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THERMAL DIGITAL PLATES VERSUS PROCESS FREE PLATES IN HEATSET WEB OFFSET

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Abstract: *This paper presents conclusions derived from testing the new type of process free plates during normal production runs obtained on offsets, heatset type printing machine, compared to developed thermal digital plates. The plates were compared based on quality of the print, durability and cost effectiveness. On the surface of the plate there are printing areas and non-printing zones that behave differently. The printing areas are oleophilic and at the same time hydrophobic to which the ink adheres. Non-printing zones have an opposite behaviour being hydrophilic and thus oleophobic. In order to achieve the required quality of the printed product, the developed thermal digital plates have to be very stable across the tonal range and the normal life cycle of the developing solution in the processor bath. With the process free plates, there is no need to develop the plates, the removal of the nonprinting coating being done under the action of the dampening solution present on the printing machine rollers.*

Key words: *thermal digital plates, process free plates, offset printing lithography.*

1. INTRODUCTION

Offset printing lithography is a method of mass-producing printing in which the images created on aluminium plates are transferred to rubber blankets and then to the paper. Because the paper never comes in contact with the plates, this prolongs their life. There are a number of advantages of offset printing compared to other methods [1, 8]:

- high quality of the image;
- fast and easy production of printing plates;
- greater printing plate durability compared to direct litho presses;
- well-made plates based on optimized ink and fountain solutions can have very long run lengths (over one million prints);
- offset printing is the cheapest way to produce high-quality prints for large quantities of prints;
- adjustment of the ink amount on the fountain roller by means of screw keys.

The offset lithography can be divided in coldset and heatset printing. Heatset printing is the process by which ink is dried by running the printed paper through an oven immediately after ink is applied by the printing units. As the paper passes through the oven, the oil-based solvents in the ink reach a “flashpoint” or evaporation point. What is leftover are waxes, resins, and pigment. The paper then passes through chilling rollers where the waxes and resins cool down and solidify, or set (Fig. 1).

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2. MATERIALS AND METHODS

2.1. Materials

In this paper we will present the testing of two different kind of plates, thermal digital plates and process free plates. Both type of plates was created using a workflow system from Kodak. The exposure was made with a Kodak Magnus VLF platesetter which is connected to an inline processor and baking oven.

The digital thermal plates used are Kodak Electra XD Thermal Plates. According to Kodak, these plates are characterized by [1]:

- extremely high-resolution output;
- exceptional press performance;
- adaptability to most print conditions and run lengths;
- perform exceptionally well in prepress and in the pressroom;
- up to 350,000 impressions without baking;
- up to 1 million impressions in baked state;
- additional durability with harsh press chemicals and UV.

The process free plates are KODAK SONORA Process Free Plates. They allow to bypass processing and have the un-imaged plate coating removed as part of the press start-up sequence. Press ready technology uses the basic principles, mechanics, and components of lithographic printing to prepare the image on the plate for printing. With SONORA the printer’s current press setups, sequences, inks, fountain solutions, and blankets can be used successfully. During the start-up of the press, the fountain solution swells the un-imaged coating, preparing it to be physically removed by the tack and shear of the ink. This enables a successful transfer of the coating from the plate to the blanket, and the coating is then carried out of the press by the substrate [2].

Fig. 1. Heatset printing machine.

Fig. 2. Computer to plate line.

Table 1. Technical specifications of the plates.

Plate	Electra XD	Sonora X
Substrate	Electrochemically grained and anodised aluminium substrate	Electrochemically grained and anodised aluminium substrate
Spectral sensitivity	800 – 850 nm	800 – 850 nm
Resolution	1 to 99% @ 200 lpi Up to 450 lpi is possible, dependent upon capability of imaging device.	1 – 99% @ 450 lpi Dependent upon capability of imaging device.
Run length	Up to 400,000 impressions with heatset web presses Dependent upon image resolution, press, press chemistry, ink and paper conditions.	Up to 350,000 impressions unbaked; 1,000,000+ baked; Dependent upon image resolution, press, press chemical, ink and paper conditions.
Laser energy required	20 mJ/cm^2 on KODAK Platesetters with KODAK SQUARESPOT Imaging Technology.	90 – 130 mJ/cm^2 with Kodak 400 xLo Chemistry System

For the digital plates we used the Glunz & Jensen HDX 165T processor, which is equipped with replenishment systems, temperature and conductivity sensors that can indicate any deviation from the prescribed values. Also, the plates were baked in an EBO – HS 1550 baking oven (Fig. 2).

After the setup of the plate specific values in the plate setter, drum speed, zoom and focus, and also the type of plate to be used, a linearization curve is created in order to complete the setup of exposure. Because with this equipment it is impossible to measure an exposed but unprocessed plate, the plate exposure and processing cannot be controlled separately. The plates are measured using a media wedge from Kodak, and corrections are made with Harmony software if needed until the desired result is achieved. Beside the measurement of the different values, a visual judging is also done in order to assure the best results and the integrity of the processed plates. For all the measurements made on the plates, an X-rite ICPlate2 measurement device was used.

For imaging, for both of the plates type, we used the technical specifications provided by Kodak (Table 1).

2.2. Testing devices

All the testing was made on a Man Lithoman 48 pages heatset machine. For the measurements we used multiple types of media wedges (Fig. 3) in accordance with ISO Standards (ISO 12647) placed outside the printed product. The measuring of the wedges was made using a Techkon SpectroDens spectrophotometer, an Xrite DensiEye, an Xrite ICPlate2 and software designed for reading and assessing the data.

Fig. 3. Media wedge used for assessing the quality of the printed product.

2.3. Conventional digital plates

On the conventional digital plates (Electra XD), after the imaging of the data on the plate, the imaged plates need to be processed in a developing solution in order to check for the correctness of the exposure and the development process [4, 6, 7].

To ensure increased strength of the plates, they are baked after the development process. Baking is periodically controlled with temperature bands as well as observing the recommended speed and temperature combination for each type of plate used.

The optimal development conditions are:

- developing solution temperature 23 ºC;
- developing speed 0.7–1.2 m/min;
- developing time: 18 ± 4 seconds
- the concentration prescribed by the solution manufacturer.

If the development process is prolonged over the mentioned optimal time, the phenomenon of over-development may occur. The effect is visible during printing, when some of the fine print items may disappear from the plate. If the development process is shorter than optimal time, the product phenomenon is called under development. The effect is visible when printing when the plate catches the tone (the exposed photosensitive layer has not been completely removed). Developing solution concentration and temperature are particularly important factors in the development process. Of the above, the solution for the development of the plates must have the following technical characteristics:

- differential dissolution capacity of compounds formed in the exposed area from those in the unexposed area;
- development speed 60–90 seconds for manual development and 45–50 seconds for automated development;
- minimal reaction to aluminium oxide at 20 ºC.

The composition of the developing solution must consist of:

- an inorganic base which converts the carboxylic acid formed into a water-soluble salt (such as sodium hydroxide (NaOH), anhydrous sodium carbonate (Na_2CO_3) and sodium metasilicate (Na_2SiO_3);
- inorganic salt, which acts as a buffer solution in the development solution. This salt has the role of maintaining the pH = 12–12.5, which is necessary for the relative development in constant conditions from one plate to the other;
- anionic surfactant – which is designed to reduce the surface tension of the solution to the contact surface with the aluminium support in order to obtain, for a minimum time, a continuous film over the entire surface to be developed (the solution acting in equal time at all points on the plate).

The developing machine include the following operations:

- sinking the plate into the developing solution;
- removing the developed debris from the plate surface for printing;
- washing the plate surface with water;
- removing the water remains on the surface of the plate;
- drying the shape;
- protecting / preserving the plate by applying the protective layer (gumming);
- drying of the plate (it is ensured by the air jet at a high temperature of up to 40–45 ° C.

The developing process depends on the following indicators:

- the temperature of the developing solution;
- the speed of passage of the plate through the device;
- speed of brush rotation;
- stability and concentration of the developing solution.

Raising the temperature of the developing solution above the recommended temperature leads to aging [5, 8].

To maintain the development solution's properties, the developing machines are equipped with an automatic refill pump. It is connected to a solution container and automatically adds the developing solution to compensate for chemicals used during plate processing.

To verify the compliance of the print media, the measurements are made using an ICPlate2 measuring device produced by X-Rite.

The checking is made using the media wedge imaged on the plate by measuring the tone values targets (Fig. 4) and comparing them to the standard targets described in the ISO 12647 standard [3, 4, 7].

Referenz	Solwert	Toleranzen	K - 01	K - 02	K - 03	K - 04
0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %
5,0 %	4,6 %	1,0 %	4,6 %	4,6 %	4,5 %	4,2 %
10,0 %	8,2 %	1,0 %	8,2 %	7,8 %	8,3 %	8,1 %
20,0 %	18,1 %	1,0 %	18,1 %	17,3 %	17,6 %	17,3 %
30,0 %	27,2 %	1,0 %	27,2 %	26,9 %	27,1 %	26,8 %
40,0 %	37,1 %	1,0 %	37,1 %	36,6 %	37,4 %	37,0 %
50,0 %	44,8 %	1,0 %	44,8 %	44,5 %	44,6 %	44,6 %
60,0 %	53,9 %	1,0 %	53,9 %	53,3 %	53,8 %	53,8 %
70,0 %	63,2 %	1,0 %	63,2 %	62,7 %	63,3 %	62,9 %
80,0 %	76,3 %	1,0 %	76,3 %	76,4 %	76,4 %	76,5 %
90,0 %	87,0 %	1,0 %	87,0 %	86,9 %	86,8 %	87,1 %
95,0 %	91,5 %	1,0 %	91,5 %	91,6 %	91,5 %	91,6 %
100,0 %	100,0 %	0,0 %	100,0 %	100,0 %	100,0 %	100,0 %

Fig. 4. Plate measured results from the media wedge tone values.

Data	0	5	10	20	30	40	50	60	70	80	90	95	100
1.mai.18	0	4,3	8,8	19	29	38,5	49	59	70	79,5	90	95	100
2.mai.18	0	4	8,3	17,7	27,4	37,4	49	59,9	69,7	80	90,4	95,5	100
3.mai.18	0	4,2	8,7	18	28,2	37,7	48,4	58,8	68,9	79,3	90	95,1	100

Fig. 5. Plate measured records.

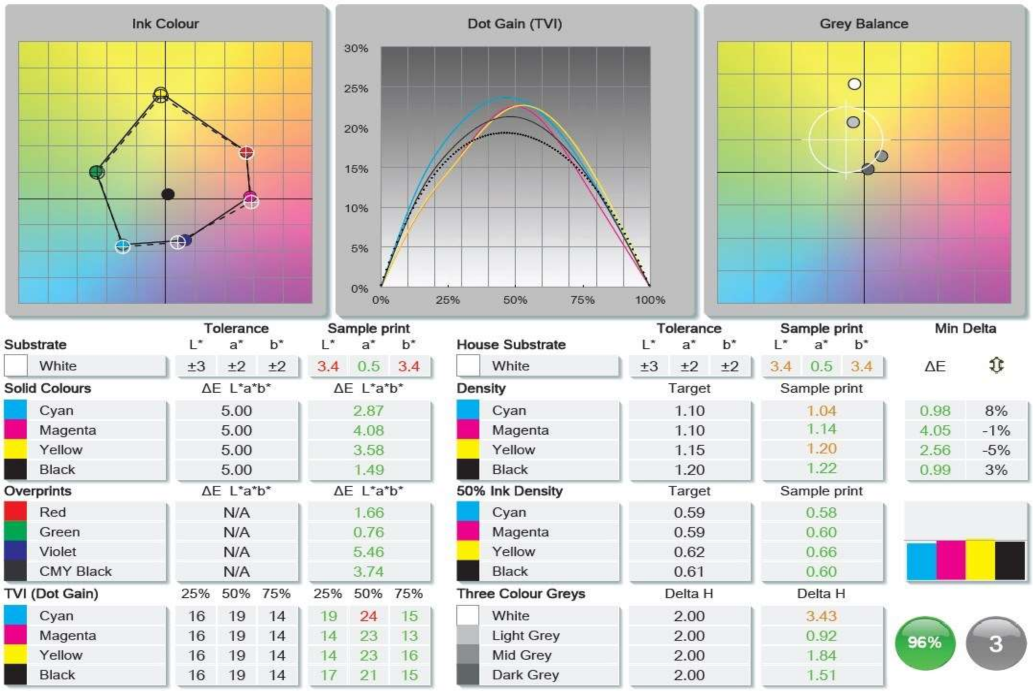

Fig. 6. Print measuring report.

2.4. Process free plates

SONORA Plates are imaged the same as any other thermal plate. Measuring the plate before it goes to press is not necessary with SONORA Plates. The only major difference is that the plates coating is cleaned during the press start-up. After the plates are mounted on press, during the normal pre-dampening process, the fountain solution swells the coating. To prevent removal of the coating, the pre-damp must be kept to a minimum. When the inking rollers are engaged, the non-image area coating is "stripped" from the plate by the tack and shear of the ink. This process is physical, rather than chemical, ensuring a very wide latitude for press chemistry and press setup conditions. Note that the background on the plate is clean almost immediately. As the paper feed is engaged, the coating is carried away, with the ink, on the substrate. Typically, within the first few sheets the ink has carried away all the coating. Registration and colour are then adjusted like with any other plate.

3. TESTING THE PLATES IN PRODUCTION

The testing took place at EDS Romania printing house. The digital thermal plates were used in production for more than 10 years, with great stability and results. The process of creating the plates is standardized, and is certified every year under the PSO certification procedure. Daily measuring of the tonal values of the plates are made, and the result are recorded (Fig. 5).The print run first step is to create the printing plates. They are created with the compensation curve for tone value increase (TVI) created accordingly to the type of paper and machine. During the print session, samples measurements shall be made both colorimetric and as density values of solids from the color scale. A combination of Techkon SpectroDens spectrophotometer and a specialized software is used for the assessment. When a wedge is measured, the values are displayed on the software. The values describe the LAB values of the solid colours, its relative density and the tone value increase. During the print run, a number of samples are selected for further measuring. The selected samples are measured, compared with the standard values described in the ISO and a report is created (Fig. 6). If the measured values are in the target range, the report will also include data for plates and printed samples.

During 650.000 rotations print run, the Electra XD printing plates showed a decrease in quality starting at around 450.000 rotations (Fig. 7).

The same amount of tone value decrease is also visible on the Sonora X plates on 250.000 rotations print run (Fig. 8).

Because the Sonora X plates cannot be baked, the maximum print run achieved with them is around 250,000 rotations.

In term of visual assessment, for the Electra XD plates the first signs of wear appear around 550,000 rotations, and on Sonora X around 240,000 rotations. The wear of the plates is visible on the printed product in the form of missing information or colour.

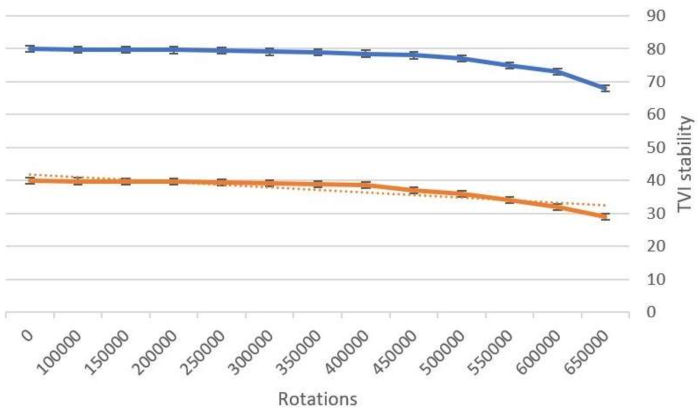

Fig. 7. Electra XD print run stability.

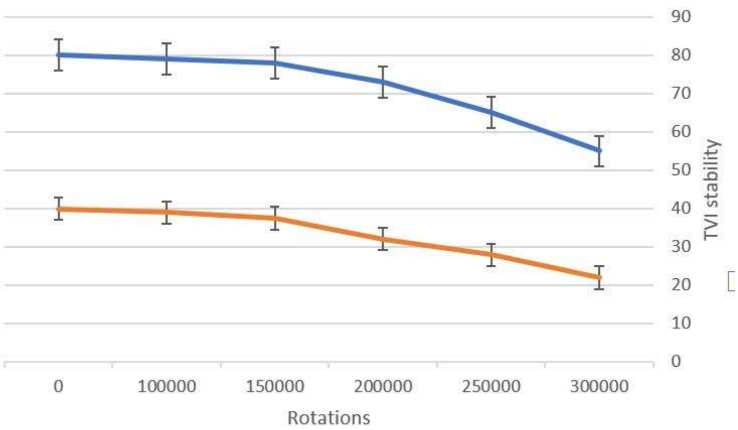

Fig. 8. Sonora X plates print run stability.

3. CONCLUSIONS

The testing allowed to compare how the new type of plates behave in a real production environment. From the stability point of view the new type of process free plates is a viable solution for short print runs.

The print quality is almost the same with both type of plates, with the mention that the process free plate quality control is difficult to manage before the printing run start. The main advantage is that the plate processing time is reduced by 50%, environmental waste generated by the process is zero. There is no need to use developing solutions, gum and electricity for the baking oven.

Based on ISO quality requirements, with both type of plates we were able to achieve the values specified in the standard, and we were able to maintain those values on all of our print run tests.

The best values for Sonora X plates were obtained only on short print runs, about 200,000 rotations. Above that value, their response is unstable, making the Electra XD plates the viable choice for printing.

In terms of plate processing devices, no changes are necessary for switching to the new type of plates.

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