ISO 13655
MEASUREMENT CONDITIONS

What they are and where they apply
ISO STANDARDS FOR THE PRINTING INDUSTRY

ISO 3664:2009
- Viewing conditions
- D50/2°

ISO 5 Series:2009
- Densitometry

ISO 13655:2009
- Spectral Measurement and Colorimetric Computation for Graphic Arts Images
- M-Standards introduced
WHY MEASURE?

• Process setup
• Process control
• Print specification
• Spot color matching
• Reporting
• Independent reference
• Easy to share

Better agreement between visual assessment and measurements
ISO 3664:2009 – VIEWING CONDITIONS

Light source
- Relative spectral power distribution must match CIE illuminant D50
- UV energy must meet CIE illuminant D50 (correlates to M1 within ISO 13655)

Two levels of light intensity conditions
- **P1** Critical Comparison: e.g. two prints: illuminance 2000 ± 500 Lux
- **P2** Practical Appraisal: less critical comparisons e.g. hardcopy to softproof: 500 ± 125 Lux or exact illuminance adjustment of lightbooth to monitor

Further definitions
- Homogeneity
- Surrounding: neutral gray diffuse surface
- Viewing angle to avoid glare
WHAT IS WRONG IN THIS SCENE?
THIS IS MUCH BETTER!
PAPER FLUORESCENCE (OBAS)
DIFFERENT LIGHTING CREATES DIFFERENT RESULTS

A - Tungsten

Daylight D50

TL84 – Retail Store

UV only
REFLECTANCE OF PAPER WITH OBA

Different UV Content in Light or Measurement Mode -> Different Result

<table>
<thead>
<tr>
<th></th>
<th>M0</th>
<th>M1</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>L*</td>
<td>94</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>a*</td>
<td>2,5</td>
<td>3</td>
<td>0,5</td>
</tr>
<tr>
<td>b*</td>
<td>-9</td>
<td>-12</td>
<td>-4</td>
</tr>
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Reflectance $\beta$ in %

Wavelength $\lambda$ in nm
REFLECTANCE OF PAPER WITHOUT OBA

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D50 - old | - new | - UVCut

Reflectance $\beta$ in %

Wavelength $\lambda$ in nm
Density and Colorimetry requirements harmonized

- For Graphic Arts all illuminants defined in 13655 allowed
- Spectral Calculation methods defined for Status Density
ISO 13655: 2009/2017 – MEASUREMENT CONDITIONS

Specifies spectral measurement conditions for graphic arts

- **Measurement geometry**
  - 0°/45° or 45°/0°

- **Backing**
  - **Black Backing**: Matte black substrate visual density 1.5 ± 0.2
  - **White Backing**: Matte white substrate w/o OBA,
    - 2009: L* between 92 and 96, C* below 3
    - 2017: C* below 3 and spectral curve defines reflectance (effectively lowering high end of L*)

- Provides a mathematical formula for substrate compensation
- Applies to press characterization, pressroom control, proof-print verification
ISO 13655: 2009/2017 – MEASUREMENT CONDITIONS

Specifies spectral measurement conditions for graphic arts

- Measurement illumination conditions
  - M0: Should be CIE Illuminant A (many legacy spectrophotometers)
    - undefined UV amount
    - covers unknown illuminants as well
  - M1: CIE Illuminant D50, 1 for paper (OBA) only
    - Part 1 is D50 match use for all fluorescence (ink, papers, etc)
    - Part 2 Calculated UV response to emulate UV excitation of OBA’s (for paper only)
  - M2: UV cut
    - Little energy below 420 nm, continuous illumination above
  - M3: Polarization Filter with UV cut equal to M2
    - Special use cases

M0, M1, M2, M3

M0, M12, M2
M3 – POLARIZATION

Colour Assessment independent of the surface

- Polarization reduces reflections caused by the surface reflection or bronzing
- On method of density comparison between wet and dry inks.
- It also removes UV equivalent to M2.
- Is used in ISO 12647 for as an option for density process control.

**Attention:** There is no viewing condition that matches this measurement condition
M'S THE GRAPHS

Reflectance of Paper with Optical Brightener
M0, M1, & M2 Illuminant Measurement Modes

- UV-included (M0)  b* = -3.85
- D50 Illuminant (M1)  b* = -6.21
- UV-Excluded (M2)  b* = +1.72
WHAT IT REALLY MEANS

Paper brighteners (OBA’s)
EFFECT OF INK COVERAGE
THE RIGHT MEASUREMENT MODE TO HIT THE TARGET
M0 - INCANDESCENT OR UNDEFINED
M1 - D50 OR SOMETHING LIKE IT
M2 – UV CUT, UV EXCLUDED, UV…
M3 – POLARIZED (AND UV CUT)
THANK YOU!