</th>
<th>100% Ink</th>
<th>50% Ink</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opacity</strong> Low</td>
<td>65.93%</td>
<td>56.97%</td>
</tr>
<tr>
<td><strong>Opacity</strong> High</td>
<td>67.07%</td>
<td>58.63%</td>
</tr>
<tr>
<td>&amp; 1.14%</td>
<td>1.66%</td>
<td>2.94%</td>
</tr>
</tbody>
</table>

Subject: Opacity

\[ \Delta O_B = (Y_b - Y_w) \times 100 \]

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- Annika Wiedemann – CGS
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**References**