Application Notes for the ECI Profiles with Surface Finishing for Film Lamination of Offset Prints

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Contents

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o Short Version for the Impatient

The Surface Finishing Working Group of the ECI provides new ICC profiles and characterisation data in addition to ISO Coated v2. They describe the final result of a PSO print (conforming to ISO 12647-2, PT 1/2, 150–200 lpi screen) being laminated with glossy or matte OPP film.

Why these profiles?

+10% TVI

Surface finishing changes the colour (5 ΔE on average, >10 ΔE max). The profiles simulate the final product in proof or softproof. They can be used to achieve better separations.

How do you use the profiles?

The data provider can check on his display whether the design will look very different due to surface finishing. A possible way is to use e. g. "Proof Preview" in Adobe Photoshop® and "Output Preview" in Adobe Acrobat®.

If changes are small, conventional production can be appropriate. If changes are larger, one can adjust the job data, or use the new profiles for a separation tailored to a glossy or matte surface finish. Then, an ISO Coated v2 proof shows different colours than the final product.

Therefore we need to distinguish **for proofing:**

– the **Finishing Proof** of the final product using a surface finishing

FINISHING PROOF!
Not for on-press colour matching!

– the **Standard Proof** of the print before applying the finishing

possible labels

STANDARD PROOF!
Print will be surface-finished later!

The **Standard Proof** is the well-known ISO Coated v2 proof with reference values according to the FOGRA39 data set.

The **Finishing Proof** uses one of the matte/glossy profiles (see table) as reference profile and is based on different target values. It should be printed on an appropriate substrate (semimatte or high gloss proofing paper).

We recommend a unique identification, e. g. as shown with the labels. Without that, a proof must always be taken for on-press colour matching, not for the final product!

The printer still prints according to standard, e. g. matched to an ISO Coated v2 proof. Surface finishing effects are not compensated (except if individual agreements are in place).

If the ISO Coated v2 proof looks lighter than expected, the effect of surface finishing has been taken into account in the data. The press result must be equally light, otherwise the desired final result will not be reached afterwards.

Questions and answers:

– What about UV or dispersion varnishes?
– What about FM/non-periodic screens?
Colour changes are smaller, therefore we haven't yet created profiles for these cases.

– Why can't the printer simply compensate undesired colour changes for me?
That's difficult. Please see details below.

– Why does my matte finish appear colourful and with high contrast on screen?
Probably, black point compensation is activated! Select "simulate black ink" in Preview settings. (In Photoshop it is not sufficient to assign the correct profile, you have to activate the proof preview.)

ICC profile	describes:	used for:
ISOcoated_v2_eci.icc, ISOcoated_v2_300_eci.icc, ISO Coated v2 (ECI), ISO Coated v2 300% (ECI)	PSO offset print, unfinished (yet)	– for on-press colour matching
NEW: PSO_Coated_v2_300_Matte_laminate_eci.icc PSO Coated v2 300% Matte laminate (ECI)	Matte lamination with OPP film, FOGRA49	– shows finished final product – dedicated separation – detection of colour changes compared to ISO Coated v2
NEW: PSO_Coated_v2_300_ Glossy_laminate_eci.icc PSO Coated v2 300% Glossy laminate (ECI)	Glossy lamination with OPP film, FOGRA50	

Overview of ECI profiles for offset printing on coated paper (PT1/2), 150–200 lpi screen, with and without finishing.

1 Introduction

Colour appearance is changed by surface finishing of printed products (by lamination or varnish). If the printing inks have the required fastness properties, the change is a strictly optical effect and predictable. Often, skin tones are adversally affected. This change is stable over time (except for oil-based varnish, which turn yellowish within a short time).

For production it is useful to know the appearance of finishing prints beforehand, either as a hard-copy proof or simply on screen. Then one can intervene and correct in time if necessary. It would be even better and more economical, to account for the colour shift already during separation.

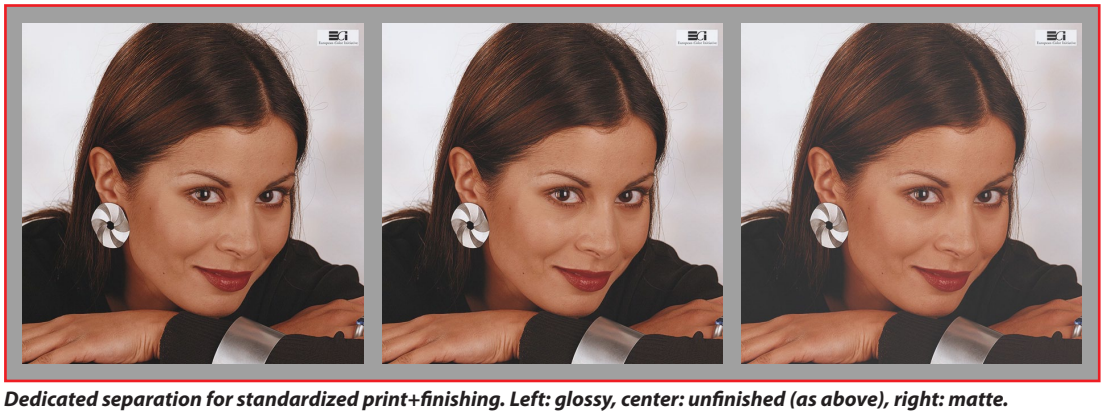
Both preview and separation are done with ICC profiles. One can easily produce profiles for finishing by printing test charts as usual, finishing them and measuring them with a spectrophotometer, thus obtaining characterisation data. From that, profiles are calculated which consequentially describe the total process of printing+surface finishing.

With this, prepress and customer can simulate the look of the final product. However, those **Finishing Proofs** are not suited for on-press colour matching, because the unfinished print still looks different from the finished result prouced later on.

The pressman thus requires a proof which describes the unfinished print, but in such a way that the surface-finished print again corresponds exactly to the Finishing Proof. Finished and unfinished state form a tight pair. This means that one has to measure the test chart also before finishing in order to create a paired profile for the unfinished print. In doing so, one achieves a consistent pair of profiles.

But then, individual profiles are obstacles in open workflows. Therefore standard profiles like ISO Coated v2 have been established. ISO Coated v2 describes an unfinished offset print according to ISO 12647-2 on coated paper with AM screens between 150–200 lpi (60–80 l/cm). We need a matching set of finishing profiles in order to work in a standardized way. Such profiles are now provided by the Surface Finishing Working Group of the ECI.

Undesired colour changes due to surface finishing. To the left: glossy, center: unfinished (ISO Coated v2), right: matte.



Dedicated separation for standardized print+finishing. Left: glossy, center: unfinished (as above), right: matte.

2 Surface Finishing Categories

It is necessary to identify the most important types of finishing from the multitude of possible cases. Those are glossy and matte finishing. A glossy finish always causes more saturated colours and darker shadows. A matte finish always results in weaker colours and shadows caused by the light scattering at the surface.

Films and varnishes are used as materials for finishing. Films typically consist of oriented polypropylene (OPP) with a thickness of 10–15 µm. For varnishes one uses mostly UV-cured or dispersion (water-based) varnishes. The finished surface of the print is most uniform and smooth with lamination, followed by UV varnishes. Dispersion varnishes reach noticably reduced gloss values, but also smaller colour shifts.

Film and UV varnish both cause an important additional dot gain (DG). Film (with > 10 %) has nearly twice the effect of UV varnish (5–7 %).

Rule of thumb: +10 %, starting early on

Dispersion varnishes increase dot gain by only 2–4% and are often applied inline during printing. Then one can inspect the final result and compensate the small varnish effect easily on press.

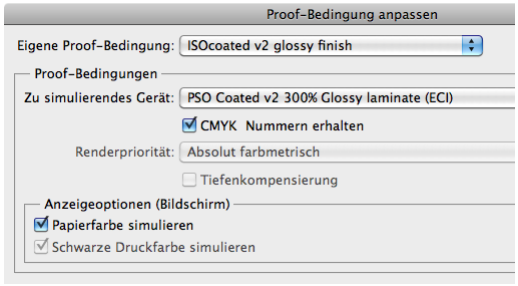
Dot gain due to lamination depends on screen ruling and sharpness, with a maximum around 150–180 lpi (60–70 l/cm). Contrary to dot gain in printing, it decreases not only for coarser, but also for finer (and FM) screens.

We conducted several test print runs with different coated papers and cardboard, and various matte and glossy films. From these we determined typical colour changes and applied those to the FOGRA39 data set. The resulting enw data sets FOGRA49 and FOGRA50 were used to create two profiles in the same manner as ISO Coated v2 (300%).

3 How to Use the Profiles

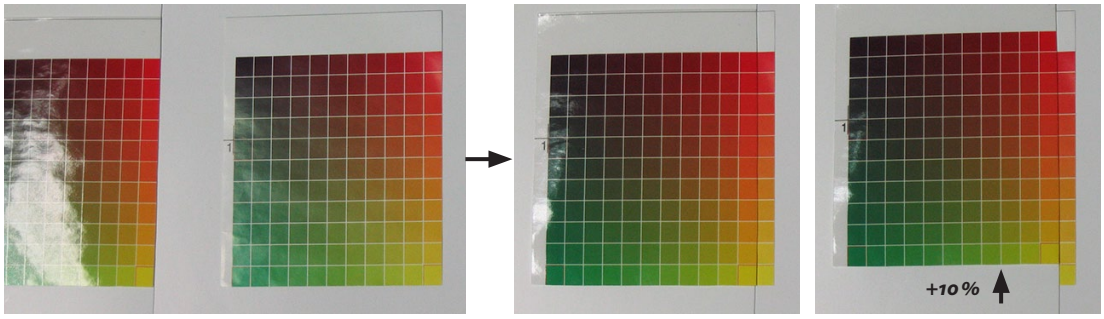
PSO Coated v2 300% Glossy laminate (ECI)
PSO Coated v2 300% Matte laminate (ECI)
are for glossy or matte lamination with OPP film, intended for standardized offset printing like ISO Coated v2 (on coated paper, and printed with 150–200 lpi AM screen).

1) Use for existing CMYK separations:



In Photoshop's "Proof Preview" one can see the colour appearance of CMYK data if printed unchanged („keep CMYK numbers"). To correctly judge darker image areas it is important that no black point compensation is used, therefore „simulate black ink" must be checked.

With two such "proofing conditions" for the unfinished „ISO Coated v2" and the finishing profile one can either switch back and forth, or open a second window with another proof preview (Menu Window – Arrange – New window for …).



Left: pair of test charts (10% steps). Center: finished is more red. Right: corresponds to roughly +10 % M in unfinished. Thus, a light orange of 10 M 100 Y looks after finishing more like a stronger orange of 20 M 100 Y.

In proofing systems one chooses the finishing profile instead of „ISO Coated v2" as reference, in order to simulate the final result instead of the unfinished print. Target values for proof control strips can be taken from the characterisation data sets FOGRA49 and FOGRA50.

2) To separate optimally for finishing:

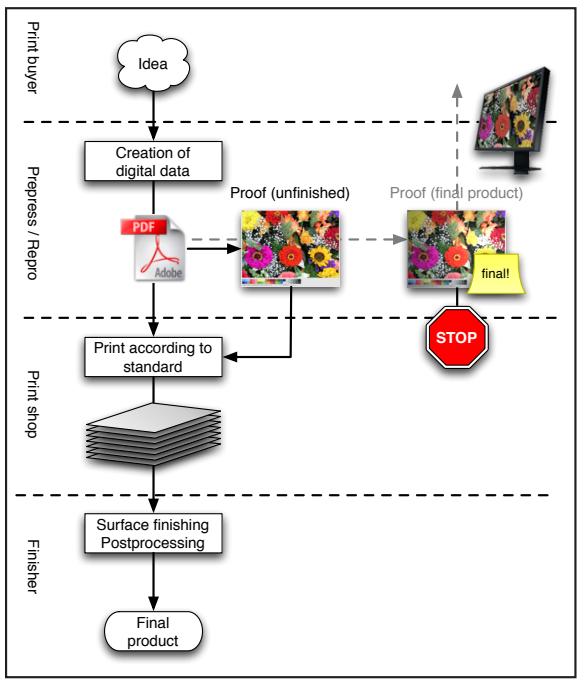
Undesired colour changes can be anticipated with softproofing or hard-copy proofing. But to fix those, CMYK data would need editing.

If the finishing profiles are used already during separation, e. g. in place of „ISO Coated v2", colour changes have automatically been taken into account. The resulting CMYK data look a bit pale if proofed with ISO Coated v2, because the additional 10% dot gain of the finishing is needed for the correct colour result. Only the proof with simulated finishing does look alright.

3) In the workflow:

Despite a possibly pale ISO Coated v2 proof, the printer must print to standard and must not apply more ink, otherwise a darkening would happen twice.

During on-press colour matching of the unfinished print, make sure that no confusing proof with a finishing profile is around!



The exchange between participating partners is depicted in the diagram. The unfinished proof is the standard case. If a **Finishing Proof** is delivered as well, this additional proof must be explicitly labeled (beyond the required caption with the simulated reference printing condition, e. g. by a special attached label).

FINISHING PROOF!
Not for on-press colour matching!

The unfinished ISO Coated v2 proof should also be labeled. The press operator must realize that he has to print to the proof or standard, not to "good looks", so that the intended result can be reached later after finishing.

STANDARD PROOF!
Print will be surface-finished later!

Despite that the **Standard Proof** generally appears too light, it is still correct. This can be verified by a successful control strip analysis.

Nevertheless one should not forget that proofs in pairs cause double costs. Many finished print products can be produced satisfactorily without this added overhead. Still, the new profiles can increase reliability, because people can check for potential colour shifts on screen beforehand and decide from case to case whether the overhead is worthwhile.

4 Recommendations for Proofing

The increased colour gamut of glossy finished prints usually cannot be fully covered in the proof. Notably, the patch 100Y 100K in the Media Wedge 3 cannot be correctly simulated by current pigment-based proofing systems. This is irrelevant for normal production and can be tolerated.

In addition to colorimetric accuracy, the optical appearance of the proof is very important for the acceptance of the simulation. Thus one should definitely use a glossy proofing paper to simulate glossy finishing. For matte finishing, particularly for matte lamination, there is no adequate paper. The next best thing to do is to resort to semi-matte proofing paper.

For highest demands one can obtain a perfect finish by laminating the proof, if the inks have sufficient fastnesses. But it does not work to simply laminate the Standard Proof. One must characterize the laminated proof and create a corresponding proof profile. It also helps that the gamut of a glossy laminated proof is increased similar to the laminated print.

A common use of the profiles is to compare unfinished and finished prints with the corresponding proofs. If the unfinished print matches the ISO coated v2 proof well, one can expect that the finished print compares well to the Finishing Proof. This gives a good idea of the accuracy of the finishing profile.

Often, the unfinished print is slightly different (e.g. colder) compared to the Standard Proof, especially when the proof has been created afterwards. After finishing, the print will again be colder compared to the finishing proof. In that case one does not expect a colour match, but only that the colour shift from before to after finishing will behave similar between print and proof.

For custom printing conditions with 150–200 lpi on coated paper you can create the related counterpart for finishing by adding the CIELAB difference due to finishing on your own characterization data. Please find the difference data enclosed in the profile package.

Please note the following for viewing booths:

Surface-finished prints have a neutral-white surface reflection (no bronzing). With matte lamination, this light covers large viewing angles and disturbs a critical appraisal. It can help to shadow the diffuse illumination in parts, e. g. using black cloth.

Unfinished ("naked") prints (i. e. without printing varnish) and proofs show bronzing. As an example, dark blue areas will have a purple sheen which we unconsciously interpret as an overall reddish cast. It helps to be aware of this effect, to look out for it, and then to choose viewing angles where surface reflections are minimized.

5 Recommendations for Printers

It has been attempted many times to compensate finishing in pre-press or the pressroom. It was hoped that average ISO Coated v2 data can somehow be produced in a roughly colour-correct way – data creation would be so much simpler since no knowledge about an intended surface finishing would be required.

For matte lamination, one would have to counteract the additional 10%. But contrast is already strongly decreased by the matte surface, so that any further reduction makes the image even more washed out. Platesetter curves obviously cannot help here. But even a CMYK-CMYK transformation is problematic because of the big differences in gamut size. And solids would turn into halftones to reduce the high brilliance and depth of a glossy finished print to the level of the unfinished print.

We think a dedicated separation of RGB data for the intended finishing is the best approach.

As before, the printer must measure and achieve his established aim values for standardized printing on the unlaminated print (paper type 1/2, 60-80 lines/cm, TVI curve A for CMY (13%) and B (16%) for black). Production-based differences to FOGRA39 in paper white, solid coloration, and tone value curves are carried forward by lamination. Therefore it is harder to interpret measurements on laminated prints than directly on the unlaminated print.

Can the lamination process be controlled?
Color changes during lamination depend only on the materials. Glossy films are very similar, but matte films can have quite different values of haze / opacity. The average matte film given by FOGRA49 leads to a lightness increase of $\Delta L^* = 6$ in the solid black patch and is well suited for typical production. A clearer film will cause less brightening, a matter film will cause more. Therefore, individual film types can be classified by measuring solid black before and after lamination (on the same patch on the very same sheet, before and after).

6 Special Notes on PDF/X

When finishing profiles are used for separation, there are several possibilites. In a *media specific workflow* (see Media Standard for Print) CMYK data are delivered. After separation of RGB data the used finishing profile is usually embedded. A proof from these CMYK data shows the intended final result. For on-press colour matching, a corresponding unfinished proof must be enforced manually, i. e. the embedded profile must be ignored and replaced by ISO Coated v2 as reference.

If RGB data are delivered as PDF/X-4 in the *media neutral workflow*, the separation at the receiver is determined by the embedded "output intent". A PDF/X-compatible proofing system will therefore use the "output intent" to create temporary CMYK data and immediately output a proof based on that same profile.

Since separation should account for finishing, it is necessary to set the glossy or matte finishing profile as "output intent". But then a PDF/X-compliant proofing system needs to create a Finishing Proof. To get an unfinished proof, one has to make sure that the temporarily separated data are proofed with a different reference profile (namely, ISO Coated v2).

This distinction of correct PDF/X treatment by "output intent" on the one side, and proof reference on the other, is currently not supported by many proofing systems, and actually is against PDF/X rules. It would also open up new sources of error in the use of proofing.

For the time being, it makes more sense to create CMYK data, and deliver PDF/X-1a, despite that PDF/X-1a also contains an "output intent". Most proofing systems allow to ignore the "output intent" and to use another, in this case the finishing profile or ISO Coated v2, as the reference.

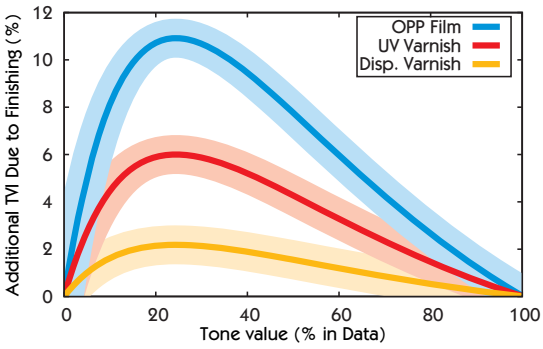
7 Concluding Remarks

We are indebted to Dr. Günter Bestmann, Heidelberger Druckmaschinen, for creation of the ICC profiles.

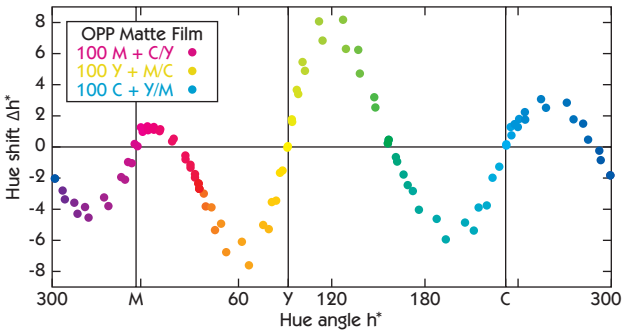
The profiles have been tested by members of the ECI work group during daily production.

Recently we came to know about a particular type of scratch-resistant matte film which is rather clear. This means that there is no decrease of contrast due to haze (ΔL* for the black solid is zero), and colour changes are only due to the additional film dot gain. Obviously, our matte profile is not suitable in this case. It is yet unclear whether this kind of film is commonly used so that there is a demand.

Finally, please let us know about your experiences and your opinion. Thanks!



Typical additional tone value increase for the various type of finishing.



Hue shifts – e. g. skin tones become noticeably redder.

(From: Hoffstadt, Simulating Color Changes Due to Coating of Offset Prints, CGIV 2004 - Second European Conference on Color in Graphics, Imaging and Vision, Aachen, Germany; April 2004; p. 489-493; modified)