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ANALYTICAL APPROACH FOR COLOUR REPRODUCTION

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ABSTRACT

This document gives information about Colour Reproduction, Colour steps, Effect of printing on colour, Colour gamut comparison, attributes of colours

KEYWORDS: *Colour, Delta E, Dot gain, Colour Density, Colour Gamut*

I. INTRODUCTION

In the printing industry, today, tradition and the notion of printing as a craft are both still valid, though the concept of printing by the numbers and standardization is more typical. In regard to offset ink sequence, it is commonplace to print CMY, as standardized by ISO 12647- 2:2004 Graphic technology—Process control for the production of halt-tone colour separations, proof and production prints: Offset lithographic processes. However, the opinion of K first or last is one of mixed conviction. There are some who favour K last while others say the opposite that wet ink trapping of offset printing creates lower contrast and D-max. Who is right? Can there be one answer that fulfils the diverse needs of printers? Whether K first or last matters or not, it is important to simply understand the ink sequence on colour and image quality to allow for repeatable and predictable results.

II. OBJECTIVE

The original ink sequence of MCYK has been standardized and well-practiced for offset printing in the old plant. But while assembling the machine in another place there are certain parameters which were changing the print quality, such as, climatic conditions, labour skills, printing environment. For that purpose, we took digital standardized print as the standard output. The digital technology continues to improve, the expectations of digital printers producing a facsimile to offset has increased.

2.1. Print Trails

To properly examine the effects of ink sequence on each process, customized test forms were needed. The target used to examine the effects of ink sequence on colour and image quality was designed by Altona measurements.

Figure 1. The Ink Sequences

The points addressed were:

1. Design of the ink sequence target,
2. Printing of each target,
3. Verification of ink consistency across the target by densitometry,
4. Analysis of gamut volume and visual differences of pictorial test images.

Printing the Test Forms-

For each press run a custom test form was created to maximize the page real estate and meet the specifications of each printer. The sheet-fed offset run was printed with a tack sequenced ink set, allowing a lower-tack ink to always be laid down onto a higher-tack grade. The tack values used on the Heidelberg Speed-master 4+1 sheet-fed offset press.

Verifying Printing Consistency-

To verify that the same solid densities were obtained on the ink sequence target, density values of the solid C, M, Y, and K patches were measured. The K measurements were made from the black bar along the target. Five density readings were made and averaged to give an approximate measure. Assuming the values are within tolerance, this would show that any further change seen through testing would be due to a change in ink sequence and not density or printer variability

Therefore, from the observation we took five ink sequences for the standardization purpose. The chosen sequences were-

1. Cyan-Magenta-Yellow-Black (CMYK)
2. Magenta-Cyan-Yellow-Black (MCYK)
3. Yellow-Cyan-Magenta-Black (YCMK)
4. Black-Magenta-Cyan-Yellow (KMCY)
5. Black-Cyan-Magenta-Yellow (KCMY)

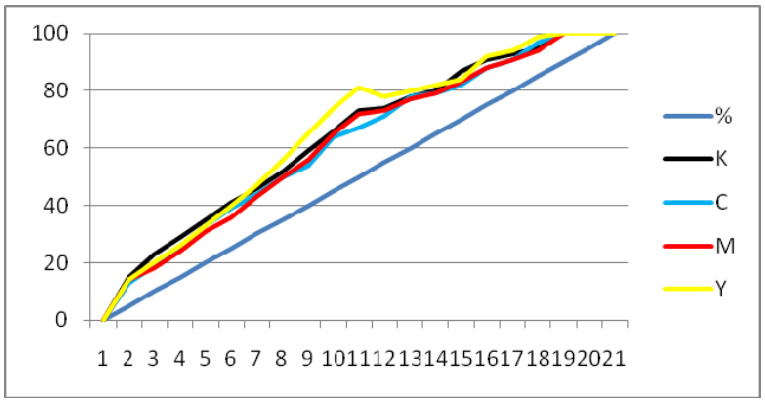
III. ANALYSIS

Below are the findings of this project with discussion relative to ink sequence and comparing offset to digital printing. The main areas of interest in analysing the ink sequence test forms were density, to verify ink consistency, colour (L*a*b* values) overprint patches with computed ΔEab and L* analysis of the 21 darkest patches, gamut volume; and visual comparison. Offset printing is an indirect printing technology. Ink is transferred to the printing substrate via an Intermediate cylinder (blanket cylinder). Printing and non-printing areas of the plate are virtually on one level. The image areas are oleophilic as well as hydrophobic and non image areas are oleophobic and hydrophilic. The transfer of the oil based ink is done by ink splitting. The ink layer on the material is between 0.7 µm and 1.1 µm.

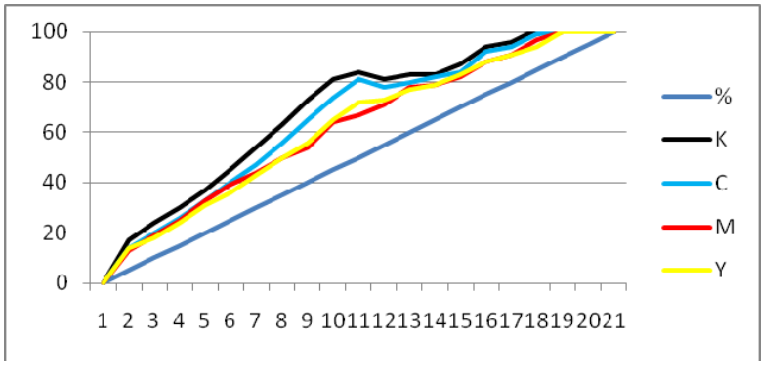
The ink supply is mostly interlinked with the dampening solution supply in a complex manner. The process depends on several chemical and physical variables: surface and type of printing plate, characteristics of inking rollers, ink and dampening solution, substrate and construction principles of the press

3.1. Print Analysis

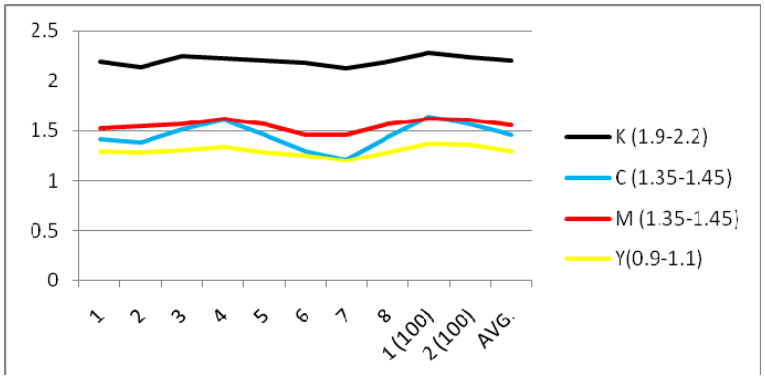
1st run Dot Gain for Digital Print



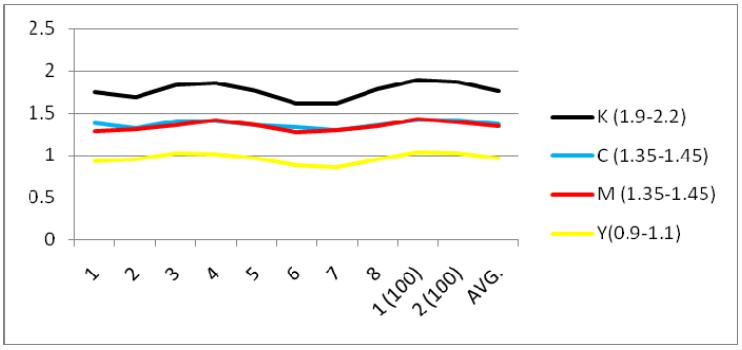
1st run Dot Gain for Offset Print



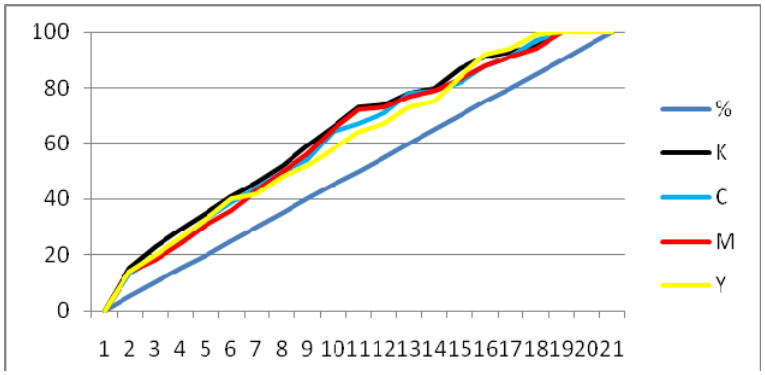
1st run Density for Digital Print



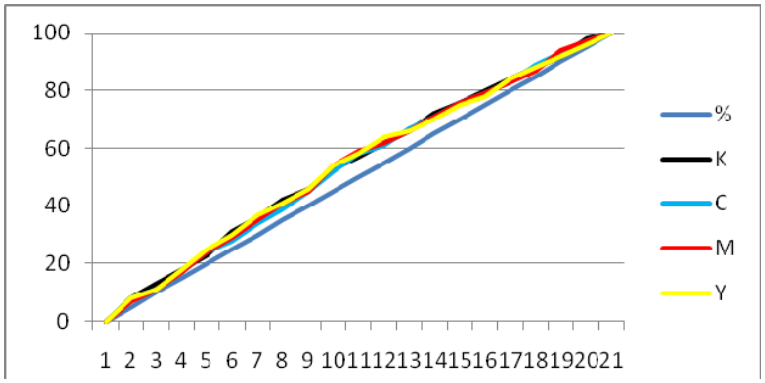
1st run Density for Offset Print



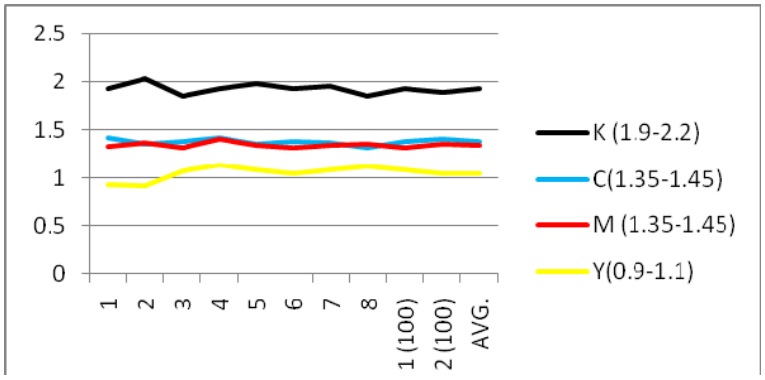
2nd run Dot Gain for Digital Print



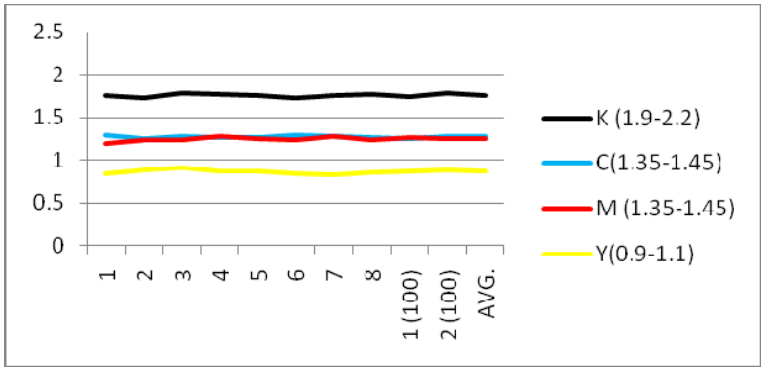
2nd run Dot Gain for Offset Print



2nd run Density for Digital Print

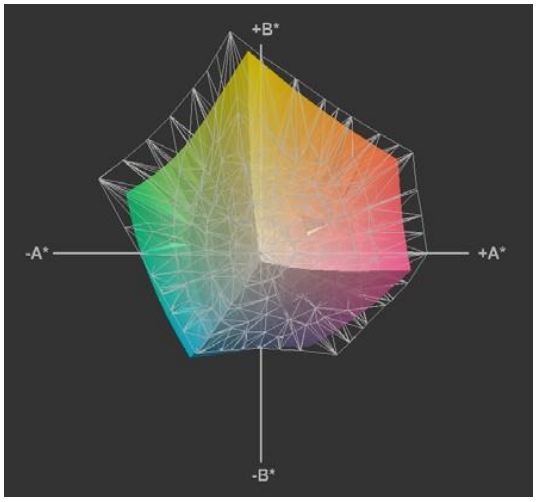


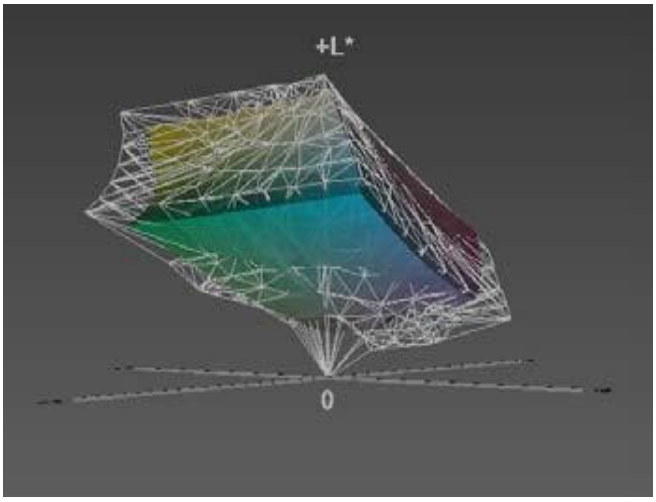
2nd run Density for Offset Print



3.1. Gamut Comparison

3.1.1. Visual Colour Vs Photoshop Base Value





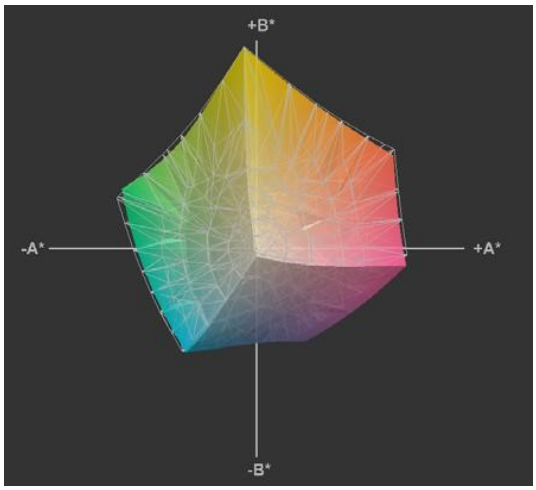
Visual colour

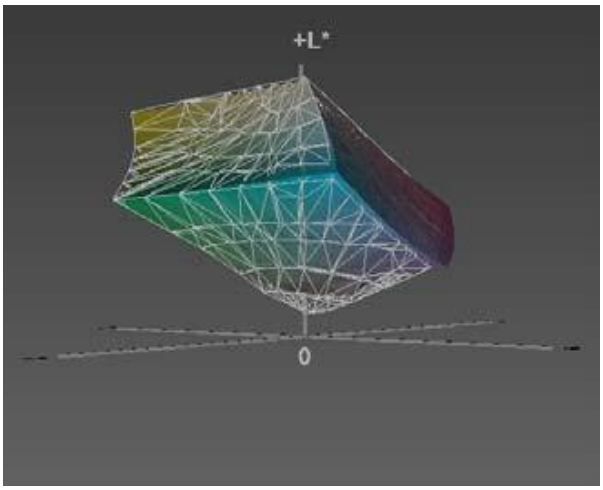
Photoshop Base CMYK

Header:
size = 722576 bytes Device Class =
Output Colour Space = CMYK
Conn. Space = Lab

Total ink limit assumed is 266%
Total volume of gamut is 468898
cubic colour space units

3.1.2. Photoshop Base Value Vs Digital Print





Photoshop Base CMYK

KM DIGI_Coated

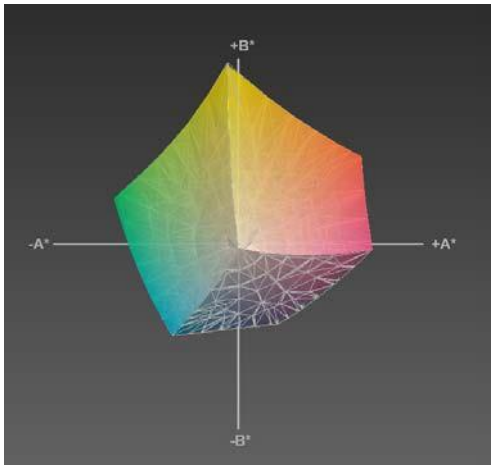
Header:
size = 722576 bytes Device Class =
Output Colour Space = CMYK
Conn. Space = Lab

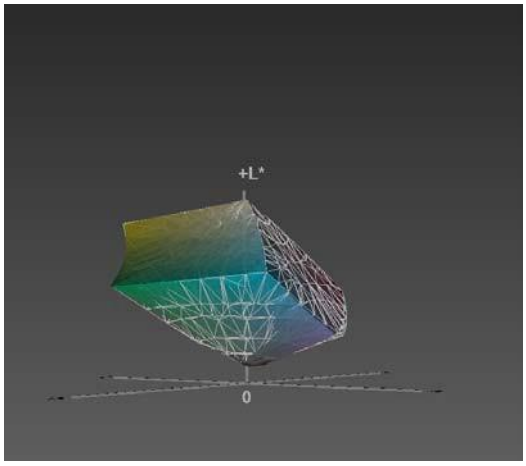
Total ink limit assumed is 266%
Total volume of gamut is 468898
cubic colour space units

Header:
size = 2747956 bytes Device Class
= Output Colour Space = CMYK
Conn. Space = Lab

Total ink limit assumed is 322%
Total volume of gamut is 361733
cubic colour space units

3.1.3. Digital Print Vs KCMY 1st Run





KM DIGI_Coated

OFF- Co-KCMY 1st run

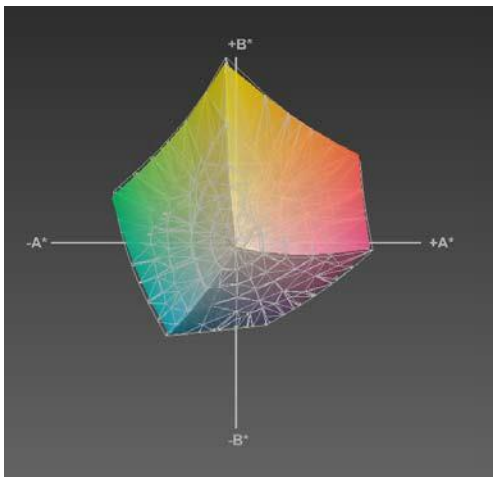
Header:
size = 2747956 bytes Device
Class = Output Colour Space =
CMYK Conn. Space = Lab

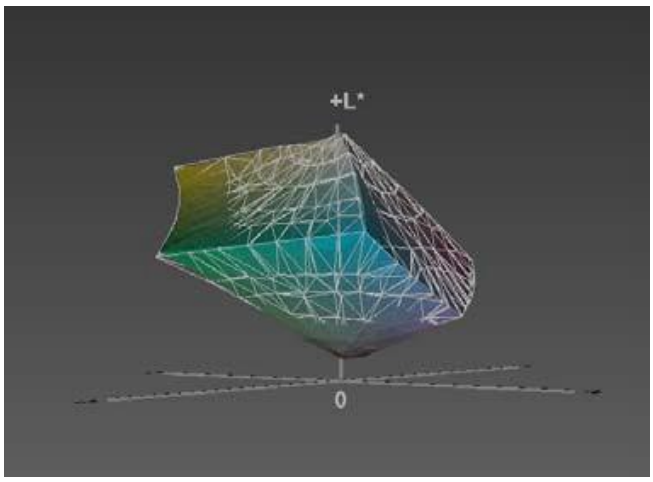
Total ink limit assumed is 322%
Total volume of gamut is 361733
cubic colour space units

Header:
size = 1526728 bytes Device
Class = Output Colour Space =
CMYK Conn. Space = Lab

Total ink limit assumed is 350%
Total volume of gamut is 371416
cubic colour space units

3.1.4. Digital Print Vs KCMY 2nd Run





KM DIGI_Coated

Header:
size = 2747956 bytes Device Class =
Output Colour Space = CMYK
Conn. Space = Lab
Total ink limit assumed is 322%
Total volume of gamut is 361733 cubic colour space units

OFF- Co-KCMY 1st run

Header:
size = 1829044 bytes Device Class =
Output Colour Space = CMYK
Conn. Space = Lab
Total ink limit assumed is 300%
Black ink limit assumed is 95%
Total volume of gamut is 388767 cubic colour space units

Carried out imperial test shows that colour sequence KCMY shows min. variation in Delta E and gives max. no of Gamut steps.

IV. CONCLUSION

1. Dot Gain – empirical test performed on digital and offset print shows dot gain in print. For print target point of view we target offset print dot gain and it is controlled at pre- press and press level. The Dot Gain range has been reduced to targeted density.
2. Density – empirical test performed on digital and offset print shows standard density values in digital print. In offset set print density values are not satisfying standard range and it need to be get improved in production output. Low screen frequency shows higher ink deposition**.** On controlled print run dot gain is controlled by compromising it at pre-press level.
3. In controlled offset print density of ink achieved within range of standard acceptance values. In controlled parameters following sequences shows respective dE as compared to digital print which considered as Base Reference. After implementation of control values for dot gain and density for Offset print for KCMY sequence, second print run shows dE range in acceptable range. The Delta E which has been derived is within the acceptable range for Black Cyan Magenta and Yellow Colour Sequence as compared to that of Digital Print which is 2.3 to 2.4.
4. KCMY, sequences shows more no of gamut steps as compared other four sequences, which indicates higher gamut volume of KCMY sequence.

1st Run

Sr. No.	Sequence	No. of Print	Delta E	Profile Gamut Steps
1	CMYK	500	4.7 - 6.4	3,56,389
2	MCYK	500	4.5 - 5.9	3,76,129
3	YCMK	500	4.3 - 6	3,12,893
4	KMCY	500	4.2 - 5.6	3,42,178
5	KCMY	500	3.6 - 4.8	3,84,251

2nd Run

1	KCMY	500	2.3- 2.8	3,81,486

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