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MICROTEXT DESIGN FOR DIGITAL PRINTING TECHNIQUES

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1. Introduction

This paper contains research results for different digital printing techniques. We are facing raising demand for printing smaller ammounts of individualised and protected prints (tickets, lottery coupons, value coupons etc.) One element of those products is microtext, and is carrier of many informations on less important documents. Because of digital printing technologies limitations (for example: toner particle size), in print procedure some letters loose their details, and so, they are less readable.

2. Market place for digital printing

Digital printing is ideal for printing smaller quantities of individualized and protected materials, like tickets, lottery coupons, value coupons etc. In most cases, that products have a short usage period, small number of prints, and because of their purpose they have to be qualitatively printed and have to contain some protection elements which would prevent their misuse. Those products are commonly individualized. Under those product individualization, we foremost consider the numbering; marking every single product with number, though the digital printing opens and numerous other possibilities. Because of its dynamic, variable press form, the digital printing is ideal for printing those kinds of products. The printing form constantly renews, so beside the numbering, now is possible to individualize all other graphic contents of the product. In this way, the unique graphic products are created, which is impossible for conventional printing techniques to achieve. This way of printing opens the unlimited possibilities of experimenting for designers. This products usually have a little room for the information. In most of the cases text is small, compressed, and the less important informations are reduced to the extremities to save the product space, and also, to keep off the accompanying information from distracting attention from the more important elements of the graphic product.
The other group of graphic products that use microtext are space-limited materials, because of their bounding with the other product (i.e. medicine recipe). Digital printing place is in printing smaller quantities of those products.

3. Technological limitations of digital printing

When printing microtext and tiny graphic elements, we meet with the limitations of single digital printing technology. The microtext, regardless to its size, must be readable. The lines have to be filled

and unbroken. Irregularly designed text in its final, printed form, probable will be unreadable and so will not forefill its role. Graphic elements will loose their form and meaning if designer does not respect printing technique limitations, because they will not be able to reproduce.Tehnology is limited by the toner particle size and a kind of printing material.

3.1 Pigment particles sizes

It is known, that today, on the digital printing market, leading place is held by two technologies: the Xerography and the Ink Jet, because beside their printing speed they also give the best printing quality. In Xerography, two branches of this technology are developed, depending upon the kind of toner which they use. Powder toner and liquid toner are used, and sizes of those toners particles differs from the manufacturer to the manufacturer. Powder toners have larger particles (Figure 1), and their diameter ranges from 6-20 μm, while a liquid toners usually are finer and have the particles diameters smaller then 2 μm. Pigment particles size which are used in the Ink Jet technology can be compared with the particle size of liquid toners that are used in the Xerography. From these data, it is easy to conclude that the Ink Jet technology and Xerography with the liquid toner have the predispositions for the more precise printing then the Xerography with the powder toner, because of the smaller pigment sizes. However, because of the specific way of printing, Ink Jet the technology is not precise as Xerography is. Ink Jet nozzles, which scatter the ink droplets, simply can not place ink pigments over very small area. Ink is dispersed widely and so loss of precision accures (Figure 2).

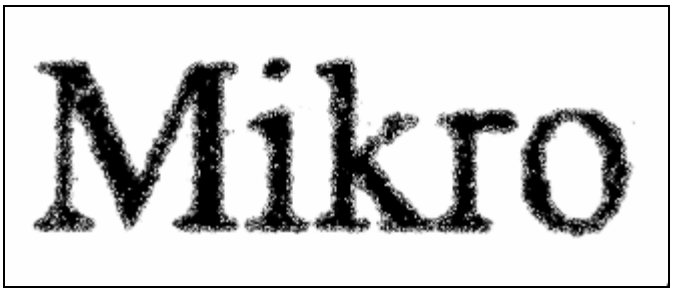

Figure 1.

Text printed with Xerography based on powder toner

Device: Xeikon DCP 32/D, Magnification: 750%

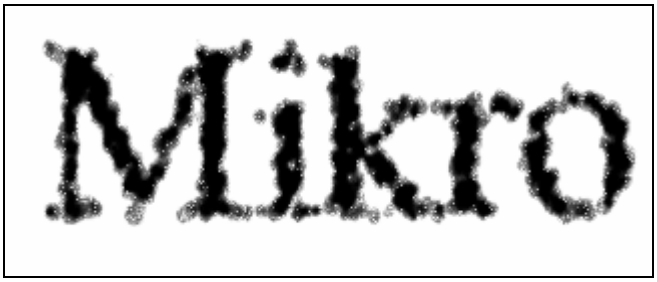

Figure 2.

Ink Jet ink spreading across the paper (Device: HP 3500CP).

Magnification:750%

When we speak about the printing quality, the printing quality of one technology is usually compared with the Offset printing. The modern digital printing technologies which want to be accepted on the market, make efforts on bringing their print quality closer to the Offset printing - most represented printing technique among the conventional techniques. The pigment particle size in the this printing technique have the diameter from 0,1-2 μm, what produces the more precise print then the all techniques of digital print.

3.2 Multicolor printing

The problem directly tied with the size of the pigment particles is the multicolored print and precision of multicolored print register. When printing multicolored microtext, it is difficult to lay precisely one color above another. Misregistration that would not be so obvious when printing normal sized text, on microtext print would be completely unacceptable, because the text would be unreadable. The four-colour print of such text, in the technique of Xerography with the dry toner, would be almost impossible because of the large toner particles. The toner particles with diameters from 6-20 μm in the end give the print whose every color layer has the thickness from 5-10 μm. The multicolored print of this text would be tangible and in the final print ironing, toner on higher layers would probably smear. Also, thin letter lines on some places would brake. When printing with Xerography with the liquid toner and Ink Jet technologies, the color layer would be from 1-3 μm so, in that way, this technologies would be more acceptable for the multicolored microtext printing.

3.3 Influence of the printing material on the precision, depending upon the printing technology

The problem increases if we also include different kinds of paper to be printed on. The print quality is less sensitive and less depending to the different printing materials in the technology that uses dry toner, and highest depending in the Ink Jet technologies. Dry toner does not tend to penetrate in the paper structure. It does not penetrate through the paper fibers, but holds on its surface where is melted at the end of the printing process. Lack of precision in the fine graphic elements printing, could come from print material surface structure and very unstable microclimate in the area in which print material is positioned. It is very probably that, on the structured papers, print will be full more imprecise because of the impossibility of even toner particles positioning over the paper surface. The Ink Jet printing technology is more imprecise because ink pigments spill through the fibers of print material (Figure 3). This technology tends to fill the print in, and that is the main defect of this technology in the microtext printing.

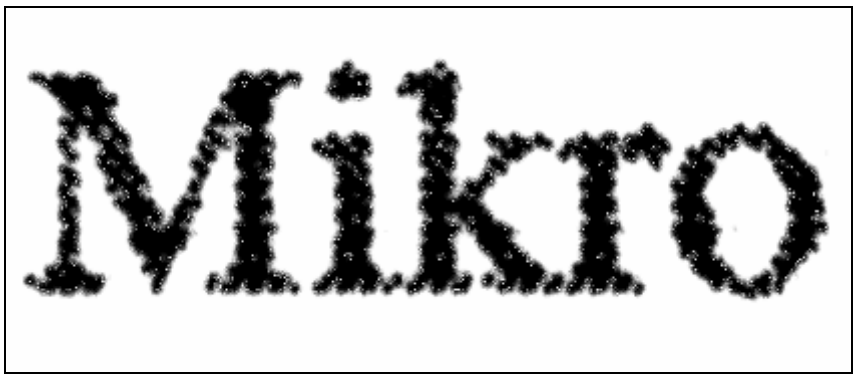

Figure 3.

Influence of structured paper on Ink Jet print quality

Device: Xerox Docuprint C20, Magnification: 800%

4. Examples of the microtext printed in the different digital printing techniques

Figure 4.

Microtext printed with Xerography with powder toner (HP 8150)

Left: real size; right: magnification 600%

Figure 5.

Microtext printed with Xerography with powder toner (Xeikon DCP 32/D)

Left: real size; right: magnification 600%

Figure 6.

Microtext printed with Ink Jet (Xerox Docuprint C20)

Left: real size; right: magnification 600%

Figure 7.

Microtext printed with Ink Jet (HP 3500CP)

Left: real size; right: magnification 600%

5. Conclusion

From the mentioned examples and facts which denote every single digital printing technology, one can conclude that on all tested machines, the smallest readeable text size is 3 pt. The Ink Jet technology has given the worst results, and though the text is readable even on 3 pt, it is better to accept one point bigger text. Also, the results are in correlation with the quality of printing machine which represents the specific digital printing technique, so on all the other machines that are not tested in this paper, lowest readabillity border must be determined by experimenting.

The Serif letters are not appropriate for microtext design, because the serifs on the smaller letter sizes erode (Figure 8) and so make letters even more difficult to read. So, it is recommended to use non-serif letters, with even stroke weights. Although the graphic production of this publication can not display the multicolored printing, it is recommended to avoid microtext multicolor printing. All these digital printing techniques print with process colors, so for the print-out of multicolor text, it is recommended to use only one process color: cyan or magenta or yellow. All other combinations will produce problems in the printing.

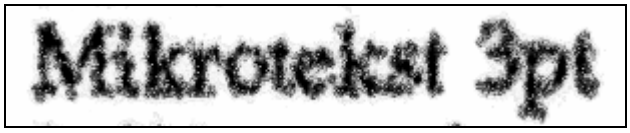

Figure 8.

Serif erosion in Ink Jet technology

Device: HP 3500CP; magnification: 700%

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