EVALUATION OF THE POSSIBILITIES OF ACCURATE MICRO-IMAGE REPRODUCTION IN DIGITAL PRINTING SYSTEMS

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The current market for visual graphic communication includes a wide range of printed products for publishing, packaging and advertising purposes. They are printed on various materials using various printing inks and printing technologies, including both digital, such as *Electrophotography* and *Ink Jet*. Each of these product categories is subject to different levels of quality requirements, depending on the purpose of the products, lifetime of the product, conditions, etc. In general, it can be stated, that the print quality evaluation includes the evaluation of colour rendering and evaluation of image micro-detail reproduction.

It is also very important to consider mechanical and environmental impact during the lifetime of the product, i.e. abrasion due to friction, colour resistance to aging, etc. Factors of environmental impact can affect the colour characteristics, as well as thin micro-lines, screen dots, brightness of other marks, definiteness and geometrical dimensions. Graphic images on prints often contain extremely fine graphic details, such as micro-lines or micro-text elements, which are often part of various identification, security markings, codes, etc. It is very important to ensure the brightness of these details, its legibility and geometric dimensions meet the requirements, not only immediately after printing, but also, after a certain period during the life cycle of the printed production. Therefore, a very important issue is, how to model the variable functional properties of modern visual 2D printed products already at the stage of design.

Currently, various digital print quality control wedges are used to ensure the reproduction accuracy of graphic micro-images. Yet, all those tests lack information to allow the accuracy of reproduction of a wide range of micro-images to be monitored. During this study, a unique wedge to control and pre-model the reproduction quality of digitally printed linear micro-images was developed in Adobe Illustrator. This original wedge is designed to assess and model the reproduction quality and geometric accuracy of linear micro-images when printed by various digital printing methods on different materials. The fragment of the control wedge with monochromatic positive micro-lines, arranged individually in parallel, perpendicular directions and in 45˚ direction to print is shown in *Figure*.

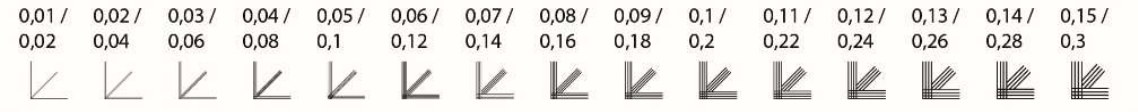

Fig. The fragment of the control wedge for 0,01-0,15 mm width positive micro-lines

The width of the micro-lines was measured under the microscope *Dino Lite AM4013MT* to assess the accuracy of the dimensional reproduction and the deviations from the nominal value. To assess the influence of different parameters of the printing system "press-paper-ink" on the reproduction of image microelements, the prints were printed using different dry-toner and liquid ink (electro-ink), electrophotographic and Inkjet printing presses and different types of paper. The width and deviations of the micro-lines on the prints

were measured along all three print directions. The surface smoothness characteristics of the paper were measured by the surface roughness metre *TR200*.

Measurements of the reproduction accuracy of monochrome micro-line images, printed in different printing systems, showed that the accuracy of micro-line reproduction depends on the parameters of the printing press (dpi), the characteristics of the paper and the type of ink. It is also evident, that the quality of micro-image reproduction also depends on the direction of the positioning of the micro-lines on the printed sheet.

The obtained results allow applying mathematical methods to compare the capability of digital printing systems to reproduce linear micro-images on printed products of any size and geometric orientation. These results also presuppose selecting optimal systems for printing specific products with micro-images and modelling the layout at the design stage by assessing the orientation of the micro-images on the printed sheet while assessing the environmental impact during the life cycle of the product.

Keywords: *Electrophotography, Inkjet, digital printing, control wedge, micro-lines, print quality.*