

Challenges Facing Soft White Gradients in Flexography Printing

Assist. Dr/ Tamer Ali Abdelmageed

Lecturer in Printing, Publishing and Packaging Dept., Faculty of Applied Arts, Helwan
University, Egypt.

Tamer.flexography@gmail.com

Abstract:

The Anilox Roll is known as the heart of the flexography printing process, and there is a relationship between the anilox screen ruling and the flexographic printing plate screen ruling, since there is a factor between 4:9 to obtain the right screen ruling on the flexographic printing plate.

The lesser screen ruling of the anilox roll results to obtain a low screen ruling on the flexographic printing plate and high ink density on the substrate. The higher screen ruling of the anilox roll results to obtain a high screen ruling on the flexographic printing plate and low ink density on the substrate.

So we are facing a critical challenge to obtain soft white gradient, and high density at the same time, So the researcher tried to face this challenge and present a solution for that problem

Research problem:

White Gradients in flexography are difficult to be established smoothly, due to the need of high volume anilox roll used with white ink, to carry the design colors.

Research objective:

This research aims to control the usage of anilox rolls to obtain soft white gradients with high density in solid areas at the same time.

Research Importance:

The Importance Of The Research Is extend the usage of flexographic printing as a challenger to rotogravure printing, after solving that limitation in white gradients.

Methodology

The Researcher Uses an Experimental Approach With an Analytical Trend to set the criteria of anilox and flexographic printing plate usage to print soft white gradients with high density in solid areas at the same time.

Conclusion

- White gradients are hardly to be printed using low screen ruling anilox roll.
- Digital plate making and new trends in software rips had the ability to solve white gradients quiet well with the help of choosing the right anilox rolls.

Keywords: Anilox roll – white ink – dot dipping.

الملخص:

تعتبر أسطوانة الأنيلوكس هي قلب الطباعة الفلكسوجرافية، وهناك علاقة بين تسطير خلايا أسطوانة الأنيلوكس وتسطير السطح الطباعي الفلكسوجرافي، حيث يتم استخدام معامل 4 : 9 للحصول على التسطير الشبكي المناسب للسطح الطباعي الفلكسوجرافي.

وعند استخدام أسطوانة أنيلوكس ذات تسطير شبكي خشن يؤدي إلي الحصول على تسطير شبكي خشن علي السطح الطباعي الفلكسوجرافي والحصول أيضا على كثافة لونية عالية على الخامة المراد طباعتها، أما عند استخدام أسطوانة أنيلوكس ذات تسطير شبكي ناعم يؤدي إلي الحصول على تسطير شبكي ناعم علي السطح الطباعي الفلكسوجرافي والحصول أيضا على كثافة لونية أقل على الخامة المراد طباعتها.

إذا فهناك تحدي للحصول على تدرج ناعم للون الأبيض مع كثافة لونية عالية في نفس الوقت، وقد حاول الباحث في هذه الدراسة مواجهة ذلك التحدي وتقديم حلا لتلك المشكلة.

مشكلة البحث:

هناك صعوبة في تحقيق تدرج ناعم للون الأبيض باستخدام الطباعة الفلكسوجرافية، وذلك بسبب الحاجة إلى استخدام أسطوانة أنيلوكس ذات تسطير شبكي خشن دائما لحمل ألوان التصميمات الطباعية.

هدف البحث:

يهدف ها البحث الى التحكم في استخدام أسطوانات الأنيلوكس للحصول على تسطيرات شبكية ناعمة مع المحافظة على الكثافة العالية للحبر في نفس الوقت.

منهج البحث:

يستخدم الباحث المنهج التجريبي مع اتجاه تحليلي لضبط معايير استخدام أسطوانة الأنيلوكس والسطح الطباعي الفلكسوجرافي لطباعة التدرجات البيضاء الناعمة ذات الكثافة العالية في المناطق المصمتة في نفس الوقت.

أهمية البحث:

تكمن أهمية البحث في إنتشار استخدام الطباعة الفلكسوجرافية وطباعة تصميمات كان من الصعب على المطابع الفلكسوجرافية قبولها كمنافس قوي لطباعة الجرافيور.

الكلمات المفتاحية: أسطوانة الأنيلوكس - الحبر الأبيض - إنغماس النقط الشبكية.

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النتائج:

- من الصعب طباعة التدرجات البيضاء الناعمة باستخدام أسطوانة أنيلوكس ذات تسطير خشن.
- ساعد استخدام الأسطح الطباعية الفلكسوجرافية المعدة رقميا مع استخدام البرامج الحديثة للريب معالجة مشكلة التدرج الناعم للون الأبيض مع الاختيار الصحيح لأسطوانات الأنيلوكس.

1- Introduction:

There is a relationship between printing plate dot to anilox line screen cell which directly affects the quality of flexo print.

When using a low line screen printing plate (such as 65) means typically using a lower line screen anilox roll (such as 280 – 550). When using a high line screen printing plate (such as 133) means typically using a higher line screen anilox roll (such as 600 – 1200). The following chart outlines proper anilox line count to printing plate dot relationships:

% Plate Dot				
	1%	2%	3%	4%
Plate Screen (per inch)	Minimum Anilox Line Count (per inch)			
55	500	330	280	250
65	550	400	330	280
85	700	500	400	360
100	900	600	500	440
110	900	660	550	500
120	1000	700	600	500
133	1200	800	660	600
150	1200	900	700	600
175	N/A	1000	900	700
200	N/A	1200	900	800

Table (1) proper anilox line count to printing plate dot relationships

Plate Line screen is chosen in direct correlation to anilox volume. For example, an anilox volume of 3.2 BCMs, requires a line screen of approximately 500. If an anilox volume of 3.2 BCM was engraved at 1000 line screen, cells would be much too deep. In correlation, a 3.2 BCM anilox at 120 line screen anilox would result in cells being much too shallow. The following chart outlines printing applications matched with appropriate line screens and cell volumes:

Application	Appropriate Anilox Line Screen	Appropriate Anilox Volume
Heavy line and solids	180 - 330	9 - 4 BCMs
Line and type	200 - 400	8 - 3 BCMs
Vignettes	360 - 500	3.6 - 2.8 BCMs
Process	500 - 1200	2.8 - 0.9 BCMs

Table (2) printing applications matched with appropriate line screens and cell volumes

Since white ink is printed on transparent films to hold the design colors it must be printed using the first category in the Table (2) to produce high density white ink, but in some cases the designer needs to do smooth white gradients as shown in

figure (1) which is a rotogravure sample shows soft white gradient and high white ink density at the same time. So in flexography that case needs to use the second or third raw in the previous table, and this will affect on the solid white areas appearance resulting with low density white ink in solid areas, or convert the white gradient to solid area under the design elements as shown in figure (2).



Figure (1) rotogravure sample shows soft white gradient and high white ink density at the same time



Figure (2) Flexography sample shows white gradient conversion to solid area under the design elements

So we are facing a critical challenge to obtain soft white gradient, and high density in solid areas at the same time, So the researcher tried to face this challenge and present a solution for that problem.

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2- Methodology and Procedures

The Researcher Has printed two test targets:

- a) Solid areas and Gradients from 1% : 100% were printed at plate screen ruling 50 LPI : 150 LPI as shown in figure (3) using 3 different anilox rollers (250 LPI, 400 LPI, and 860 LPI) with white ink .

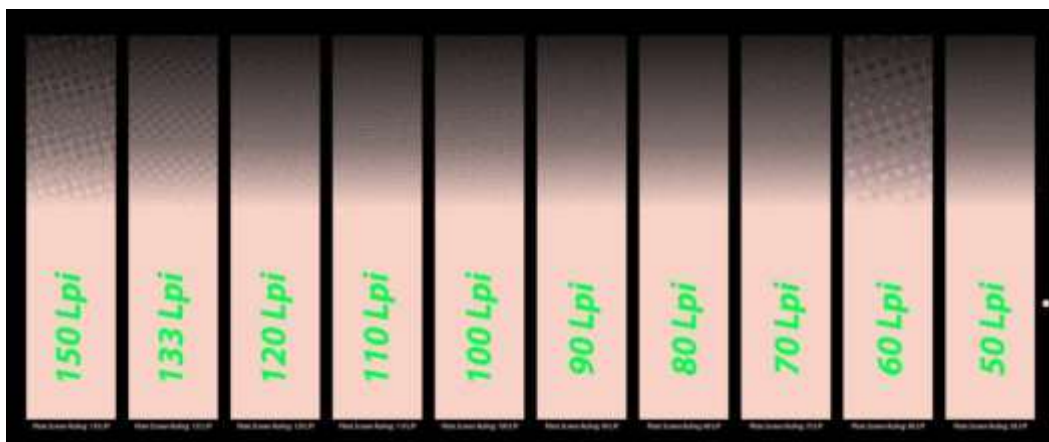


Figure (3) Solid areas and Gradients from 1% : 100%

b) Different hybrid screen gradient shapes including solid areas with plate screen ruling (110 LPI, 120 LPI, and 133 LPI), were printed using two printing plates over each other with white ink, as shown in figure (4 and 5), since Fig. 4 was printed using 860 LPI anilox roll, but Fig. 5 was printed using 860 LPI anilox roll, then Using 400 LPI Anilox roll

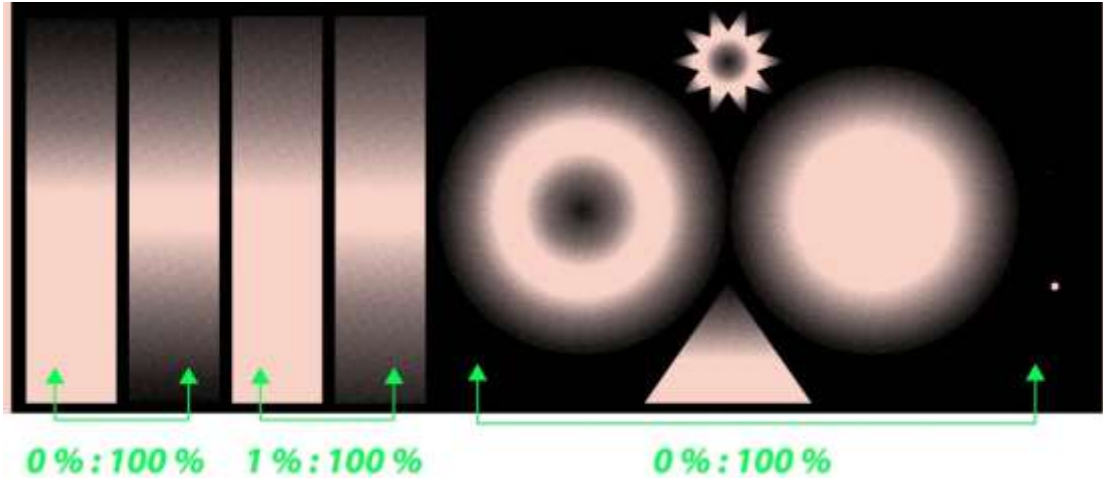


Figure (4) Different Gradient shapes were printed using 860 LPI anilox roll

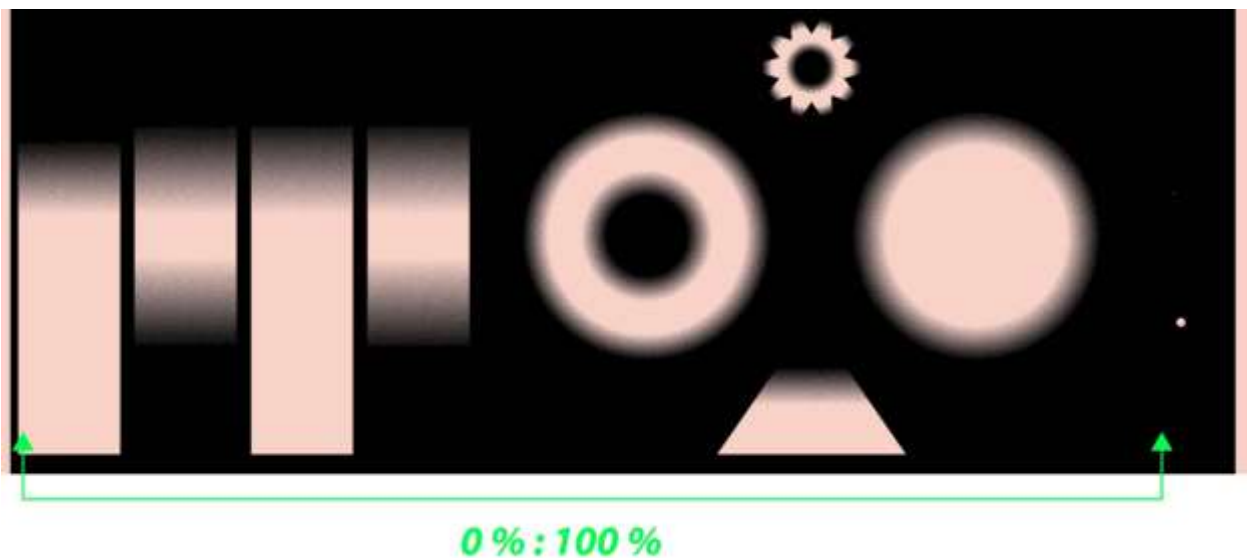


Figure (5) Different Gradient shapes but they were cut to 0% at the shadow area in the corresponding shapes of the previous figure (4)

were printed using 860 LPI and 400 LPI anilox rollers

3 - Materials and Methods:

Substrate	Transparent BOPP 20 microns	
Printing Machine	Windmüller & hölscher CI 2012	
Machine Speed	300 m/min	
Anilox Roll	Lpi	volume
	860	3.4 BCMs
	400	6.6 BCMs
	250	12.9 BCMs
Ink	White Nitrocellulose ink	
Viscosity	First Test Target	19 : 20 sec
	Second Test Target	15 : 16 sec
Solvents	Ethyle Acetate – Iso Propanol	
Printing Plate	- Huaguang Digital Flexographic Printing Plates, its thickness 1.14 mm and hardness 72 shore A. - Minimum dot diameter for hybrid screen is 40 microns	

4- Results and Discussion:

a) First Test Target

Anilox roll	Solid Density	Visual Appearance	Microscopic examination	
			Highlight	Middletone
860 LPI	0.165 D	Gradients are clear at all screen rulings, but solid area suffers low density.	Dot gain is Less than printed using 400 and 250	Better than both 400 and 250
400 LPI	0.22 D	Gradients are clear at screen rulings from 50 : 100 LPI, Then it starts to appear unstable from 110:150 LPI, and density looks better than 860 anilox roll.	Dot gain is Less than printed using 250.	Better than 250 but dot bridging started from 110 LPI
250 LPI	0.26 D	Gradients are clear at screen rulings from 50 : 70 LPI, Then it starts to appear unstable from 80:150 LPI, and density looks better than 860 and 400 anilox rolls.	Dot gain is higher than both 860 and 400.	Looks stable until 60 LPI, but dot bridging started from 70 LPI.



Figure (6) Visual Appearance of First Test Target Printed using 3 different anilox rolls

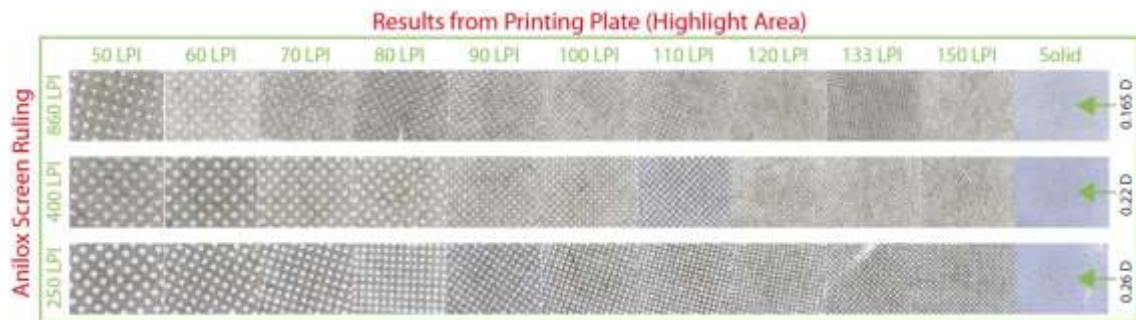


Figure (7) Highlight Area Results from Printing Plate with different screen rulings Printed using 3 different anilox rolls

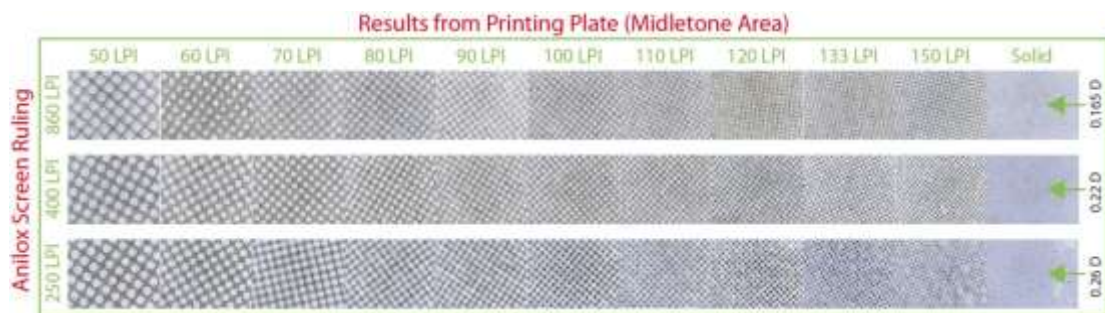


Figure (8) Middletone Area Results from Printing Plate with different screen rulings Printed using 3 different anilox rolls

b) Second Test Target:

Anilox roll	Solid Density	Visual Appearance	Microscopic examination	
			Highlight	Middletone
860 LPI + 860 LPI	0.245 D	Gradients are smooth at all screen rulings, and solid area expressed density more than using anilox roll 400 alone.	Clear on all screen rulings	Clear on 110 LPI and 120 LPI screen rulings, but very little dirty pattern at middletone of 133 LPI screen ruling, due to the need of tuning ink viscosity.
860 LPI + 400 LPI	0.285 D	Gradients expressed dirty pattern at middletone, but solid area expressed density more than using anilox roll 250 alone.	Clear on all screen rulings, since the anilox roll 860 LPI is used to produce the gradient full range.	Dirty pattern at middletone due to dot dipping of hybrid screen highlight dots, which needs to be tuned to a larger dot size at highlight to suit anilox roll 400 LPI

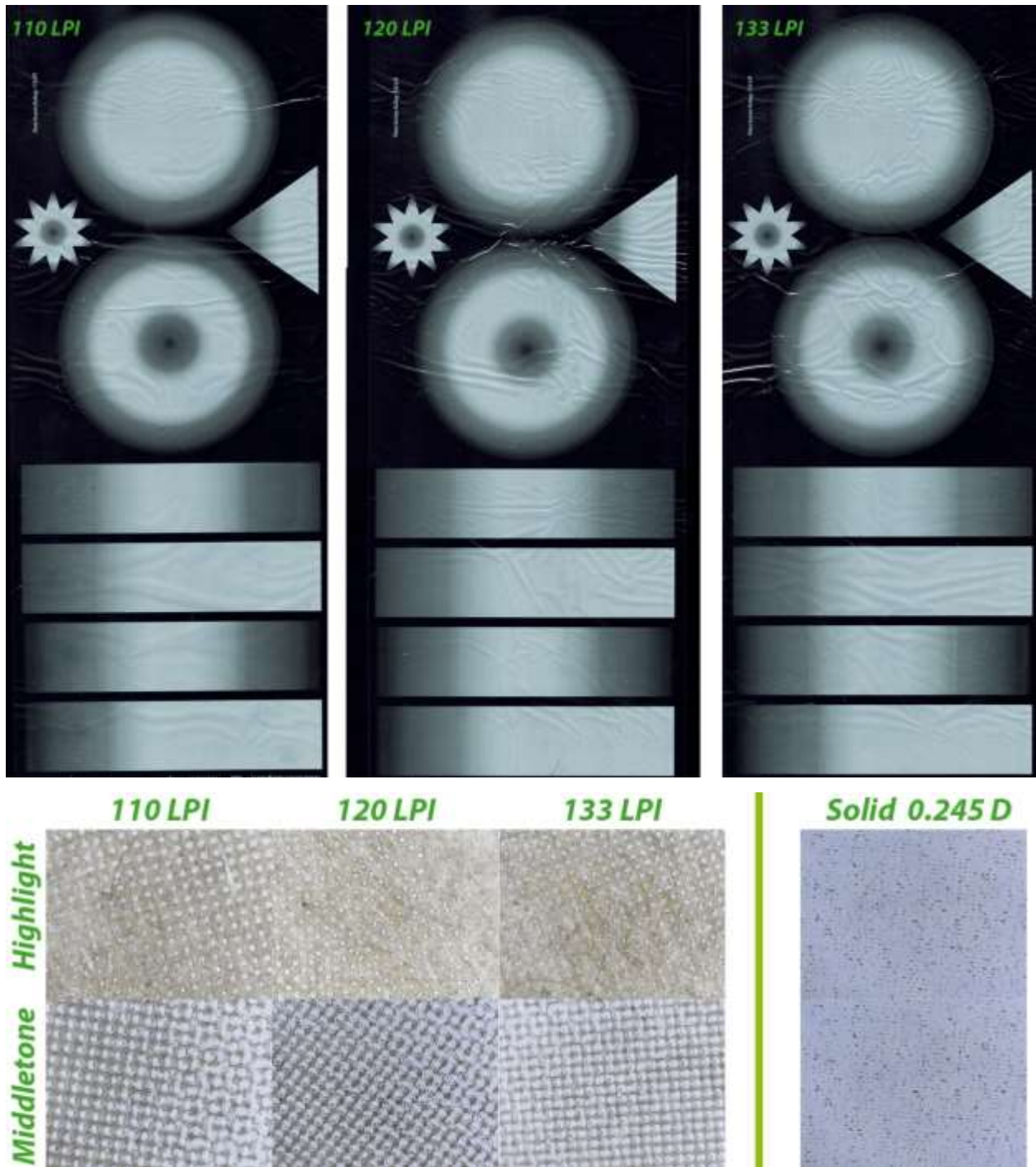


Figure (10) Second test target, Both plates were printed using 860 LPI Anilox Rolls

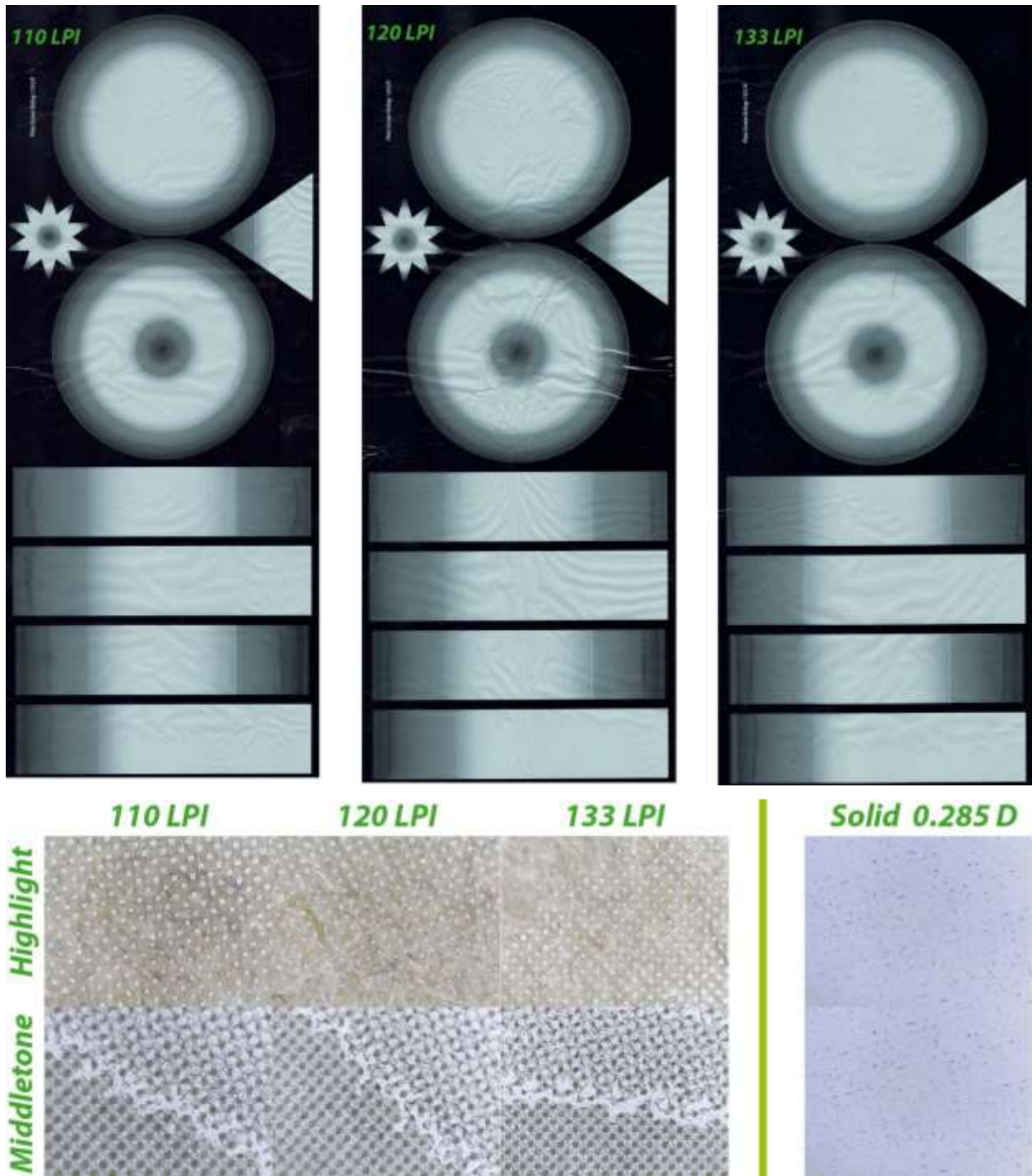


Figure (11) Second test target, printed using 860 LPI and 400 LPI Anilox Rolls

5- Conclusion

- White soft gradients can be applied using soft screen ruling anilox rolls, but we will face low density in solid areas, since 860 LPI has presented 0.165 D for solid area.
- Up to 100 LPI white gradients can be applied using anilox screen ruling 400 LPI, with solid area density 0.22 D, depending on the anilox roll cell volume.
- Up to 70 LPI white gradients can be applied using anilox screen ruling 250 LPI, with solid area density 0.26 D, depending on the anilox roll cell volume.
- When using two soft anilox screen rulings like 860 LPI, white gradients are clear, and solid area density 0.245 can be reached.
- When using two anilox screen rulings like 860 LPI for gradient full details, and 400 LPI as density supporter white gradients can face dot dipping in middletone area, but solid area density 0.285 can be reached.
- Digital plate making and new trends in software rips had the ability to solve white gradients quiet well with the help of choosing the right anilox rolls.

5- Recommendations:

- White soft gradients and high density solid area can be reached by printing two printing plates on each other using Hybrid screens, since one of them expresses the gradient full details, and the other one will cut at shadow areas.
- Ink Viscosity and Hybrid screens dot size must be examined with anilox screen roll selection to fulfill better results when using that research idea.

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