

Securing The Governmental Eagle Stamp manufactured from Photopolymer flexographic plate against Reproduction or Counterfeiting

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Abstract

Many government documents can be forged, even documents which are marked with "Eagle Stamp" sometimes unfortunately fake. Who is in his hands this "Eagle Stamp" sees that is enough to prevent counterfeiting and fraud completely. But what happens in reality is quite the opposite. "Eagle Stamp" is usually printed on formalized paper documents by using a relief printing plates. Such as letterpress and flexographic printing, When we need to use flexographic printing technology to print a new design structure of the "Eagle Stamp"-which build from lines and dashes in order to prevent its reproduction and therefore preventing government documents counterfeiting, we have to be careful, so the research investigated into critical parameters such as flexographic plate thickness, flexographic plate shore, line or dash thickness and the spaces between lines or dashes, digital file resolution, relief depth ... etc., that help to comprehend the effect of these and other parameters on the final printed "Eagle Stamp" and to determine which of these parameters can produce a perfect ink film module to print high quality and valid "Eagle Stamp" that can be used on formalized paper documents without possibility for reproduction or counterfeiting. So our pre-press work prior to printing is designed to serve the research *hypothesis*, that choosing the appropriate parameters will make any attempted reproduction of our design very difficult to replicate.

After experimental work study, the results have shown that using photopolymer flexographic plates with compatible parameters and printing the samples with appropriate printing machine, would result in very successful and clear printed eagle stamps build in prepress stage from lines and dashes in order to achieve the research objective.

Keywords: Flexographic printing, Photopolymer flexographic plate, flexographic plate thickness, flexographic plate shore, Eagle stamp, Counterfeiting, Forgery.

Introduction

"Eagle Stamp" occupies a prominent place in our daily life in the government apparatus in particular. The most important thing in the life of our government employee is "Eagle Stamp", to a degree that comes close to sanctification. It is hardly accomplished, and does not fulfill a mission until after to foil with this stamp. It is the symbol of bureaucracy in our country, and one of the most dangerous consequences of the "Forgery phobia" that sweeps the corridors of the state, and who is in his hands this "Eagle Stamp" sees that is enough to prevent counterfeiting and fraud completely. But what happens in reality is quite the opposite. Many government documents can be forged, even university certificates,

including master's and doctorate certificates, military service, judicial rulings, medical reports and many others, all of which are marked with "Eagle Stamp" and unfortunately fake. (Muhammed Abulmagd, 2016)

"Eagle Stamp" is usually printed on formalized paper documents by using a letterpress printing plate. Letterpress printing is a relief printing process that initially utilized raised metal type and engravings to transfer words and designs which is built using dots directly from the plate to the substrate using pressure. Based on letterpress-printing principles, flexographic presses are composed of the same basic elements as letterpress. (Leopold der Nederlanden, 2018). So When we need to use flexographic printing technology to print a new design structure of the "Eagle Stamp"-which build from lines and dashes in order to prevent its reproduction and therefore preventing government documents counterfeiting, we have to be careful.

Originality/ value:

This paper serves to be one of the first comprehensive papers to fully help the designers who are preparing flexographic digital files in pre-press stage and the flexographic plate maker, and delineate the critical parameters which can produce a perfect ink film module to print high quality and valid "Eagle Stamp" that can be used on formalized paper documents without possibility for reproduction or counterfeiting.

Literature Review:

Letterpress VS Flexo Printing:

Flexography, flexo for short, or aniline printing as it was then called, is a letterpress printing technology. Letterpress printing, or relief printing, is the oldest printing method where ink is transferred from a rigid printing plate to paper through raised printing elements and relatively high pressure. Flexo printing, in contrast to letterpress printing, the printing plates are flexible (Martin H., 2007).

Flexographic plates vary in their hardness and thickness which has to be adapted to the particular substrate and specific process characteristics. They are mainly made of rubber or photopolymers, and can be produced by photographic/chemical processes or by one of the digital laser-based computer to plate (CtP) technologies. The greatest changes in flexo printing occurred due to computer-to-plate (CtP) making technology which has improved the reproduction quality with a wider tonal range and in more detail. (Dean Valdec, et al, 2018)

The pressure between the printing plate and the substrate, must be carefully adjusted to give a uniform print with no areas of over impression. (Dragoljub Novaković, et al, 2010). As too much pressure creates a halo effect and too little pressure creates gaps in the graphic because of missing dots. (Leopold der Nederlanden, 2018).

A characteristic feature of flexo printing is the low printing pressure; so called kiss printing. The low printing pressure and flexible printing plates make flexo the primary printing method for rubber stamps (Martin H., 2010).

Flexographic printing plates are flexible photopolymer plates, used in flexo printing to transfer ink & images to a flexible substrate, such as paper or film. The printing plates are a critical element of the flexographic printing process and the quality of the printed image is largely dependant on the quality of the flexo plates used.

Flexo Printing plates:

The plates are designed in relief, which means the print surface is raised where the image has been exposed. The plate surface is the only area that comes into contact with the substrate after the ink is applied to the plate. The etched or relieved areas do not contact the ink. Originally, flexo plates were made from rubber, but are today made from photopolymer material in sheet form.

Most flexo plates today are exposed using direct 'computer-to-plate' technology (CTP). In this case, the unexposed film negative is supplied pre-laminated onto the photopolymer sheet, so that both layers can be exposed in the same piece of equipment.

A laser is directed by a computer to first expose the negative layer, after which the photopolymer is then exposed to the UVA light source. This exposure technique produces a superior quality plate, compared with the traditional method. The exposed plate is then processed, using the washout. (David Lee, 2018) Photopolymer Plate is one of the innovations in modern flexography. In early days of flexography, the rubber plates did not reproduce fine halftones; particularly in highlight and shadow areas but with the advent of photopolymer wash-off plates; this issue has been resolved. E.g. "Nyloflex" from BASF and "Cyrel" from DuPont. It uses negative and produces excellent image. There are many systems available to produce photopolymer plates.

Plate Thickness:

Normally flexo plates are available in 1.4 mm to 6.5 mm thickness. Plate thickness depends upon repeat length. (Manisha S. Deshpande and Sameer S. Deshpande, 2013)

Environmentally friendly Flexographic plate material available in 0.95mm up to 2.84mm thickness. (Flexographic/Letterpress Photopolymer Materials, 2018)

Plate Shore (Hardness):

Hardness is defined as a resistance of material to indentation when a static load is applied. Hardness is also related to other important physical properties such as tensile modulus. The most common instrument for measurement of hardness is called the Shore durometer. This instrument measures the depth of penetration from zero to 0.100 inches. Shore A scale is used to test the hardness of soft vulcanized rubber and soft plastics. The hardness of the raw plate is not really relevant for the printer; hence it is usually not controlled. The plate hardness after processing influences the ink transfer and must be considered carefully. Suppliers indicate tolerances within a range of +/- 2 °Shore A. Photopolymer plates are available in 25 to 70 shore A. 12 For corrugated sheets i.e. for rough surface soft plate are used. Their hardness is 25 to 40 shore A. 12 For other quality printing 45 to 60 shore A hardness plates are used.

Relief Depth: Relief depth is the difference in height between the printing surface and the floor of the plate. We can obtain this measurement by measuring the overall plate thickness, then subtracting the floor thickness. There are recommended relief depths for different plate thicknesses:

Plate Thickness	Ideal Relief Depth	Max Relief Depth
1.14mm	0.046 mm – 0.056 mm	0.056 mm
1.70mm	0.046 mm – 0.056 mm	0.064 mm
2.84mm	0.050 mm – 0.064 mm	0.076 mm
6.35mm	0.127 mm – 0.178 mm	0.178 mm

(Catherine Green, 2016)

One of the most important variables to control during plate making is relief-depth. As noted earlier, this is the difference between the plate surface and the supporting floor—the measured physical difference between image and non-image area on a relief plate. This difference is measured in mm using digital plate micrometer. Generally speaking, the lower the relief, the sharper the printed dot. (Manisha S. Deshpande and Sameer S. Deshpande, 2013)

Objectives

This study aims to investigate the effect of using some critical parameters such as flexographic plate thickness, flexographic plate shore, line or dash thickness and the spaces between lines or dashes, digital file resolution, relief depth ... etc., on the final printed "Eagle Stamp" and to determine which of these parameters can produce a perfect ink film module to print high quality and valid "Eagle Stamp" that can be used on formalized paper documents without possibility for reproduction or counterfeiting.

Methodology

In order to achieve the research objectives, an experimental study is conducted as following:

Materials and procedures:

1- A test form of 12 rubber "Eagle stamp" were generated by Adobe Illustrator CC 2020 software, structured with combinations of parallel and intersected lines patterns with digital file resolution of (5080 dpi) as shown in (*figure 1*), and a size of (3.8 cm X 3.8 cm), for every stamp, and the flexographic parameters were selected for building the 12 stamps as following:

- Line or dash thicknesses: 0.03 mm, 0.05 mm, 0.07 mm and 0.1 mm
- Spaces between lines or dashes: 0.25 mm, 0.2 mm, and 0.15 mm
- Finally, the test form printed with 2 Flexographic plates, one was "STRONG[®]", with plate shore of 77 Sh A, and plate thickness of 1.14. The other was "Nyloflex[®] FAR", with plate shore of 53 Sh A, and plate thickness of 2.54. resulting 24 samples of printed "Eagle Stamp" as shown in (*figure 2*)

The parameters values have been chosen carefully to be variable from low to high to get varieties of prints which make it easy to determine which of these parameters could achieve the research objectives.

- 2- The 24 rubber stamps were printed by using "trodat[®] printy 4926" self-inking stamp machine, in a size of 75×38 mm.
- 3- The 24 rubber stamps were checked by using "Lumagny[®]" Illuminated Microscope, under zoom of 100x

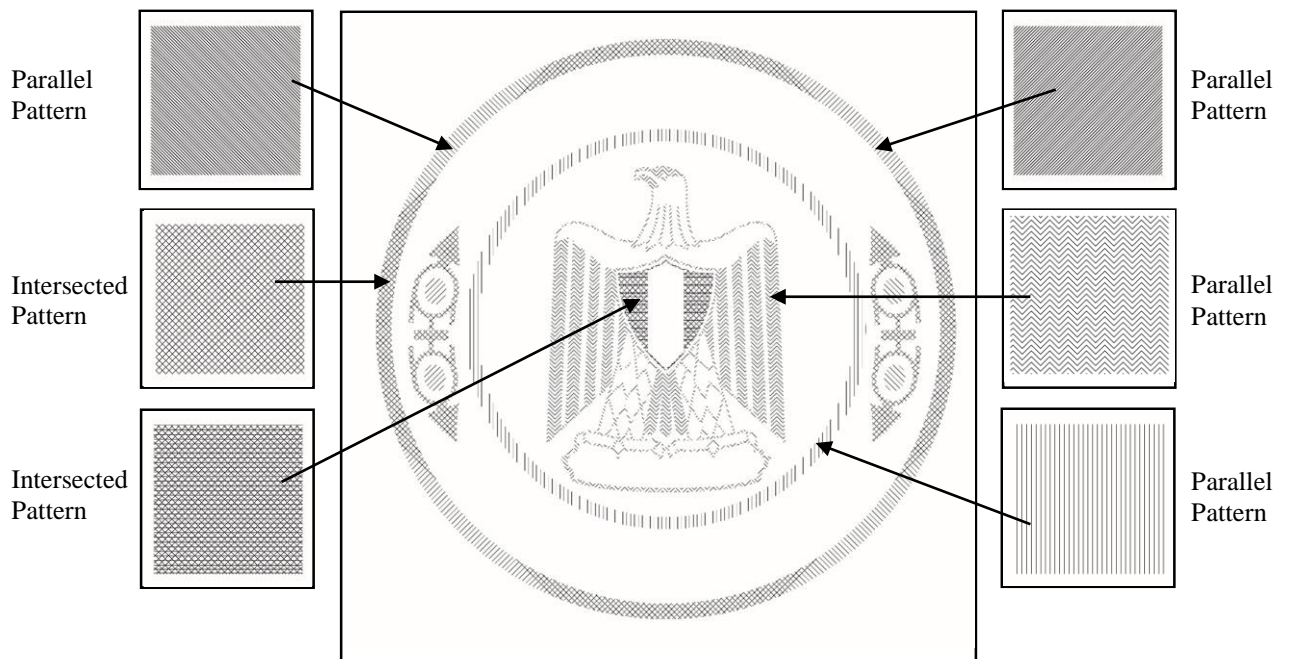


Figure 1: illustrates A test form of 12 rubber "Eagle stamp" were generated by Adobe Illustrator CC 2020 software, structured with combinations of patterns with digital file resolution of (5080 dpi)

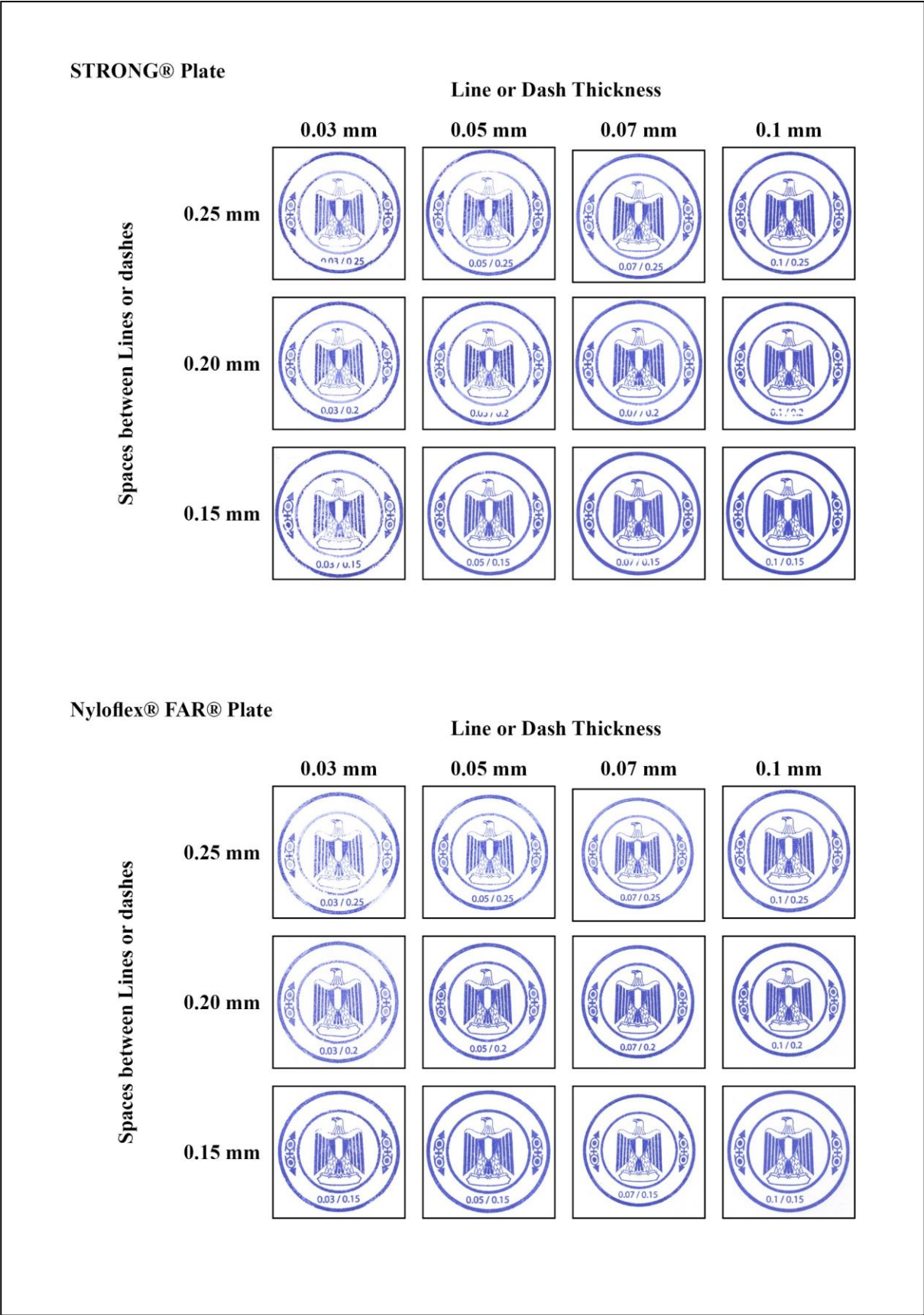


Figure 2: illustrates 24 samples of printed "Eagle Stamp"

Results:

The following table (*Table 1*) outlines the Key results for the research experimental procedures:

Table 1: outlines Table Key results

Table Key Results		
Printed Stamps that have the perfect values of spaces between lines or dashes or their thicknesses (opened spaces)	Printed Stamps that have the nearest values of spaces between lines or dashes or their thicknesses (opened spaces)	Printed Stamps that have the farthest values of spaces between lines or dashes or their thicknesses (Closed spaces)
✓✓	✓	×

Table 2: outlines the checkup results of the 24 samples using "Lumagny®" Microscope, under zoom of 100x

Samples Specs.			STRONG ®Plate		Nyloflex ®FAR Plate	
No.	Line or Dash Thickness	Spaces between Lines or dashes	Parallel Patterns	Intersected Patterns	Parallel Patterns	Intersected Patterns
1	<u>0.03 mm</u>	<u>0.25 mm</u>	✓ specially in vertical lines	×	✓	✓
2	<u>0.05 mm</u>	<u>0.25 mm</u>	✓ specially in vertical lines	×	✓	✓
3	<u>0.07 mm</u>	<u>0.25 mm</u>	✓ specially in vertical lines	×	✓	✓
4	<u>0.10 mm</u>	<u>0.25 mm</u>	✓ specially in vertical lines	×	×	×
5	<u>0.03 mm</u>	<u>0.20 mm</u>	✓ specially in vertical lines	×	×	×
6	<u>0.05 mm</u>	<u>0.20 mm</u>	✓ specially in vertical lines	×	×	×
7	<u>0.07 mm</u>	<u>0.20 mm</u>	✓ specially in vertical lines	×	×	×
8	<u>0.10 mm</u>	<u>0.20 mm</u>	×	×	×	×
9	<u>0.03 mm</u>	<u>0.15 mm</u>	×	×	×	×
10	<u>0.05 mm</u>	<u>0.15 mm</u>	×	×	×	×
11	<u>0.07 mm</u>	<u>0.15 mm</u>	×	×	×	×
12	<u>0.10 mm</u>	<u>0.15 mm</u>	×	×	×	×

Discussion:

First: for samples which printed with **STRONG ®Plate** as shown in table 2:

- 1- Samples from **No. 1 to No. 7**, were printed correctly and the spaces between lines or dashes were very near from the original file, especially in parallel vertical lines, That's because of the large spaces between lines or dashes which ranges from 0.2mm to 0.25mm, but were closed to a large extent, in the area of intersected lines.
- 2- Samples from **No. 9 to No. 12**, were printed correctly and the spaces between lines or dashes were closed and very far from the original file, whether in parallel lines or intersected ones. That's because of the small space between lines or dashes which was 0.15
- 3- Sample **No. 8**, was printed correctly and the spaces between lines or dashes were closed and very far from the original file, whether in parallel lines or intersected ones, despite of it has the same space between lines or dashes which was 0.2 like the samples **from**

No. 1 to No. 7, that's because of the large thickness of these lines or dashes which was (0.1mm).

- 4- There was not any samples has the perfect values of spaces between lines or dashes or their thicknesses

Second: for samples which printed with **Nyloflex ®FAR Plate** as shown in table 2:

- 1- Samples from **No. 1 to No. 3**, were printed correctly and the spaces between lines or dashes were very near from the original file, whether in parallel lines or intersected ones. That's because of the large spaces between lines or dashes which was 0.25mm, but they differs from similar ones which printed by **STRONG ®Plate** especially in intersected lines because of another parameters related to **Nyloflex ®FAR Plate** nature, like plate thickness, plate shore and relief depth ... etc.
- 2- Samples from **No. 4 to No. 12**, were printed correctly and the spaces between lines or dashes were closed and very far from the original file, whether in parallel lines or intersected ones. That's because of the small spaces between lines or dashes ranges from 0.15mm to 0.2mm
- 3- Sample **No. 4**, was printed correctly and the spaces between lines or dashes were closed and very far from the original file, whether in parallel lines or intersected ones, despite of it has the same space between lines or dashes which was 0.25 like the samples **from No. 1 to No. 3**, that's because of the large thickness of these lines or dashes which was (0.1mm).
- 4- There was not any samples has the perfect values of spaces between lines or dashes and their thicknesses

Conclusion

As a result of the investigation, using photopolymer flexographic plates with compatible parameters like thickness of 2.54 or higher, shore of 53 or lower, digital file resolution of 5080, large spaces between lines or dashes of 0.025 mm or higher, line or dash thickness of 0.07 mm or lower, and finally printing with appropriate printing machine, would result in very successful and clear printed eagle stamps build in prepress stage from lines and dashes in order to prevent its reproduction and therefore preventing government documents from counterfeiting.

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