G7® and Paper Color: The Importance of Paper Color on Proof to Press Match

Paper color is an important part of a press to proof match. Today, virtually all paper has optical brightening agents, also called OBAs. These are an inexpensive way to make a paper brighter. They work by converting invisible ultraviolet light (UV) into blue light. This is known as fluorescence. Since paper is naturally yellowish in color, the extra blue light will make the paper appear to be whiter.

While this is an inexpensive way to make paper that looks great, there are some downsides. One negative effect, which is not well appreciated, is that the OBAs are broken down by exposure to light. The paper may look bright when it is freshly printed, but it will lose that brightness over time. If the paper is in direct sunlight, it can yellow substantially in a matter of hours.

Another downside of optically brightened papers is that the degree of whiteness depends on how much UV light is present. Sunlight has a large amount of UV, so a paper with OBAs will look very bright white or even blue under sunlight. Since incandescent light has much less UV, that same paper will look yellower in an office or someone’s living room. Fluorescent lights may or may not have much UV.

Print Buyers
Print buyers should be especially aware that brightened papers cause a major unpredictable shift in the measured color of the stock due to UV energy in the viewing light fluorescing back out as a white that measures blue on spectrophotometers. The brighter the stock the larger the problem, and brightened stocks lose their florescence rapidly with time making them a moving target. While it is nice to try and differentiate your product with a very bright paper, make sure that the major point of differentiation is not that the colors in your product don’t match what you or your customers expect.
component, so the color of the paper will vary under one fluorescent bulb as compared with another.

**OBAs and Color Management**

Most standard print conditions are based on a substrate matching the reference print color. Typically papers are made brighter than the reference print color by adding optical brighteners. The presence of OBAs poses a large problem for any sort of color management, since the color of the paper depends critically on the amount of OBAs present. If the press sheet and the proof have different amounts of OBAs, they may match under one lighting condition but not under another.

G7® has proven to be a valuable method for calibrating printing devices, as well as specifying color. One of the important limitations of GRACoL and SWOP when using G7 is paper color. G7 datasets such as GRACoL and SWOP have solids and overprints based on a specific paper color. When a G7 calibration such as GRACoL or SWOP is performed on the stock specified, the process works spectacularly well.

When we print on a paper that is out of spec, we begin to see color matching problems. Overprints, solids, and colors shift in the direction of the underlying paper color. The more out of spec the paper is the worse the color match will be. (By out of spec we mean the paper color is shifting away from the neutral paper specified by the G7 print condition.) Paper color has a major impact on the ability to match a proof and meet expectations. The more colorful (and away from the standard) the paper is, typically towards blue or yellow, the more the printed color shifts away from the desired
It is important to note that this isn’t just a problem with GRACoL or SWOP, but that this same problem applies to all proof to press matches because they are based on an assumed paper color. When the actual paper color is far enough away from the calibration paper type it becomes impossible to get a reasonable match to the proof. While the buyer is using the proof and the ISO values in the control strip religiously, the painful truth is that because of the paper shift these values are no longer valid -- on the paper stock specified by the print buyer, the printer cannot achieve the specified overprints. The paper is so different that all of the solids and overprints are shifted, and and no amount of curve changing will make those light highlight areas match the proof. Many stocks are close enough that the press operator can often hit the proof.

**Optically brightened paper and measurements:**

Standards have provided new tools to work with the of OBA’s but implementing the total solution has been more challenging than just implementing a single standard. To work properly the entire workflow needs to adjust simultaneously. Viewing, Measuring, and aims for paper color and overprints must all be reviewed when implementing any change. The latest viewing booth standard tightened the requirements for the amount of UV energy provided, typically increasing the amount of UV for most booths. While this is relatively easy to implement, this may result is a poorer press to proof match than before the change. The most recent instrument standards, and new instruments built on them have provided clearer definitions for the actual source of the device and a simple naming scheme to go along with this; M0 is expected to be tungsten but covers unknown sources as well. M1 is the definition of daylight sources, M2 is continuous illumination without UV energy and M3 adds a polarization filter to M2. Adoption of a new instrument that incorporates these options may in combination with other workflow changes provide a better match between viewing and measurement but these workflows have not been proven or fully developed yet.
Brand owners and those seeking precision expect perfect proof matches from their printer – and when the match isn’t there on an odd stock, they don’t understand why.

**Determining if a Paper Is Out of Spec**

Each IDEAlliance dataset contains a substrate definition. These definitions are expressed in CIELAB. CIELAB values can be obtained with a spectrophotometer (0/45, D50, 2degree observer) IDEAlliance is currently researching tolerances for substrate variation to provide a more accurate idea of when the substrate should be recalculated. If the paper color is different enough from the paper color specified in the reference print condition you can anticipate color matching issues. (Currently the tolerance is $5 \Delta E_{ab}^* \).