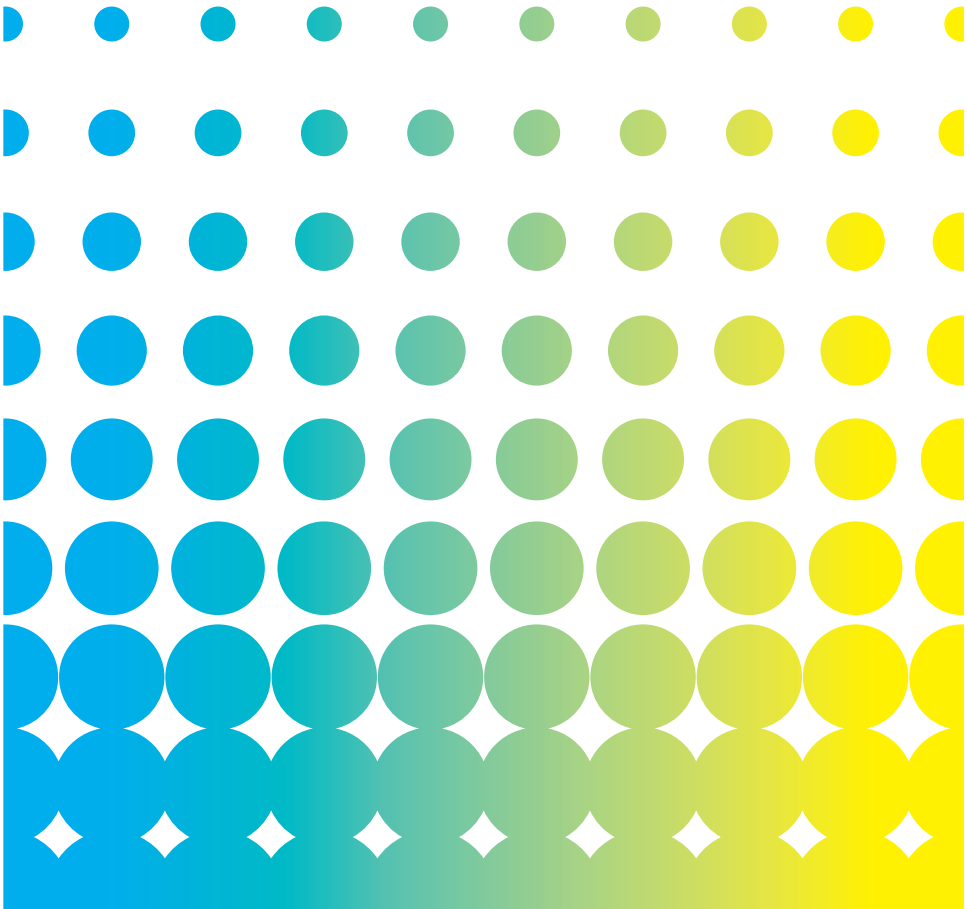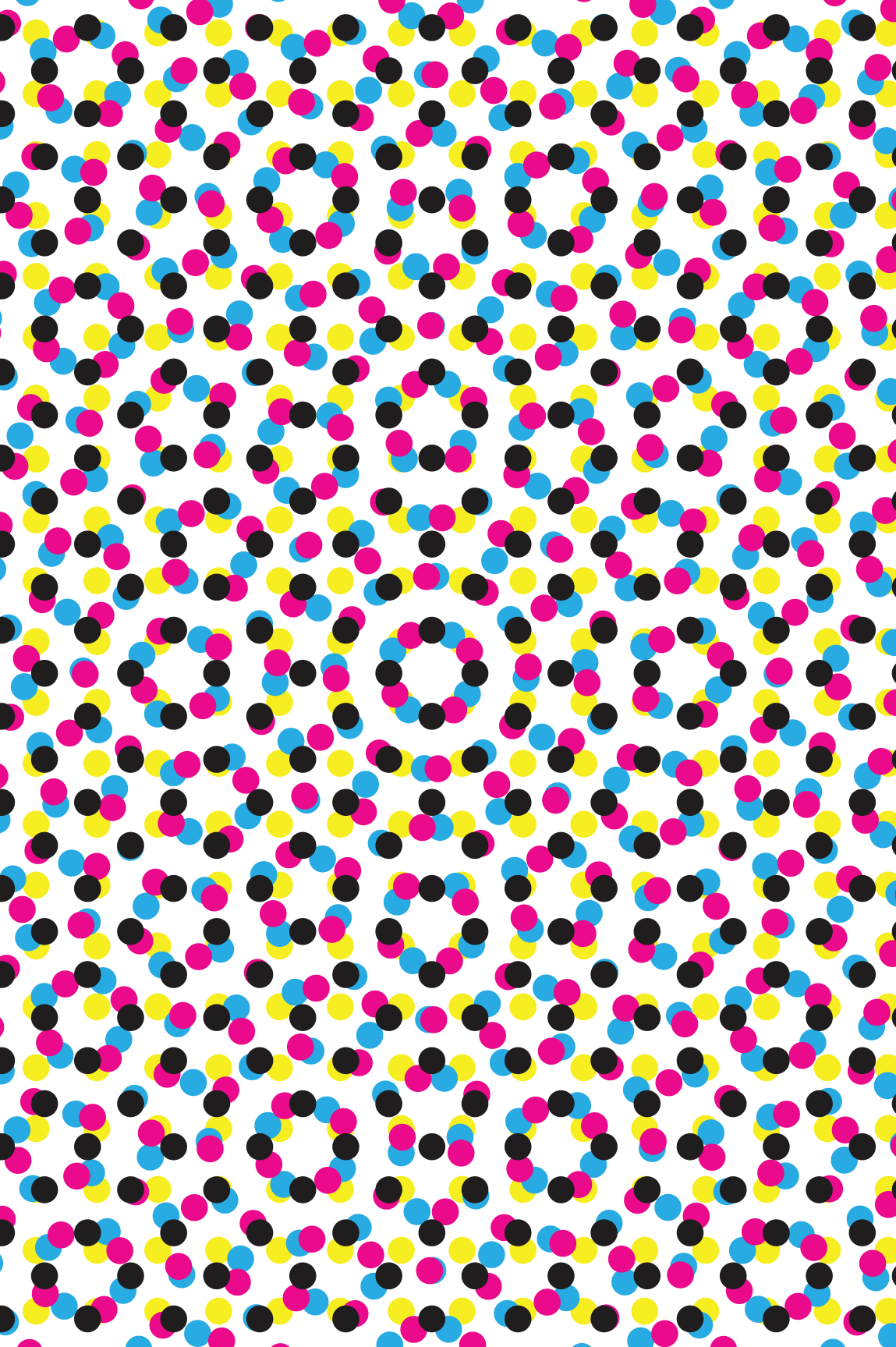# PRINTING BASICS

THE DESIGNER'S GUIDE TO ACHIEVING BRILLIANT RESULTS ON UNCOATED PAPER

ASK MOHAWK

Innovations in papermaking, printing and ink technologies have made it possible to deliver beautifully crisp printed images with the rich feel of uncoated paper.

Ever-evolving paper and print technology makes it possible to use premium uncoated papers in exciting new ways. The natural surface of these papers is a perfect background for four-color process printing. But it is essential to remember that uncoated papers are absorbent, so inks, varnishes and coatings perform differently than on coated papers.

Your client has high expectations. Your printer has broad technical expertise. And you, the designer, are the conduit to bring these two together. All it takes is communication and attention to detail to achieve spectacular results.

Expectations differ widely from client to client and printer to printer, and may even change from project to project. The printer may want press-ready files or they may want to manage color conversion and necessary output adjustments in their own controlled environment.

Your job is to navigate these waters with an understanding of how the printer would like the files prepared and then create the files to the best of your ability. Don't be afraid to ask questions. Print technology is constantly improving and changing. Don't assume that what was status quo yesterday, is normal operating procedure today.

PRINTING BASICS
COLOR GAMUTS

Modern digital cameras and scanners capture images in the red, green, blue (RGB) color space. Our computer monitors and televisions display those images in RGB. In most video displays each pixel is composed of red, green and blue sub-pixels which combine in various proportions to produce a range of colors. The colored pixels when viewed from a normal distance appear to blend.

Offset printing requires that those RGB original images be converted to cyan, magenta, yellow, black (CMYK). Though it varies by the job, ink is typically applied in the order of the abbreviation. The CMYK model works by applying ink colors to a lighter, usually white, background. The ink reduces the light that would otherwise be reflected. This model is called subtractive because inks subtract brightness from white. A full combination of colored inks results in black. However, to produce deeper black tones and unsaturated and dark colors black ink is added.

Like the RGB pixels of your computer monitor, CMYK color is broken down into dots in offset printing. Our eyes connect the dots to create the illusion of continuous tone and a range of colors.

RGB AND CMYK COLOR GAMUTS

A color gamut, is a subset of colors which can be accurately represented in a given color space or by a certain output device. Each color space has its own limitations.

When converting from RGB to CMYK, the original colors which are outside of the CMYK space gamut must somehow be approximated. Simply trimming the colors which are out of gamut can seriously hurt the image. Most printers use profiles to simplify this process. Talk to your printer early to find out how they want files supplied. Many printers request CMYK press-ready files while others prefer to make this conversion within their color-controlled environment.

THE ADDITIVE PRIMARIES: RED, GREEN AND BLUE.

THE SUBTRACTIVE PRIMARIES: CYAN, MAGENTA, YELLOW AND BLACK. IN OFFSET PRINTING BLACK IS ADDED FOR DEPTH, CONTRAST AND RICHNESS OF COLOR

CMYK COLOR GAMUT

RGB COLOR GAMUT

VISUAL COLOR GAMUT
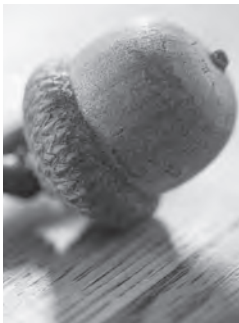
PRINTING BASICS
HALFTONES+CMYK

A photograph, painting or illustration that includes different shades or gradations of color is said to be continuous tone. A halftone is the reprographic technique that simulates continuous tone imagery through the use of dots, varying either in size, in shape or in spacing. Where continuous tone imagery contains an infinite range of colors or grays, the halftone process reduces visual reproductions to an image that is printed with only one color of ink, in dots of differing size or spacing.

In printing, ink is applied to the dots but not to the spaces between them. The size and angle of the screen controls the size and proximity of the dots to create the desired shade. Larger, closer dots create darker color because they allow less of the paper to show through. As dots get smaller and farther apart, the color gets lighter.

In digital halftoning, images are broken down into dots when printing plates are made. This process is precise and can produce extremely fine dots, allowing for many shades and gradations.

Duotones are two color halftones that use two screens at two different angles and two colors of ink on two different plates to create more depth and contrast. Tritones and quadtones add additional screens at unique angles. All are great options for jobs where spot colors are used.

CMYK printing uses the four process color inks—cyan, magenta, yellow and black—to reproduce a broad spectrum of colors and tones and is made possible by repeating the halftone process for each color. The semi-transparent nature of ink allows halftone dots to optically reproduce full-color imagery.

HALFTONE

DUOTONE

FOUR-COLOR PROCESS

PRINTING BASICS
PIXELS, DOTS+LINES

The history of printing is the history of progress toward reproduction of continuous tone in mass quantities.

A halftones ability to fool the eye into seeing continuous tone depends on the size of the screen used to divide the image into dots. The most common method of creating screens—amplitude modulation or conventional screening—produces a regular grid of dots that vary in size. The other method of creating screens—frequency modulation—is used in a process also known as stochastic screening.

The resolution of a conventional halftone screen is measured in lines per inch (lpi). This is the number of lines of dots in one inch, measured parallel with the screen's angle. Screens range from 60 lpi to 600 lpi. The higher the number, the finer the resolution of detail in the image. Coarser screen in the 60-85 lpi range have been commonly used in newspapers. For high-quality printing on premium paper, 175 lpi is considered the minimum standard line screen and high-quality ultraviolet (UV) printing can print as high as 300 lpi. (Read more about this on page 10.)

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Note: Images are measured in pixels per inch (ppi). The higher the resolution of your image, the greater the detail that can be reproduced. Your image's pixel resolution should be twice your intended line screen or a standard 300 ppi.

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In stochastic printing, uniformly-sized dots are placed randomly. So the density of a color is determined by the number of dots instead of the size of the dots. Stochastic screens are measured in microns and refer to the size of the dot. The lower the number of microns, the finer the resolution of the image. The random dot pattern of Stochastic screening eliminates rosettes and the potential for moiré patterns forming. It also offers a broader possible color gamut and therefore may require different curves.

All screening technologies have tradeoffs. For instance, stochastic can be used to smooth out screens and maintain consistency but it may not be the best choice for the imagery or ink coverage in your project. Consult your printer to determine which screening method is appropriate for your project.

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Note: Sometimes misused, the term dots per inch (dpi), refers to the imaging of your computer monitor or printer.
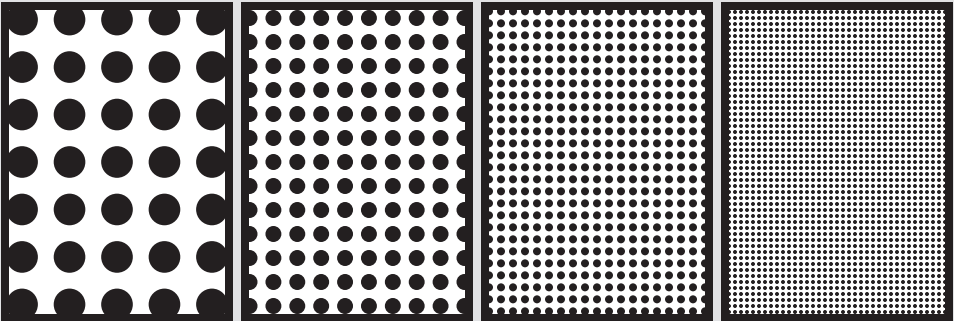
## IMAGE RESOLUTION

72 PPI IMAGE FILE

300 PPI IMAGE FILE

IMAGES ARE MEASURED IN PIXELS PER INCH. THE HIGHER THE RESOLUTION OF YOUR IMAGES, THE GREATER THE DETAIL THAT CAN BE RE-PRODUCED. YOUR IMAGES PIXEL RESOLUTION SHOULD BE TWICE YOUR INTENDED LINE SCREEN OR A STANDARD 300 PPI.
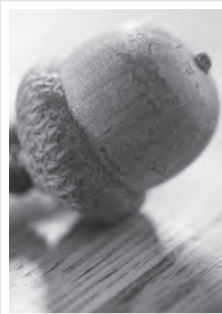
LINE SCREEN

THE RESOLUTION OF A CONVENTIONAL HALFTONE SCREEN IS MEASURED IN LINES PER INCH (LPI). THIS IS THE NUMBER OF LINES OF DOTS IN ONE INCH, MEASURED PARALLEL WITH THE SCREEN'S ANGLE. HERE A TONE OF THE SAME VALUE IS REPRESENTED BY INCREASINGLY FINER LINE SCREENS.
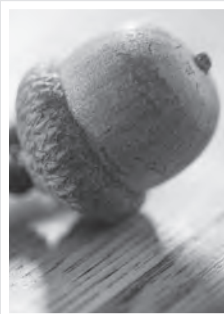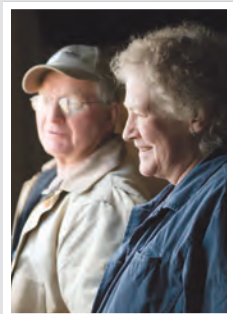

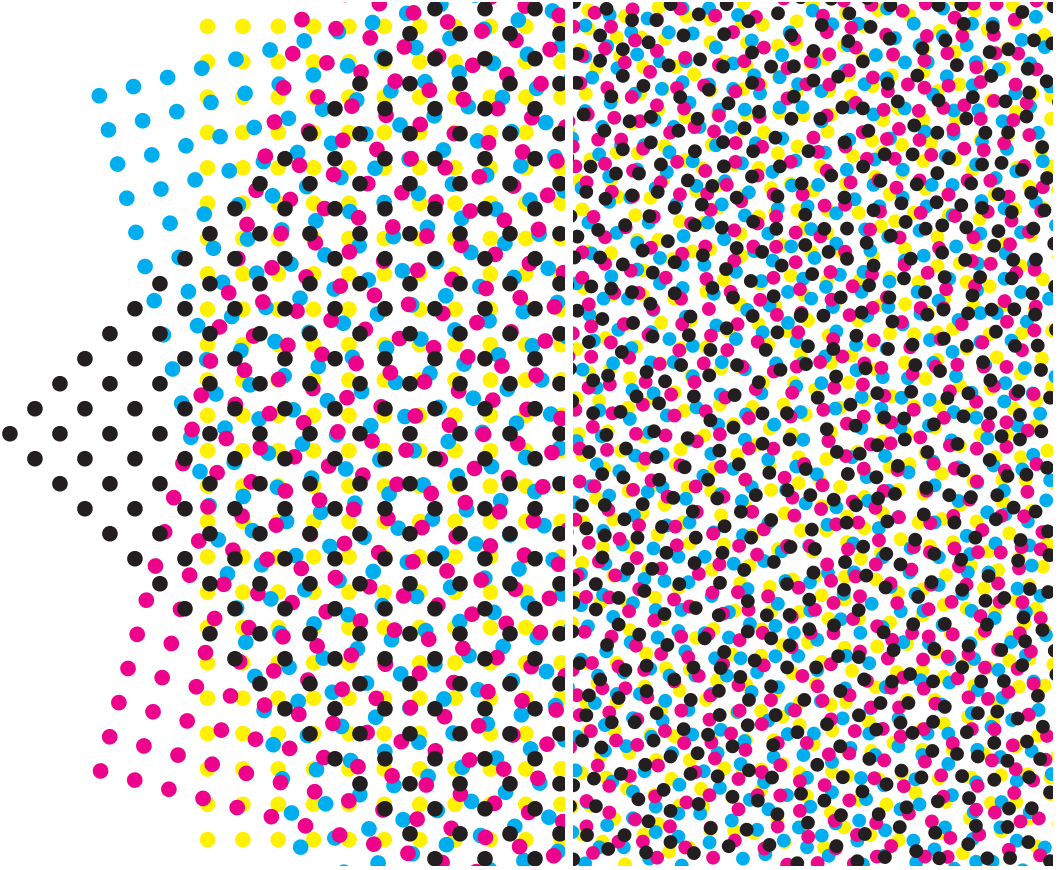
60 LPI   **150 LPI**   **60 LPI**   **200 LPI**

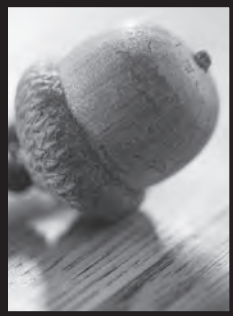THE SAME IMAGE IS SHOWN AT COARSE LINE SCREEN, SIMILAR TO A NEWSPAPER (ON THE LEFT), AND THEN AT A STANDARD OFFSET LINE SCREEN (ON THE RIGHT).
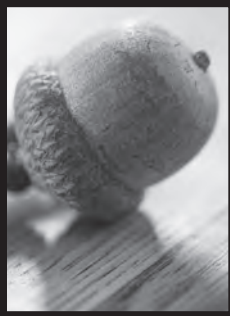
CONVENTIONAL LINE SCREEN ANGLES AND THE
RESULTING ROSETTE PATTERN. (YELLOW AT 0°, BLACK
AT 45°, CYAN AT 15° AND MAGENTA AT 75°.)

STOCHASTIC SCREEN (REPRESENTATION)

SCREEN COMPARISONS

60 LPI CONVENTIONAL

35 MICRON STOCHASTIC

200 LPI CONVENTIONAL

10 MICRON STOCHASTIC

PRINTING BASICS
DOT GAIN

Good color management is crucial for successful printing on uncoated paper. Color management is a science that results in true color fidelity, image brightness and detail. It allows input devices (cameras and scanners), display devices (monitors and projectors) and printing presses of all shapes and sizes to speak a universal color language. Color management helps ensure consistent and more predictable color reproduction by using profiles to translate the different technologies. The International Color Consortium (ICC) has developed profiles for optimizing images on uncoated paper depending upon the paper's texture, finish and shade. Talk with your printer to find out if they have profiles they will apply to your project.

Because of the ever-changing nature of color management technology, it is best to clarify when and how image adjustments should be made and who will be responsible. Some printers require designers to submit print-ready files with all color corrections in place. Other printers prefer to make the adjustments within their own color management system.

One challenge of managing color when printing on uncoated paper is the phenomenon called dot gain. The precise halftone dots spread and deform as they meet the surface of the paper. If the printer doesn't adequately adjust for dot gain in the color management phase, images can become filled in and flat, colors may not match your builds and knock out type and fine rules may fill in.

Dot gain can be controlled to a great extent through color management and file preparation. The use of adjustment curves can help accommodate for natural dot gain leading to cleaner, crisper printing with brighter colors and highlights and more detail in the shadows. Curves compensate for dot gain by opening up the separations, decreasing the dot size and increasing the space surrounding it, allowing the press operator to print to normal ink densities. Curve adjustment can take place on the designer's computer, in prepress or when the plates are imaged.

The following adjustments offer a good starting place when preparing images for printing on uncoated paper:

Open images 12% in three-quarter tones (shadows)

Open images 15% in mid tones (50% tones)

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Note: Curves to optimize images for uncoated paper vary depending upon the paper's texture and finish. Talk to your printer early to find out if they have curves they want to use.

STRAIGHT CURVE HALFTONE

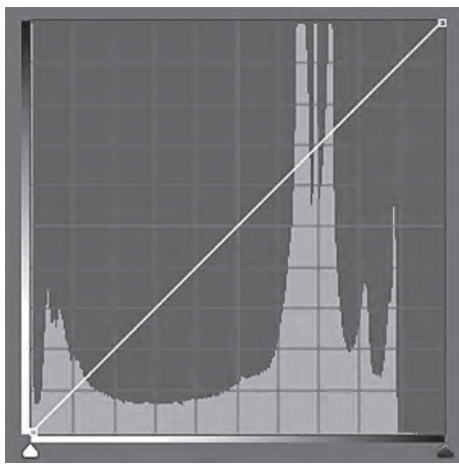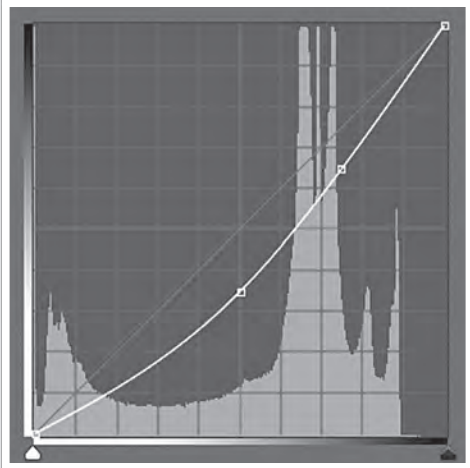CURVE-ADJUSTED HALFTONE

STRAIGHT CURVE CMYK COLOR

CURVE-ADJUSTED CMYK COLOR

PHOTOSHOP ADJUSTMENT LAYER SHOWING THE
UNADJUSTED CURVE OF THE ORIGINAL CMYK FILE

PHOTOSHOP ADJUSTMENT LAYER SHOWING AN ADJUSTED CURVE

EACH SEGMENT OF THE CURVE GRID REPRESENTS 10%.

NOTE THAT THE THREE-QUARTER TONES (THE TOP DOT) HAVE
BEEN OPENED UP 12% AND THE MIDTONES (THE LOWER DOT)
HAVE BEEN OPENED UP 15%.

PRINTING BASICS
INKS+TECHNIQUES

Different types of ink and methods of applying it can produce great effects on uncoated paper. Always consult your printer for their recommendations.

HEXACHROME PRINTING

Hexachrome is six-color process printing, adding green and orange inks to the traditional cyan, magenta, yellow and black. The added colors make a broader gamut of color reproduction possible. Hexachrome inks are brighter, cleaner and more vibrant than CMYK but can carry higher ink and press costs.

TOUCHPLATES

Touchplates or bump plates use one unit of the press to apply extra ink to certain areas of an image that require an extra pop. Photoshop or other software is used to isolate touchplate areas and incorporate them into an image.

ENHANCED BLACK/RICH BLACK

Printers use many techniques to achieve a denser, richer black. Some use two hits of black, CMYK black or process black over a screen of cyan. Consult with your printer regarding their favorite mix to add drama and weight to artwork.

METALLIC INKS

Metallic inks use metallic powders in a varnish base to create images with metallic luster in virtually any printing process. Smooth uncoated papers deliver the best results. Leafing inks which have metal flakes that rise to the top of the ink mixture have more shine but increased rub off. The metal flakes in non-leafing metallic inks sink down with less rub off and a little less shine. Non-leafing inks with a dull varnish or aqueous coating perform most reliably on uncoated paper.

ULTRAVIOLET PRINTING

Ultraviolet (UV) Inks produce sharp images because they are cured instantly under UV lights on press. UV printing minimizes dot gain and also eliminates the need for varnish or aqueous coating.

CO-CURE PRINTING

Co-cure presses have UV lamps on only a portion of their ink towers. These lamps use heat rather than light to dry the inks and the lamps can be moved around the press adding flexibility.

FLUORESCENT INKS

Semi-transparent and naturally bright, fluorescent inks increase the clarity and brightness of images printed on uncoated paper. Fluorescent inks may be used as spot colors or may be added to process colors to alter a color image. Fluorescent inks are not recommended for images of people because they can make flesh tones appear too hot or sunburned.

SOLID SPOT COLORS

Solid coverage on uncoated papers can be tricky. Many ink formulas use transparent white to create light colors. These colors, when printed can appear mottled or muddy. To smooth out the solids you can ask your printer about trying a second hit of ink; moving the spot color to the last unit on the press; substituting opaque white in the ink formula; or using a dull coating to minimize the mottle.

GRAY COMPONENT REPLACEMENT (GCR)

Gray component replacement, or achromatic color replacement, uses specialized software to remove the graying or achromatic component of combined cyan, magenta and yellow and replace it with black. GCR uses less ink and offers better color stability on press making registration easier and greatly reducing trapping issues.

SOLID SPOT COLOR
4 PARTS BLUE
12 PARTS TRANSPARENT WHITE

SOLID SPOT COLOR WITH OPAQUE WHITE INK
4 PARTS BLUE
12 PARTS OPAQUE WHITE

**CONVENTIONAL
FOUR-COLOR PROCESS**

**WITH FLUORESCENT MAGENTA
TOUCHPLATE**

SEMI-TRANSPARENT AND NATURALLY BRIGHT, FLUORESCENT INKS INCREASE THE CLARITY AND BRIGHTNESS OF IMAGES PRINTED ON
UNCOATED PAPER. A FLUORESCENT MAGENTA TOUCH PLATE ENHANCES THE WARM TONES IN THIS PHOTO.

ULTRAVIOLET
FOUR-COLOR PROCESS

CONVENTIONAL INKS LOSE SOME INTENSITY AS THEY DRY. ULTRAVIOLET INKS PRODUCE THE SHARPEST IMAGES BECAUSE THEY DRY INSTANTLY UNDER ULTRAVIOLET LIGHTS ON PRESS. THIS LEAVES LITTLE TIME FOR DOT GAIN AND ELIMINATES THE NEED FOR A VARNISH OR AQUEOUS COATING.

PRINTING BASICS
COATINGS

Heavy ink coverage can sometimes rub off at the touch of a finger or transfer onto the sheet next to it. Varnish, aqueous and ultraviolet coatings help seal ink to prevent rub off.

VARNISH

The most flexible of coatings, varnishes may be used on any weight stock and be applied over ink without fear of bleeding. Varnish is a petroleum-based sealant applied by a standard inking unit on press. It can be specified in matte, dull, satin or gloss and applied to the entire sheet or only in selected areas.

Matte and dull varnishes are recommended for uncoated papers. (Gloss and satin varnishes can make images appear uneven or mottled.) Varnish darkens inks on uncoated paper—making solid blacks blacker, but will not provide any other visual effect. If your project requires glue, you may need to knock out or remove the varnish where the glue will be applied. Check with your printer or bindery to be sure.

Varnishes can yellow paper over time. Varnishes can also be tinted with pigments to provide very light and transparent colors.

AQUEOUS

Water-based aqueous coating can be applied over wet ink from a special coater tower. Aqueous seals a press sheet instantly allowing the ink to continue to dry underneath. Matte, dull and lay flat aqueous are recommended for uncoated paper. Aqueous coatings generally cover the entire sheet because they do not yellow over time. Like varnish, aqueous coating primarily prevents rub off.
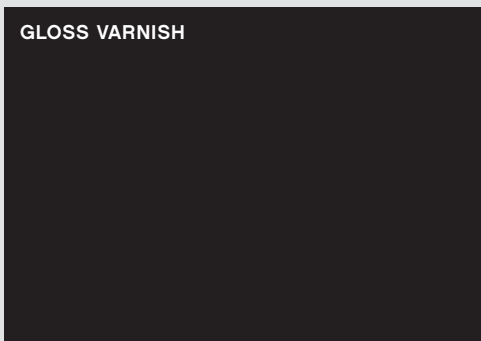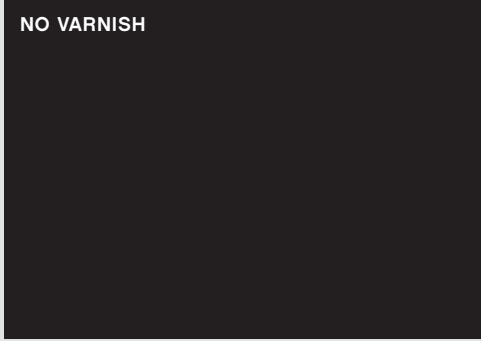
Some printers will only use aqueous coating on 100 lb. text and heavier paper to avoid the risk of curling edges. Additionally, be sure it is compatible with the pigments in the ink, as aqueous can cause some pigments to bleed.

ULTRAVIOLET COATING

Like UV inks, UV coating is dried quickly with UV radiation. Applied by silkscreen, UV coatings deliver the best rub protection and fastest drying time. UV coating can be used on smooth, cover-weight papers. Pre-testing is recommended. UV coating is usually specified in gloss, although matte, dull and satin UV coatings are available. Options include spot and overall coverage.

TWO HITS OF BLACK INK

NO VARNISH

DULL VARNISH

LAY FLAT AQUEOUS

GLOSS VARNISH

TWO HITS OF MATCH SILVER

NO VARNISH

DULL VARNISH

LAY FLAT AQUEOUS

GLOSS VARNISH

PRINTING BASICS
PAPER SPECIFYING

Paper makers have been just as innovative as printers in the past several decades. In response to market demand, uncoated papers have gotten increasingly smoother while offering a variety of colors, visual effects and surface textures.

Premium uncoated papers are formulated to strike the delicate balance between ink holdout and ink receptivity. Mohawk's uncoated papers provide superior ink holdout and are dimensionally stable. Given the extensive range of uncoated papers on the market, you should specify the manufacturer and the grade that reflect the quality standard you expect. Discussing your paper choice with your printer and paper representative early in the process will help ensure that the paper you want is delivered in time for your print date. (Request a copy of Paper Basics at mohawkconnects.com.)

The process begins by choosing a stock, finish and color. You then decide upon a basis weight. Start by feeling the samples in the swatchbook. A complete range of basis weights is usually shown. Double check the chart in the swatchbook to make sure the color comes in the basis weight you prefer.

It's important to be as specific as possible. Ask your paper representative or paper merchant for plain paper samples or dummies of the paper you've chosen. A dummy is a complete bound version of your project with no printing. It shows how papers look next to each other and makes it easier for the designer and end user to imagine the finished piece.

When specifying paper for your job, don't cut costs by cutting the quality of paper. Fine paper is manufactured with superior formation and minimal side to side variation which positively affects printed results. Consider the following qualities when choosing a paper:

SMOOTHNESS
In general, the smoother the paper, the crisper the halftones. Different degrees of smoothness are achieved in a process known as calendering, the last step in paper making when the paper is run through a stack of large steel rollers with different surfaces. These rollers or calenders tighten the fibers and smooth the paper. Common finishes for uncoated paper, in order of increasing smoothness, are eggshell, vellum, smooth and super smooth or ultra smooth.

PRINTING BASICS
PAPER SPECIFYING

FORMATION

Formation refers to the distribution of fibers within a sheet. To check the formation, hold a sheet of paper to the light and look for uniformity rather than clumps or clouds. Good formation makes uncoated paper absorb ink evenly to yield uniform solids and crisp reproductions.

SHADE

A paper's color affects the way process colors reproduce on it. Not all white papers are the same color. Warmer whites contain more yellow, while cooler whites contain more blue which will affect the appearance of the printed colors. The printer may want to compensate for this possible color shift.

SIDE-TO-SIDE CONSISTENCY

Paper technically has two sides: the wire side, which comes in contact with the wires on the papermaking machine, and the felt side, which does not. On some papers, a color printed on the wire side will appear different than the same color printed on the felt side. Better uncoated papers have good side-to-side consistency and therefore more consistent print results from side to side.

PAPER TEXTURE

Textures are embossed on paper after it leaves the papermaking machine to create effects such as linen or felt. Textured papers are used to add tactile effect and visual interest. Genuine felt papers tend to be more absorbent. Linen finish papers by contrast have a harder surface and better ink holdout.

BRIGHTNESS

A paper's brightness is a function of the amount of color and light the paper reflects. The whitest paper may not always be the brightest. In general, brighter paper leads to the appearance of sharper images because more light goes through the ink and reflects back to the eye. Uncoated papers tend to have less glare than coated papers. Brightness is not the same as whiteness. Whiteness is a shade or color.

OPACITY

Opacity refers to the degree of show through, and should be a consideration with any job that prints on both sides of a page.

A designer's guide to selecting and working with a printer.

The key to successfully completed printed projects is communication. Every project has its own set of details to cover between the designer, printer and paper merchant. Mohawk recommends that you call your paper representative early in the design process. Their experience will help you select a stock which is appropriate for your project. Paper reps can also provide samples and promotions, dummies, and printing tips for particular grades.

PRINTING BASICS
THE PRINTER

CHOOSING A PRINTER

Most print salespeople show samples. This is a perfect opportunity to gain more insight. What were the critical areas in the sample and how did they achieve the results? Ask for samples showing the specific techniques you'll be using in your project. Because communication is the key to success, you should be comfortable with your salesperson's knowledge and understanding. Ask about any specifics you're interested in: what line screen is generally used; do they have any special bindery equipment? What is their proofing system? Do they have digital presses? Tour the pressroom.

Look for an organized and clean plant. The pressroom and warehouse should be temperature and humidity controlled. Ask about quality control systems and techniques.

COMMUNICATION

Keep in mind that you are buying a custom-made product. Your expectations should be clearly defined in the beginning. Discuss critical areas of your project and talk about the samples that you sent showing the results you like and those you want to avoid.

Ask your printer for a production schedule that includes dates for receiving proofs, returning proofs, press runs and deliveries.

SAMPLES

Have you had a print job in the past that you just loved? Or one that you didn't? Show the printer samples of print jobs that have specific qualities that you want to repeat or avoid.

PRINTER SALES → CUSTOMER SERVICE → ESTIMATING → PREPRESS → PRESS → BINDERY
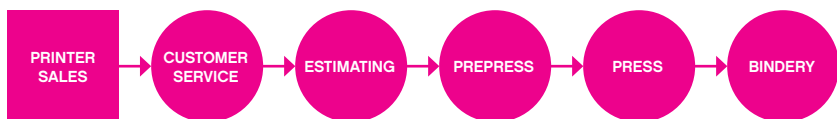
THE DEPARTMENTS A JOB MOVES THROUGH AT THE PRINTER

PRINTING BASICS
PRE FLIGHT+PREPRESS

Your job is to supply the best possible files to the printer. It is best to go through the design page by page with the printer and discuss your work flow:

What kind of files will you submit to the printer?

What kind of proofs can you expect to receive?

Can your printer supply you with a PDF profile that is built to match their presses, ensure print outcome and streamline proofing?

Who will convert the images from RGB to CMYK?

Who will adjust the curves?

Will your images need any GCR?

Start with high-quality images (good exposure, color, etc.)

Are your images of adequate resolution, twice your line screen or 300 ppi at final print size?

Will your image files be final or need color correcting?

Do you need any scanning done?

Who will fine tune images if required?

Who should build special plates for—touchplates, coatings, etc.?

Who will set the traps?

Who will adjust files for any necessary finishing considerations such as creep in booklet making?

PRINTING BASICS
PROOFS

THE BEST PROOFS ARE THE ONES YOUR PRINTER CAN MATCH

Find out which proofs your printer prefers. In almost all cases the printer has fingerprinted the equipment to the proofing system. Keep in mind that, short of a press test, there is no proof that 100% replicates the printing process.

DRAWDOWNS
This offline test uses the ink for your job on the paper you've specified. Ink drawdowns are important when you are using specialty inks, for a critical color match or to see a double hit of color on your stock. This is especially important if using a cream or colored stock. Make sure you also ask for appropriate coating–varnish, aqueous or UV–on your drawdowns, as these can affect your ink shade.

LOOSE COLOR PROOF
A printer who is doing scans will provide a loose color proof that lets you compare the scanned color against the original image. This step if especially important if you are providing your printer with digital photography.

DIGITAL COLOR PROOF
Direct-to-plate printing uses digital proofs, rather than film or blue lines, for composite color, type and position. Digital proofs, also called spin jets, save time and money and can sometimes be made on the actual paper you plan to print on.

PDF PROOF
A PDF proof gives you a good idea of how your job is going to print and are an easy way to check text and overall design. However, they may not be adequate for complex color projects or long documents with unusual pagination.

Keep paper shade in mind when reviewing color proofs. For warmer stocks like a cream white, you might want to reduce yellow, particularly in skin tones. For a shade like blue white, you might want to reduce the cyan. These changes are best done in scanning, although slight adjustments can be made on press. Many printers can sometimes proof on actual printing stock, which makes it easier to anticipate the effect of paper shade on printed color.

PRESS TEST
A short-run test proof made on press using the plates, ink and paper specified for your job. Also called strike off and trial proof.

PRINTING BASICS
ON PRESS

Make sure your printer understands what you expect—and you understand their capabilities. Use the checklist in the back pocket, take your time, and follow it step by step.

You should have all final proofs, original art and ink swatches/drawdowns to check against on press.

This is your final opportunity to verify that your job matches your specifications. Check artwork, separations, ink colors, paper stock and overall impact. Concentrate on critical areas of color such as flesh tones or product photography. Keep in mind that the color on press may never exactly match the color proof. Your goal is to make the images look as good as possible.

Make one or two changes at a time.

Once you are satisfied, sign and date three sheets; one for the printer, one for you, and one for the client. Have your printer slip sheet a complete set to take with you.

GLOSSARY OF TERMS

CMYK
Subtractive primary colors used for four-color process printing: cyan, magenta, yellow and black.

COLOR GAMUT
The color gamut, is a subset of colors which can be accurately represented in a given circumstance, such as within a given color space or by a certain output device. Each color space has its own limitations.

COLOR MANAGEMENT
A system that allows input devices (cameras and scanners), display devices (monitors and projectors), and printers to speak a universal color language. Each of these devices uses different technologies to reproduce color. They also have different color ranges or gamuts, so one device may be able to produce colors that the other devices can't. Color management helps achieve consistent and more predictable color reproduction by translating the different technologies using ICC profiles. These profiles describe the behavior (range or gamut) of each device. The color management system uses this information to accurately reproduce colors among all of the profiled devices.

COLOR SEPARATION
The process by which original artwork is separated into individual CMYK color components for printing.

COMPUTER TO PLATE
Digital output directly to a printing plate.

CURVES
Dot gain compensation curves are a method of controlling tones using calibration that manipulates the exact size of the dots on the printing plates so that tone saturation and gray balance are controlled on the press sheet. This calibration can account for the type of plate used, the type of paper stock used, the dot shape used and the type of screening used—stochastic or conventional.

DENSITOMETER
Instrument that measures the density of colored inks on paper. Used to determine consistency in ink densities throughout a press run.

DOT GAIN
The phenomenon when halftone dots grow or spread on press.

DOTS PER INCH (DPI)
The resolution of an imaging device. i.e. Number of dots of ink a desktop printer prints per line per inch.

GRAY COMPONENT REPLACEMENT (GCR)
A technique that removes the graying or achromatic component of combined cyan, magenta and yellow and replaces it with black.

ICC PROFILE
A set of data that characterizes a color input or output device according to standards promulgated by the International Color Consortium (ICC). It allows for reproducible representations of color, in both analog and digital representations. ICC Profiles describe the color attributes of a particular device or viewing requirement by defining a mapping between the device source or target color and a profile connection space (PCS). Every device that captures or displays color can be profiled. Some manufacturers provide profiles for their products, and some end-users generate their own color profiles.

INK HOLDOUT
A characteristic of paper related to its capacity to keep ink sitting on its surface rather than absorbing into the sheet. Better ink holdout produces sharper, more vibrant printed images.

LINES PER INCH (LPI)
The number of lines of halftone dots in one inch, measured parallel with the screen's angle.

LOUPE
A printer's magnifying glass.

MOIRÉ
Patterns in an image caused by incorrect screen angles.

MOTTLED OR MOTTLING
Having a blotchy, cratered appearance similar to the lunar surface. Mottling is a risk for images that include big areas of solid color.

PAPER DUMMY
A paper dummy uses the specified paper and shows how the job will be assembled during production—including size, fold and binding. Get a paper dummy at the outset for any project involving numerous pages. Make sure to get a new paper dummy if the page size, paper or job specifications change.

PIXELS PER INCH (PPI)
The number of pixels per inch in a digital image. The higher the number, the higher the resolution and the better the image quality.

PORTABLE DOCUMENT FORMAT (PDF)
A file format used to present documents in a manner independent of application software, hardware, and operating systems. Each PDF file encapsulates a complete description of a fixed-layout flat document, including the text, fonts, graphics, and other information needed to display it.

PREFLIGHT
Describes the process of confirming that the digital files required for the printing process are all present, valid, correctly formatted and of the desired type.

PRESS-READY PDF
This file contains all the necessary items to print a job successfully on press. Including fonts, images, colors, document specifications, etc. Many printers can supply a profile that is used to generate a press-ready pdf with to their exact specifications.

RASTER IMAGE PROCESSORING
The process and the means of turning vector digital information such as a PostScript file into a high-resolution raster image for printing.

RESOLUTION
The resolution of a halftone screen is measured in lines per inch (lpi). This is the number of lines of dots in one inch, measured parallel with the screen's angle.

RGB
Additive primary colors used for monitors and image capture by camera or scanning: red, green and blue.

REGISTRATION
Proper print registration means that any impression on the paper—ink, metallic foil, embossing, die cut shape, etc.—occurs in the precise position as intended.

SPREADS AND CHOKES
Similar to trapping, these terms refer to the overlap of overprinting images to avoid white or colored borders around details of images.

STOCHASTIC
A halftone process based on the random distribution of halftone dots, using frequency modulation (FM) to change the density of dots according to the gray level desired.

TRAPPING
When an offset printed document uses more than one ink on the same page, each ink must be printed in register (perfectly aligned) with any other inks that it abuts, so that there is no gap where the different inks meet. Trapping is a method of adjusting the artwork by slightly overlapping the areas where two distinct, adjacent colors meet so that press misregistration won't cause white spaces.

UNCOATED PAPER
Paper manufactured with no surface coating. Characterized by a wide variety of grades and levels of quality.

Mohawk has a long-standing tradition of craft and technological innovation.

Papermaking at Mohawk began near the end of the Civil War when the Frank Gilbert Paper Company, a small newsprint mill, began operating where the Mohawk and Hudson Rivers meet. The company was purchased in 1931 by George O'Connor and renamed Mohawk Papermakers and remains family owned today.

Over the years, Mohawk has blended traditional craftsmanship with state-of-the-art papermaking technology and a view toward the future. With ongoing capital investment, a corporate culture focused on rapidly evolving customer needs and a commitment to the environment, Mohawk is the most technologically advanced papermaker in its field.

Mohawk is a non-integrated mill, which means that we do not manufacture our own pulp. When we buy pulp, it has already been purified and formed into thick sheets. We buy a variety of hardwood and softwood pulps and postconsumer waste fiber, because each of our papers requires its own special mix of fiber.

LEARN MORE

To learn more about Mohawk papermaking, download the Mohawk Live app at the App Store or at Google Play. Launch the app using your mobile device, hover over this image and prepare to be inspired!

Download envelope dielines, see complete stocking charts, order samples of paper and envelopes and more on the web at mohawkconnects.com.

Please visit www.mohawkconnects.com/caculator/papermath for our PaperMath calculator to translate inches to millimeters, sheets to pounds and more.

PRODUCTION

Design: Aurora Design / Niskayuna, NY

Printing and bindery: Sandy Alexander / Clifton, NJ

Covers and insert: Mohawk Superfine Smooth, Ultrawhite 100c / 270 gsm

Text: Mohawk Superfine Smooth, Ultrawhite 80t / 118 gsm

Inserts: See individual leaves
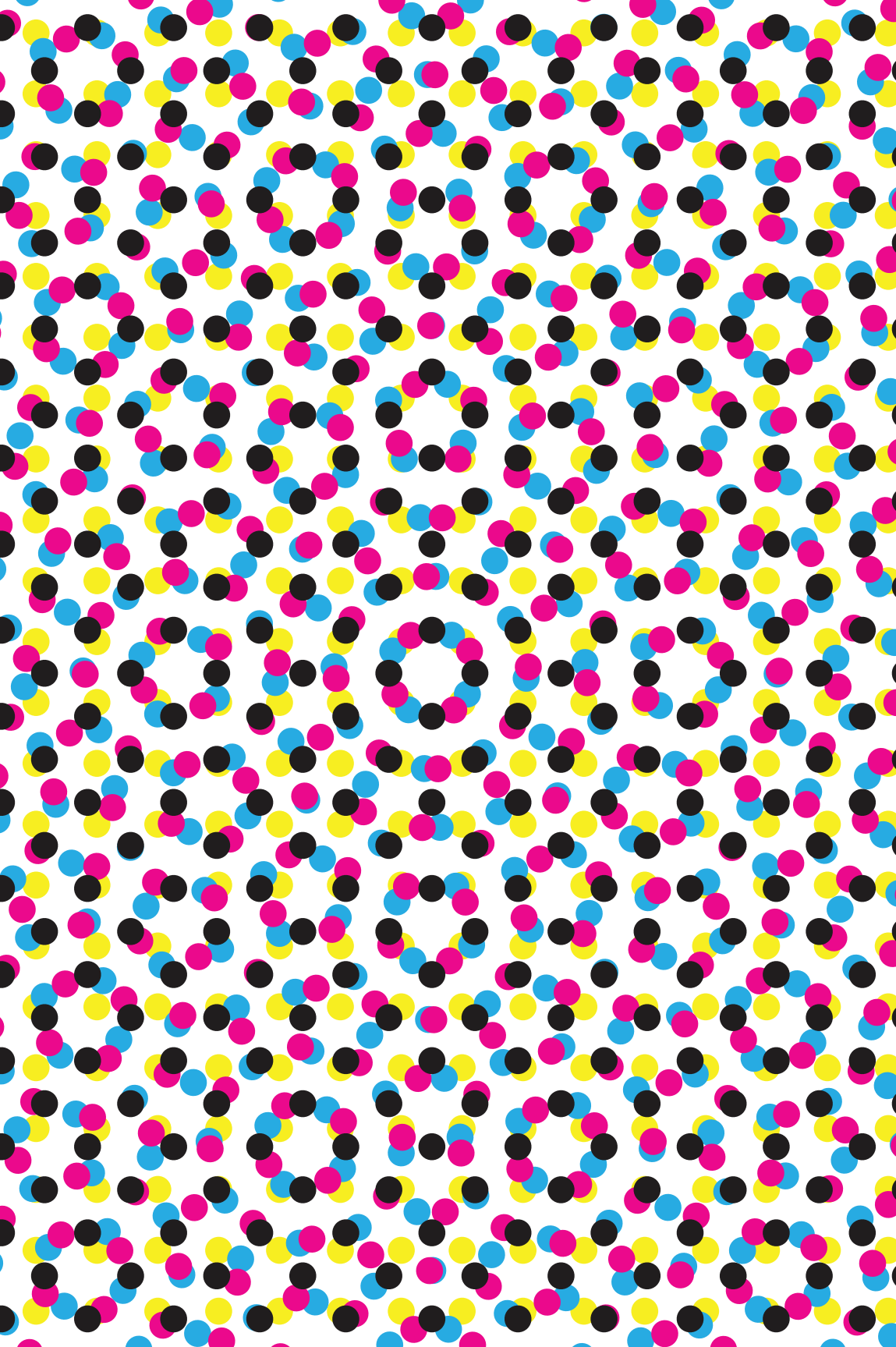
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Mohawk is North America's largest privately-owned manufacturer of fine papers and envelopes which are preferred for commercial and digital printing, photo specialties and high-end direct mail. Mohawk fine papers and envelopes, include the signature brands Mohawk Superfine® and Strathmore,® as well as proprietary treatments Inxwell® and i-Tone.® With a culture of innovation, Mohawk's business model now extends beyond paper manufacturing into new areas of growth, including digital substrates and web-based tools, which connect designers and printers to new markets.

As a leader in environmentally and socially responsible business practices, Mohawk was the first U.S. manufacturer of commercial printing papers to match 100% of its electricity with wind power renewable energy credits and the first U.S. premium paper mill to shift toward carbon neutral production. Most of Mohawk's portfolio of recycled papers is certified by Green Seal and the Forest Stewardship Council (FSC).

Mohawk is a fourth-generation, family-owned and operated business based in Cohoes, New York, with global sales and operations located throughout North America, Europe and Asia. For more information, please visit www.mohawkconnects.com.

Press check checklist

The key to success on press is communication. Make sure your printer understands what you expect—and you understand their capabilities. Use this checklist and take your time to follow it step by step. Make one or two changes at a time.

- [ ] Bring all approved proofs and ink drawdowns on press to check against.
- [ ] Use a magnifying loupe for close inspection.
- [ ] Check paper stock. Ask for the carton label and make sure it is the finish, weight and color you specified.
- [ ] Look for missing elements. Be sure all of your text and images apear where they are supposed to.
- [ ] Proofread any last minute copy changes.
- [ ] Check registration. If items look out of register or fuzzy, check the side of the sheet for the printer's registration marks to see which color is out of alignment. Check in more than one place to see if it is an isolated or general problem.
- [ ] Review match and process colors. Check solids for look, density and consistency. Compare the proof and ink drawdowns to the press sheet. All inks should be laying down smoothly. Densities should be even across the sheet and match between forms. Check by eye and with the densitometer. Check for mottling. Ask if they densities can be maintained consistently throughout the press run.
- [ ] Review separations and four-color process. Compare the proof to the press sheet. Move one color at a time and keep track of your moves on each press sheet. Concentrate on critical areas of color such as flesh tones or product photography. Keep in mind that the color on press may never exactly match the color proof. Your goal is to make the images look as good as possible.
- [ ] Check dry back on the sheet. If you are concerned that the colors will look lighter or darken when dry, quickly dry a sheet with a blow dryer, microwave or shrink wrap tunnel.
- [ ] Look for broken or fuzzy type, odd scratches, hickies, spots and ghosting.
- [ ] Check overall impact and legibility.
- [ ] Sign and date three sheets; one for the printer, one for you, and one for the client. Have your printer slip sheet a complete set to take with you.

ASK MOHAWK

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Print specs checklist

Print specifications, or print specs, list all of the job requirements of a job. The print specs you develop are used by the printer to accurately quote your job. Your specs should include:

SCHEDULE

☐ Delivery date

☐ File release date

PROJECT DETAILS

☐ Document trim size

☐ Number of pages

☐ Quantity

☐ Ink colors

☐ Paper brand, grade, shade, finish and weight

☐ Bleeds

☐ Critical crossovers

☐ Artwork concerns

☐ Proofs required

☐ Special processes or effects

☐ Bindery and finishing details

FILE PREPARATION

☐ File formats

EXPECTATIONS

☐ Press check expectations

☐ Billing and shipping instructions

Offset printing on smooth white paper

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones

- Four-color process, offset printed

- Conventional 200 line screen

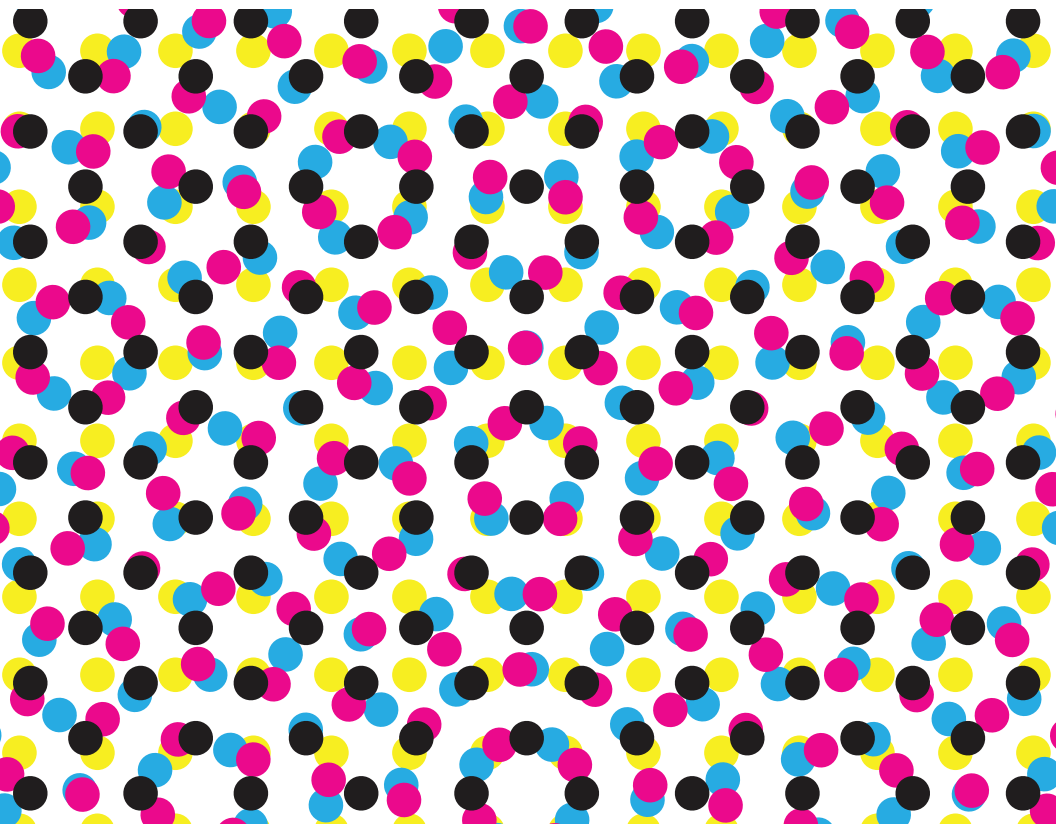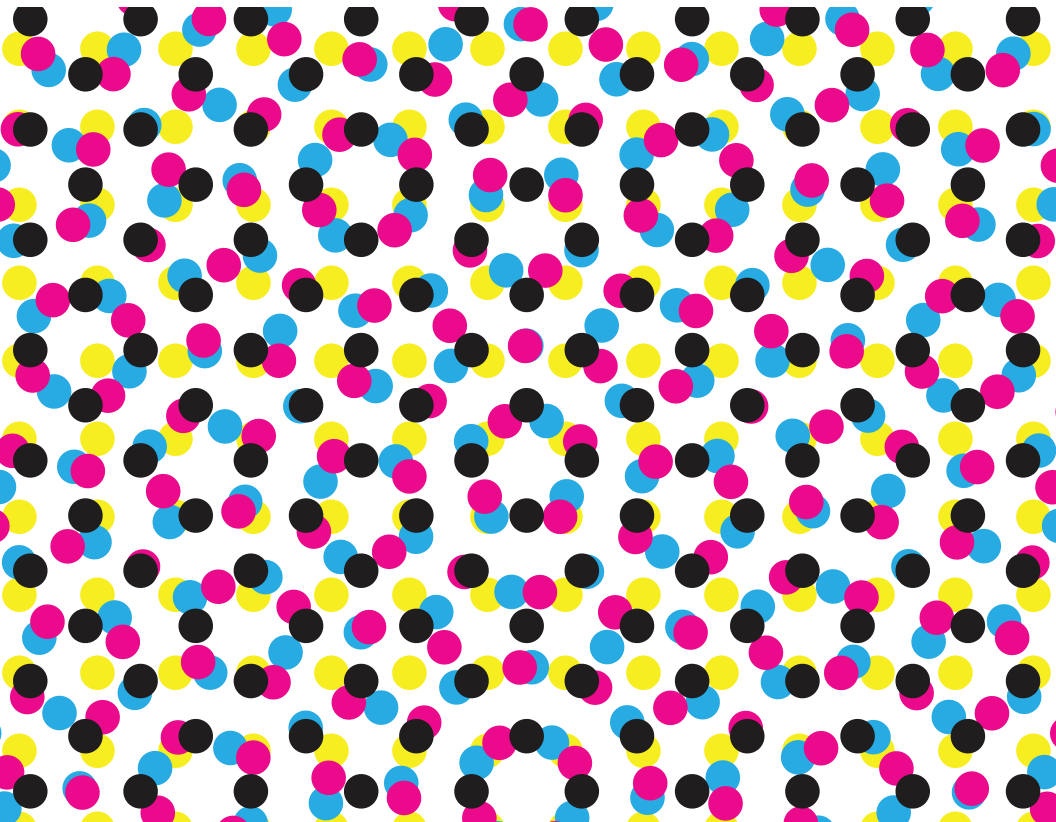- Mohawk Superfine Smooth, Ultrawhite 80c/216 gsm
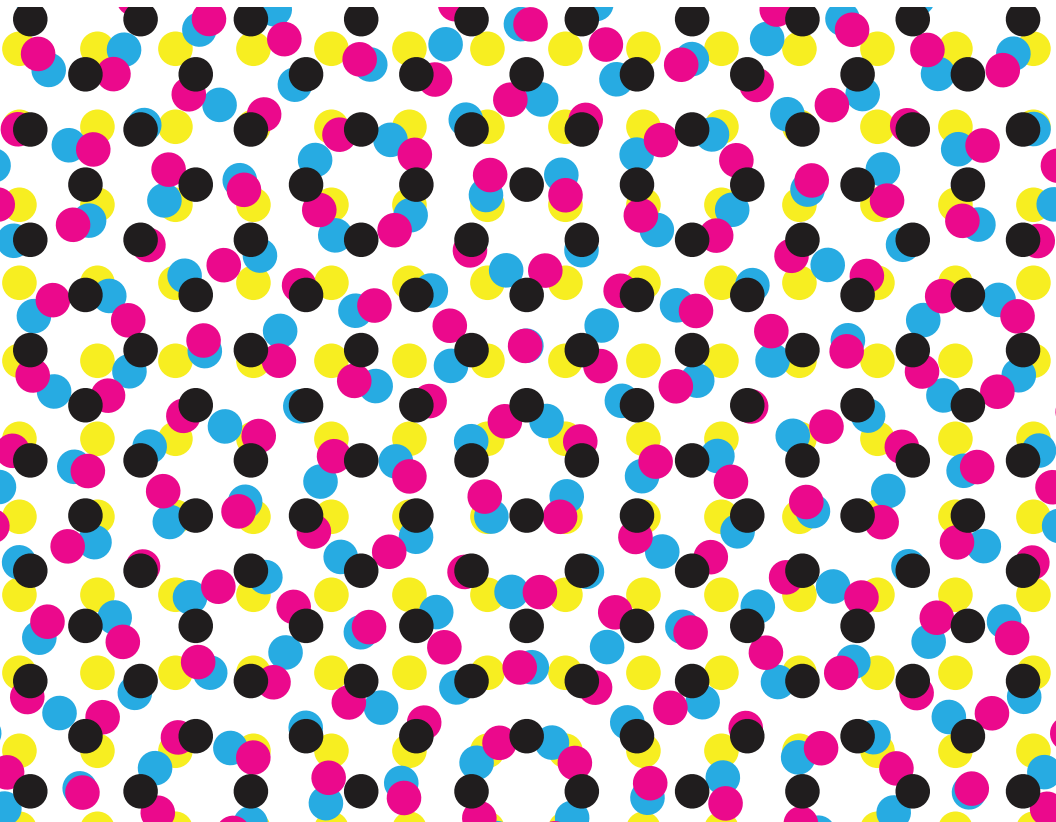
Offset printing on smooth soft white paper

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones
- Four-color process, offset printed
- Conventional 200 line screen
- Mohawk Superfine Smooth, Softwhite 80c/216 gsm

Offset printing on felt finish white paper

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones
- Four-color process, offset printed
- Conventional 200 line screen
- Mohawk Via Felt, Pure White 80c/216 gsm

Offset printing without curve adjustments

- No curve adjustment to compensate for dot gain
- Four-color process, offset printed
- Conventional 200 line screen
- Mohawk Superfine Smooth, Ultrawhite 80c/216 gsm

PROOF DEMO

Epson proof

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones
- Standard proofing stock

Note: Standard proofing stock is intended for short term use and will discolor quickly when exposed to light.

Four color process from an RGB original

- No curve adjustment to compensate for dot gain

- Non-color managed (from an RGB original)

- Four-color process, offset printed

- Conventional 200 line screen

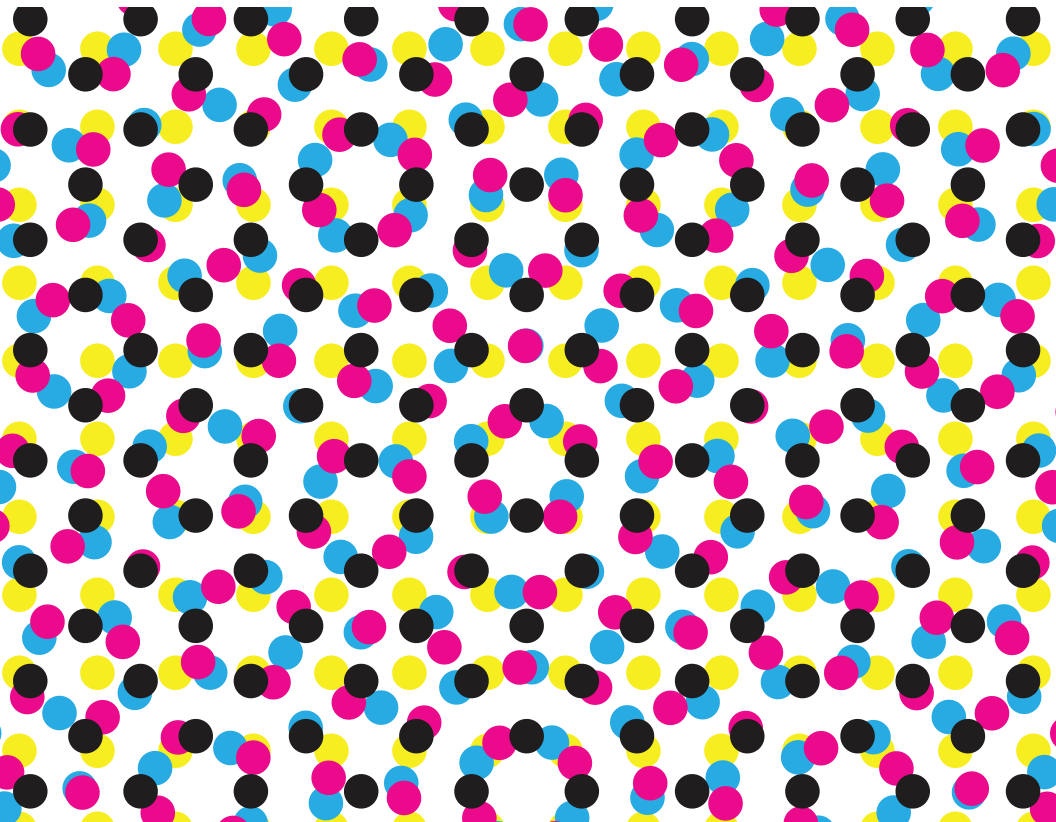- Mohawk Superfine Eggshell, Ultrawhite 80c/216 gsm
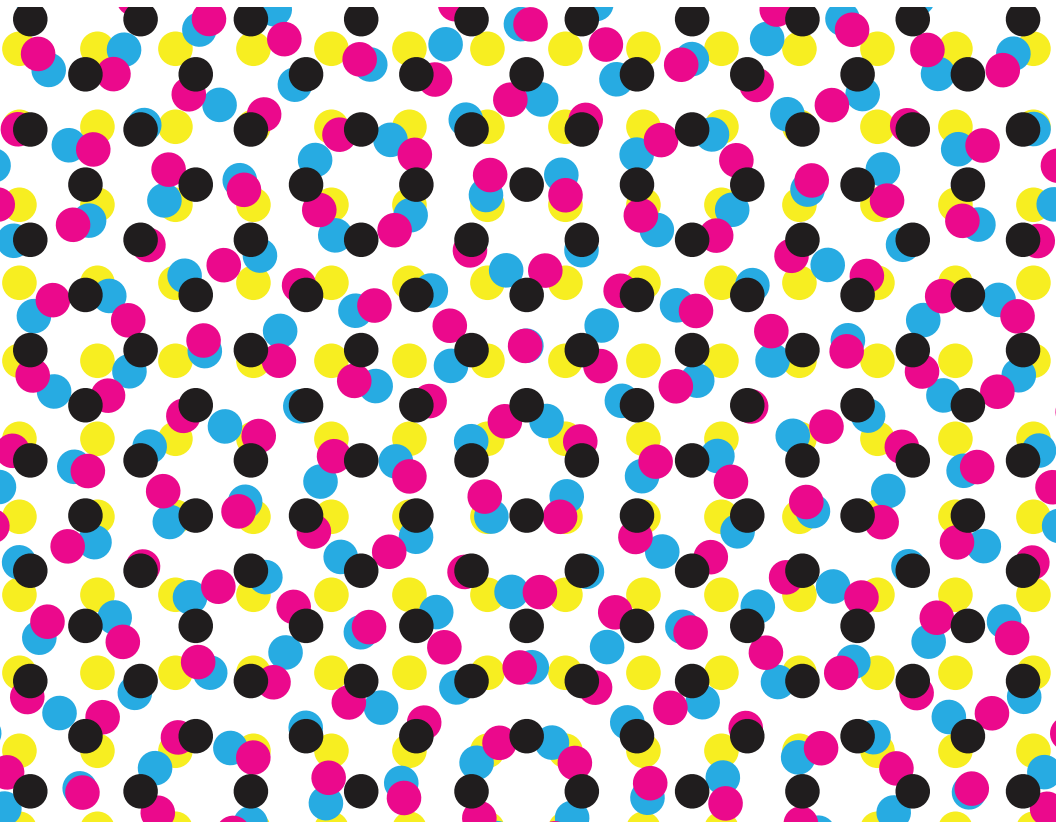
Four color process on eggshell finish white paper

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones

- Four-color process, offset printed

- Conventional 200 line screen
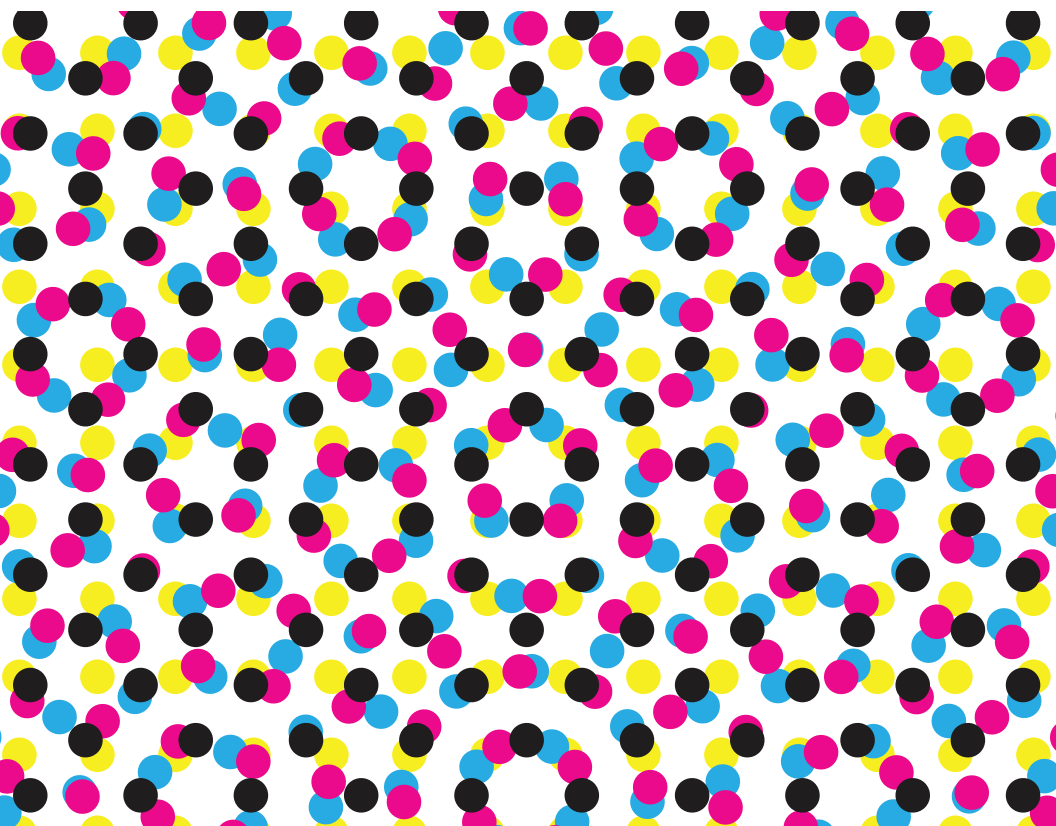
- Mohawk Superfine Eggshell, Ultrawhite 80c/216 gsm

Digital printing on eggshell finish white paper

- Curve adjustment not required for digital printing
- HP Indigo printed
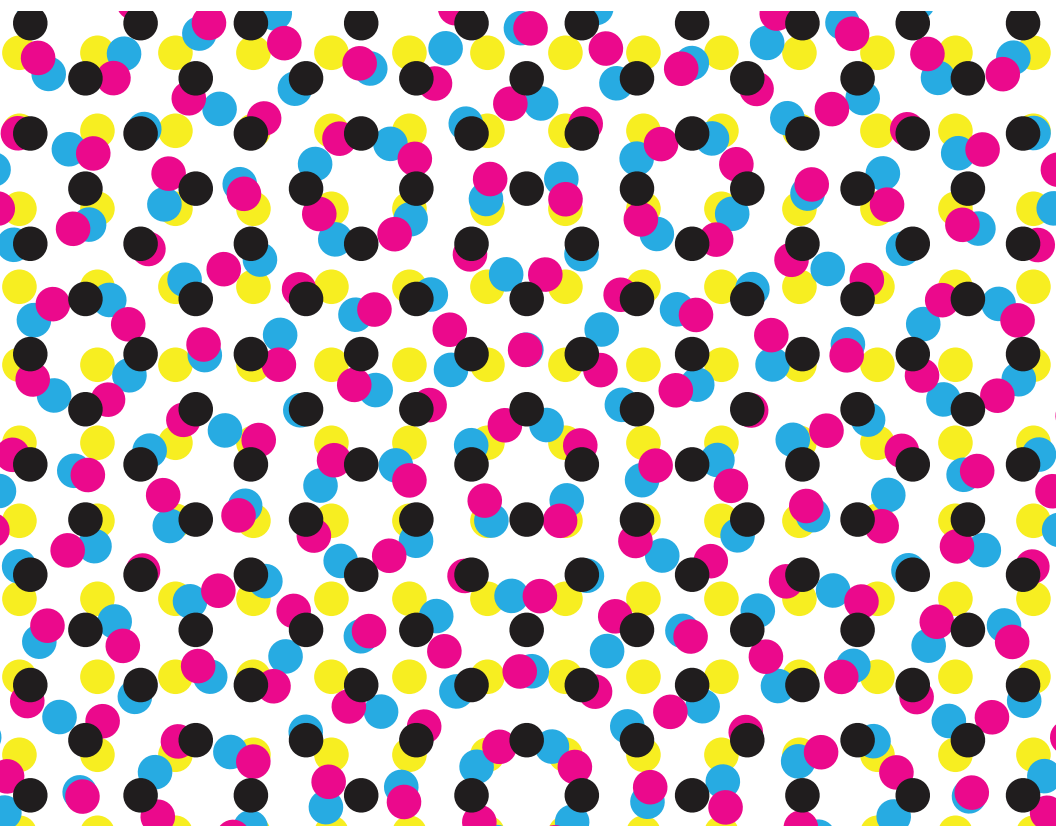- Mohawk Superfine Eggshell, Ultrawhite 80c/216 gsm

Four-color process black and white image

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones

- Four-color process, offset printed

- Conventional 200 line screen

- Mohawk Superfine Smooth, Ultrawhite 80c/216 gsm

Black halftone

- Curve adjusted: 12% in three-quarter tones, 15% in mid tones
- Offset printed
- Conventional 200 line screen
- Mohawk Superfine Smooth, Ultrawhite 80c/216 gsm