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Process Standard Offset print [PSO] for Digital Printing?

Between appropriate use and opportunism

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Digital printing has matured and it is now present in daily production. This is true for both the large format inkjet printing and digital commercial printing [with toner based and increasingly with inkjet based machines].

In the graphic arts industry in particular the latter use case shows tremendous growth figures where small and medium run lengths are taken over increasingly from the offset market. For higher run length, digital commercial printing is currently used for shorter pre- and/or post-productions. In the majority of such applications the requirement could be termed as "matching offset". In light of this it stands to reason that where possible it would be good to make use of the established means to control offset printing processes. This would include the usage of the same control wedges, measurement devices [in particular densitometers to measure the tone response] and, last but not least, the evaluation and the comparison of digital prints by means of press acceptance tests established for offset printing.

Press acceptance tests usually cover the solid coloration, the tone value increase [formerly known as dot gain] as well as grey reproduction. Those figures are compared against aim values derived from [or being the underlying basis of] state of the art characterization data sets such as FOGRA39. Whilst ISO 12647-2 and hence PSO make provisions for a binary [conforming or not-conforming print] evaluation, manufactures of such solutions also offer a single value index also known as scoring value. Such scores typically range from 0% to 100% or from 1 star to 5 stars. The problem with these scores is that there is no agreed basis for their calculation so any score is somewhat proprietary and can't be compared among different vendors.

Contrary to digital printing the binary [Yes/No] evaluation of offset prints represents the results of many years' research and practical implementations. By highlighting problematic aspects the following three paragraphs describe why the "offset concept" can't be transferred without some modification to the digital domain. For each aspect a concrete proposal is mentioned as to how Fogra can help to address these concerns rather just to raise problems without proposing solutions. This is achieved primarily through the direct transfer of the research results into the relevant working group [ISO TC130/WG3] which is responsible for the all new digital printing standard ISO 15311.

1: Inadequate definition of the pertinent scope

The usage of PSO for digital printing needs to be critically reviewed as there is no description as to what technologies and substrates it should be applied to. The term "digital printing" as a description for a given printing technology or imaging process is quite unsuitable. While the use of PSO for digital printing might be considered intuitive for toner based systems it is more than questionable for large format banner printing using UV-curing inkjet or textile printing using thermal processes.

Proposed solution: The recently started multi-part standard ISO 15311 [Graphic Technology - Requirements for printed matter utilizing digital printing technologies for the commercial and industrial production] will provide a process-independent classification of the relevant use cases and applications and these will be accurately defined. Thus, for example, part 2 of ISO 15311 addresses commercial production printing while part 3 stipulates aim values and tolerances for large-format signage printing. The fine-tuning of the draft structure and the creation of coming use cases is subject to ongoing discussions and market research within working group 3 of ISO TC130.

2: Lack of scientific knowledge and practical experience

The various digital printing technologies are compared to conventional printing processes at a relatively early stage of their development and so that standardization activities and the necessary research is still scarce. This means that the implementation of procedures and methods which are successfully used in offset printing are not necessarily transferable to every kind of digital printing. Rather, such a "transfer" must be tailored and optimized for each use case [application] taking into account strengths and weaknesses of the pertinent imaging processes.

Examples include the typical inkjet-banding or a characteristic graininess as is found in some inkjet printing systems induced by coalescence. These digital-printing-specific problems might severely affect the final image quality but are not included in the "offset evaluation method toolbox". An audit or a compliance check in accordance with PSO ignores this property completely.

Proposed solution: Fogra has applied for a research project that has started recently. It focuses on the development [and improvement] of objective methods for evaluating inhomogeneity and sharpness. First ideas were discussed during the last meeting of the DPWG [Fogra Digital Printing Working Group] and in the October 2010 ISO/TC130 WG3 meeting. In the short- and mid-term results from this research project can be expected that contribute to the vendor-neutral, objective evaluation of the pertinent print image quality attributes.

3: Missing Link to underlying process parameters

The primary aim of densitometry is to monitor the amount of colorant per area on a print. In order to measure the tone reproduction [the tonal response [CIEY] of the primary colours from 0 % to 100 %] the graphic arts industry uses the tone value, better known to some as apparent dot area. The solid densities and the tone value increase helped conventional process control reliably by indicating [with high sensitivity] press problems and monitoring the relative changes in tone reproduction of an image as it moved through the various stages of data preparation to a printing plate and eventually to the printed image.

The underlying concept in ISO 12647-2 is that once the correct process colour solids and two-colour solid overprints are achieved, a satisfactory overall result can be reached by simply adjusting the tone value curve to match the specified tone value curve defined for the pertinent printing condition. In general this assumption can't be made for digital printing although it is possible to measure solid density and tone value increase. This doesn't allow for any direct link to the underlying process parameters since they can't be easily identified. They are dependent on the imaging process and the interaction of the colorants with substrates used. For example, there is no doubling in inkjet printing. A possible evaluation of established doubling-slur patches thus leads to results that are hard to interpret by the user or are simply meaningless.

Further it should be noted that densitometers mostly use a cross polarizer to reduce the effect of first surface reflections which reduce the measured differences between wet and dry prints. This may not be suitable for many digital printing technologies since it differs from colorimetrical readings which are made without polarization filters.

Note that the machine's internal use of density measurements for dedicated control processes, for example the control of the toner transfer to the photoconductor, is not considered here as being inappropriate [it actually might be a very good solution].

Proposed Solution: Many manufacturers of digital printing systems are moving towards a colorimetric evaluation or inspection of their prints. This begins with the adjustment and calibration, via ICC profiling and ends with the colorimetric print quality evaluation. This development is already covered in the process independent definitions of contract proofs [ISO 12647-7] and the so-called "Validation Prints" [ISO/DIS 12647-8]. Both are fully defined without using any densitometric methods.

Within the DPWG [Digital Printing Working Group] we are working on a fully-fledged all colorimetry-based metrology including the respective statistical analysis [and uncertainty analysis] for process control and quality assurance.

Summary:

In summary, it can be stated that the underlying concept of ISO 12647-1/2/3 [including the recently started revision] is completely adequate for offset printing. In contrast, digital printing tailored to specific technologies is hard to imagine. Instead, a process-independent concept that addresses the individual applications with dedicated print quality measures seems more appropriate.

The demand for a dedicated digital printing standard alongside methods for process control and quality assurance is evident and also subject of extensive requests to Fogra. The use of established methods in offset printing, in particular by offset printers that also use digital printing systems might be quite useful - but it comes quickly to the limits outlined in this article. Although it might be tempting for those oriented towards profit making to simply use the existing PSO system ["low hanging fruit"] for digital printers, too, this has a poor technical basis and is, thus, likely to reduce the industry's confidence in certification altogether. For this reason it is best to work on something appropriate.

Let me finish with a word of a former Fogra colleague, K. H. Schirmer [1]:
„Standardization shall not be made arbitrary, instead it must the developed from practical experiences and shall reflect the current state of the art and be based on sound science".
In this sense, Fogra invites all interested people to participate in the Fogra Digital Printing Working Group to actively shape the future of digital printing! For more details please visit the webpage: http://forschung.fogra.org/index.php?menuid=200&getlang=en

[1] K.-H. Schirmer, Fogra News 38, P. 13, 1963

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