

CHOOSING AN INKJET PAPER FOR EXHIBITION PRINTING

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INTRODUCTION

Paper is vital to the image making process, it is the thing that the viewer holds in their hands when they look closely at a print. An appreciation of fine paper is an essential trait in a fine art printer or exhibition print maker.

Mike McNamee teaches exhibition printing at the Epson Print Academy and Photoshop technique for Aspect2i courses and seminar. He is also the editor of Professional Imagemaker magazine and before that Digital Photographer and Creative Imaging. Over the past decade he has tested almost every printer intended for the serious, enthusiast market, along with most wide format printers. For an ongoing series in Professional Imagemaker he has tested almost every inkjet paper that has been made, some of them on a multitude of printers. The tests now run into the thousands almost every one subject to rigorous statistic analysis of paper performance backed by exhibition size prints. In this white paper for Apspect2i he gathers together the important features of what has be learned in the quest for the perfect image/printer/paper combination.



What is Paper?

Paper is made in truly vast quantities worldwide, and Reymond and Co, the biggest manufacturer, have more than 100,000 people on their staff. As long ago as 2003 projections were being made that 5.2 billion sheets would be produced by the year 2008. In 2010 an estimated 115 billion sheets were used on personal computers alone – the ‘paperless society’ never happened!

While it is something we take for granted, paper is also something that many people know little about. It is made from a variety of materials depending on both cost and intended use. Newsprint is made from ground wood pulp and has residual amounts of lignin which make it discolour with time. It has to be fiercely bleached and residual chemicals from this process cause it to disintegrate over long periods of time. Wood based papers are not, therefore, ideal for imaging-making – acid free and rag papers are preferred. These are made from fibres derived from cellulose rather than lignin. The cellulose can come from grasses such as esparto or from cotton. Scrap cloth is used to make rag paper (hence the name) one of the finest materials in use.

The so-called wood-free papers are anything but. The wood is very finely ground, heavily bleached and often has whitener added which fluoresces mildly to make the paper appear whiter than it is – the same trick that is used to make washed clothes ‘whiter than white’. The US Library of Congress reported that 97% of books produced between 1900 and 1930 had lives of less than 50 years so it is obvious that a serious print-maker must strive for a higher level of excellence in both materials and production of their artwork if it has any pretensions for lasting value.

Art papers have a surface coating of china clay to give a smooth, non-absorbent finish. This keeps the inks close to the surface and hence more vibrant. The glossy art papers are made by callendering the surface with multiple passes through hot (steam heated), high-pressure rollers. Strangely, ‘art papers’ are not normally used for drawing and painting, they are used for quality art books and magazines, with the paper being optimised for ink-on-paper printing. The terminology is now rather old and less used to describe today’s papers.

In recent times new materials have made an appearance as ‘paper’. The classic one, known to photographers, is ‘resin coated paper’ such as Ilford Multigrade. Here plastic film is bonded each side of a paper carrier material and super coatings are applied to the top surface to hold the ‘high tech’ surface of a silver halide emulsion. This same substrate technology is often used for gloss and lustre inkjet papers today. In the same way that resin coated paper requires less washing because of the ‘barrier’ to chemicals provided by the polythene, the same philosophy may be used to prevent ink running away into the base paper in the inkjet printing process. The inking process is more physical than many people imagine. When the printing heads are set too high the droplets of ink actually bounce on the paper surface and land as much as a millimetre away from their intended target zone. Historically, resin coated papers suffered from a number of serious flaws. Early silver halide materials deteriorated over time and some early colour prints were appallingly unstable in light, shedding emulsion and flaking badly. Thankfully these days are long gone and the highly resistant modern materials have lives which exceed those of previous generations by some way.

Inkjet papers, therefore, are characterised by the following parameters which combine to impart a particular feel or character to a paper:

1. The make-up of the underlying substrate in the body of the paper
2. The paper weight (how much a 1 metre square would weigh)
3. The thickness, also known as the caliper
4. The number and type of surface coating materials
5. The surface finish or texture and tone

With just these five parameters to play with it is amazing the individual characters that papers can take on. Many are similar to each other, but some are almost unique in character. Choosing a paper for a particular purpose is endlessly fascinating for those who care about such things!

The Substrate

The substrate for quality prints should always be classified as acid free and lignin free. The words ‘archivally permanent’ or ‘museum grade’ are often associated with the better papers. The actual substrate material is usually a rag-based, alpha cellulose or often a mixture of both. Alpha cellulose is usually stiffer than a rag paper and mixtures lie in between the two. Alpha cellulose maybe derived form various grasses, sugar canes or bamboo. Pulped mulberry is a common material for hand-made artists papers.

For high-gloss finishes a plastic substrate backing a paper may be used to provide the additional sheen – this is true of many gloss, lustre and silk finishes.

Paper Weight and Caliper

These two parameters are related. Thicker papers tend to be heavier but not in every case. Weights of less than 160gsm are a little thin for exhibition, mounted work. When a paper reaches more than 300gsm it may require special handling to ensure that it runs smoothly through a printer and may even require the use of the board feeder should one be available. Weights of 500gsm are exceptional and such papers feel more like board products. The Fine Art Trade Guild demands a paper of more than 250gsm for limited edition printing and most quality products lie between 250 and 325gsm. The caliper or thickness varies with the density of the substrate but quality papers are usually between 250 and 450 microns.

Surface Texture

Textured papers are only normally used for painting, drawing, inkjet printing and letter press printing. They are difficult to use with Offset Litho printing, the type used to print magazines. When we use the term art paper we really mean fine art, that is paper intended for painting or creative imaging.

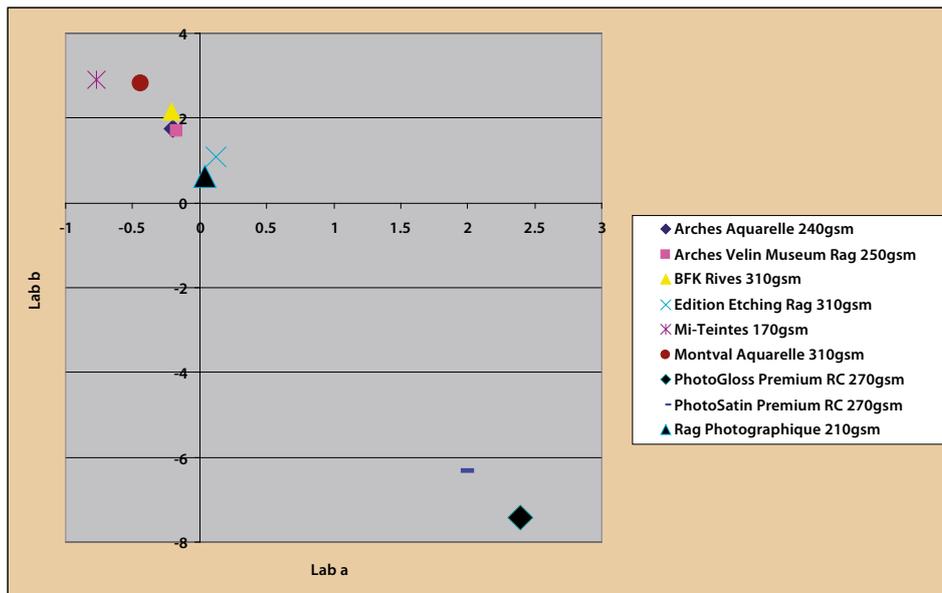
The texture or ‘tooth’ of the paper is a key element in imparting its feel. A size is usually applied to keep the inks or paints close to the surface. A traditional watercolour paper is often prepared for use by wetting and stretching it out to dry. Some people make paper as a hobby in its own right. This is very ancient technology stretching back to Egyptian times and papyrus (from where the name paper is derived). Many of the quality art papers come off a mould machine rather than the Fourdrinier machine used to make huge rolls of paper in a continuous sheet. The mould machine makes rolls of paper but has a woolen felt that presses the mash of fibres against the drying rollers and imprints its own unique signature to the surface of the paper. As the felt wears the texture of the paper becomes less pronounced. Other materials may be substituted for the wool felt and these impart different characteristics. There are only a small number of mould-making machines in the world so it is hardly surprising that many papers share the same base paper. The subsequent inkjet receptive coating has a great influence on the final result though.



The image reproduced here is from the Canson Infinity range of papers, some of the types approved for the Epson Digigraphie scheme. The glancing light macro shot illuminates the surface textures and goes some way to explaining why a narrative description is difficult – you really need to handle and see a paper for yourself.

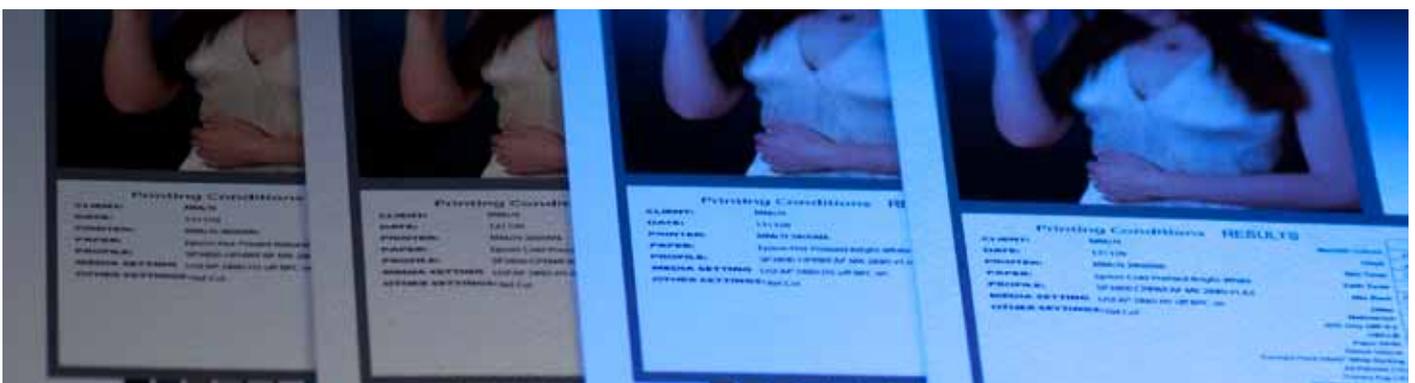
The best way to do this is firstly to obtain a swatch book and then to buy a test pack. We discuss testing a little later.

The tone of the paper is usually defined as warm or cool, bright or natural. Papers described as ‘natural’ are usually free of OBAs and slightly creamy. Less expensive papers tend to rely on optical brighteners to bring up their base whiteness. A cooler, bright paper is almost certain to contain OBAs. These can be effective for more modern, avant garde images, for fashion images, street portraiture and some types of nature work. The warm-toned papers are favoured by landscape workers, black and white specialists and for some portraits. As ever with photography there will be exceptions to each of these notions.



Coating Technologies

Coating is a relatively new area for things such as inkjet printing and this is where the trouble begins! An inkjet relies on squirting a very tiny drop of ink onto the page. By tiny we mean as low as 3 pico litres. This is a very small drop indeed, you would need 34 million of them to fill a thimble. Even at the 30,000 drops per second this would take the printer well over an hour to fill the thimble! In terms of spatial resolution, a modern Epson spits 2880 drops in an inch-run of image. The last thing that they want is for this ink to run about all over the surface thus destroying their carefully arranged dot pattern. You have to prevent ink droplets bouncing across the surface and you have to prevent the ink running straight down the microscopically sized holes in the paper surface and disappearing deep into the body of the paper. That is what happens if you print onto a photocopy paper and the result is a dull, lifeless image. If you coat the paper with an impenetrable layer, the ink will sit on the surface, smudge and resolutely refuse to dry. The trick is to take the ink away from the surface but then stop it and hold it close to the surface. Even when you have achieved that aim you are not secure. The ink continues to diffuse into the surface overnight and the print



may not look the same colour in the morning. Even if it does, it may still be subject to long-term migration. As if this is not enough, the different inks diffuse at different rates depending upon their chemical properties which means that there may be a colour shift as the ink dries. A number of different coating technologies are now available to the paper maker.

There are a number of paper and paper coating combinations in common use. Most of them make use of the mineral, rutile, which is titanium dioxide, TiO₂, a very white powder when it is ground. It should not be confused with titanium golf drivers or hip replacement joints, they use the pure metal, as a cast material. Titanium dioxide is used for all sorts of applications which require whiteness. Your white PVC windows, for example, are a PVC loaded with titanium dioxide. This PVC version is very clever as it consists of little balls of titanium dioxide coated first in a shell of silicon dioxide then an aluminium dioxide shell and then an organic surface coating. Discovered in 1913, titanium dioxide is a ceramic and is frequently mixed with other ceramics and minerals when used as a coating medium. When a coating is referred to as a “swellable polymer” the outer coating of the ceramic balls is most likely coated with a hydrophilic additive (hydrophilic means water swellable).

For coatings you have a choice of five technologies

1. Cast Coated
2. Swellable Polymer
3. Microporous (meso porous, nanoporous)
4. Infusion Coated
5. Bartyta Coatings

Many matt papers are cast coated. Examples of swellable polymer were Epson ColorLife and Ilford Galerie Classic. Microporous coatings are used in conjunction with Resin Coating (RC) in Ilford Galerie Classic papers and Epson Premium Lustre. At the moment the only infusion coated paper we are aware of is the St Cuthbert Bockingford fine art paper. The overall characteristics of papers are shown in the table. Art papers are governed by the expectations of artists and fine art publishers. The UK's Fine Art Trade Guild (FATG) requirements are listed in the table and are typical of higher-end requirements.

In the inkjet market, the ‘latest’ coating technology is referred to as ‘baryta’ or ‘baryta like’ and is of such importance that we give it its own sub-chapter. The use of baryta is not at all new as it has been coated onto imaging papers almost since the inception of photography.

Life Issues

The advantage that swellable polymer had was that the swelling of the coating sealed the surface and reduced the ingress of airborne chemicals (principally ozone and water vapour). This helped to improve fade resistance. Originally it solved an early problem that came to be known as Orange Shift, principally on Epson Premium Glossy Photo Paper, which used a microporous coating. The effect was variable, unpredictable and, at the time (around the year 2000) had a disastrous influence on thinking about inkjet longevity. For a dye ink, swellable coatings last between 2 and 3 times longer, but only from about 8 years to 25 years). Thankfully those days are long-passed and the newer formulations of microporous coatings are very much more stable. Today only a handful of papers use swellable polymer.

The down side of swellable polymer is that the small scale of the surface porosity will sometimes reject the larger particle, pigment materials, flood more easily or not dry at all. Pigment inks always outlive dyes in terms of fade resistance and despite their smaller gamut, higher metamerism and greater manufacturing difficulty they have come to rule the roost that is the quality inkjet market. For the black and white printer, pigment properties win all round, with the exception of metamerism, and even that is substantially under control with say the Epson K3 UltraChrome ink set.

Fade resistance of pigment-based inks, on quality paper for monochrome images, are now quoted out to more than 300 years in ideal conditions and more than 60 years in less protected environments. This white paper, just five years ago would have been talking about 60–70 years for fade resistance in specialised

showing environments. The topic has largely fallen off the radar during that time and is no longer a hot topic on forums. However, the warning is clear and producers of fine art, limited edition, high value prints should embrace new technology with caution and seek out only the very best quality materials!

Baryta a special kind of coating.

Around 23 January 2006 in the UK, Chau Digital announced a new inkjet paper, da Vinci Fibre Gloss, with claimed properties that were similar or even better than traditional silver halide. The claims were not misplaced and it is testament to just how good this type of technology is that the availability now extends to more than 30 variants – indeed some were still being added as we were compiling the lists. All claim allegiance to the ‘Fibre Base Baryta’ flag. Names, however, can be deceptive, some of the products are ‘baryta type’ and so do not contain barium sulphate, although they display ‘air-dried fibre base’ properties.

Instead of titanium dioxide, the ‘baryta type’ media can use barium sulphate to provide the base whiteness to media, some add barium sulphate only to the coating, others (principally Harman Technology) impregnate the base layer with barium sulphate. Harman, by way of example, super coat, some of their product with alumina (aluminium oxide). Almost all products are topped off with a final coat, which used to be gelatine, but this material is not compatible with inkjet inks and other materials are employed. Some makers even impregnate the final coat with a perfume to make it smell authentic!

If you are wondering why barium sulphate should have ended up as a major component of photographic printing paper, it is because the pure material is very white, insoluble in water and impervious to many acids and chemicals. Originally it had a secondary purpose of keeping contaminant chemicals in the base paper from migrating into the vulnerable, light-sensitive silver halide layer. It is still used in the form of pressed cake as a white reference standard, as it reflects 98% of light falling upon it. Bleached, finely ground barite is prepared in a gelatine slurry form and coated onto the surface of traditional air-dried, gloss silver halide papers and it is the baryta that imparts the sought-after finish. For this reason it is slightly surprising that it has taken so long for the coating to appear on an inkjet paper. The traditional silver-gelatine technology was slightly left in the wilderness by the rise in the use of resin coated silver halide papers, with their fast-drying, flat-drying characteristic. Here the original baryta layer was replaced by a layer of plastic, as well as an additional plastic layer on the bottom surface, so that water (and the chemicals of the development process) did not absorb into the fibres of the paper base and thus need long washing times. Baryta papers thus retained a premium tag in the fine art silver-print market, more difficult to deal with, but with more subtle characteristics.

When used as part of an inkjet media, ‘baryta’ imparts the look and feel of its older cousins but additionally has been shown to hold high Dmax values in the blacks and good neutrality of greys and whites. In addition, our analysis also showed that the gamut volume was extended and that the skin tones were more accurate.

In Use – the basic properties

The baryta coatings confer good neutrality to the base white of the paper which may or may not be modified by the addition of optical brightening agents. If OBAs are added there is a cooling of the paper’s appearance along with a brightening (ie an apparently higher reflectance). These attributes come at a cost, OBAs are less stable to light over extended periods, causing a loss of brightness and yellowing of the base tone. The cooling and brightening also drags the tones towards the cooler base tone of the paper, resulting in a loss of accuracy in absolute terms (even though the image may look excellent). Skin tones, as an example, are dragged towards blue-magenta, causing a loss of saturation.

Despite these apparent downsides, the ‘baryta’ family of papers have consistently produced some of the best colour audit data that we have measured. In particular, the deep earth tones were more accurate; in statistical terms we found an improvement in the overall colour error of around 100% when comparing non-baryta and baryta type papers under similar test conditions. The improvement was predominantly in the darker tones, assisted by the ability to hold higher densities, but the expanded gamut also allowed for improvements in both hue and saturation. For the black and white printer the high Dmax and good neutrality are sought-after

characteristics.

How to Choose a Paper

This is an agonisingly difficult choice to make. The reason for the pain is simple; we are blessed with an array of top-class papers and every photographer will have their favourite, although very few will have the time, opportunity, or inclination to test more than a handful. Confusion surrounds the situation because of the availability of specific papers in a number of different liveries – ‘same product different packaging’. As far as we can ascertain there are less than a dozen mould-making mills in the world – two in Germany, one in the UK, two in France, and one in Italy; the remainder are either in the USA or the Far East. Between them they provide all of the world’s mould-made paper, so the sums lead to the inevitable conclusion that many papers share the same provenance! Even this is subject to caveats. Epson, for example, must have their branded papers ‘made out’, as they do not own a mill! However they impose different quality control standards on the mill so their version of PaperX may not quite be the same as that provided by another supplier. Guessing the provenance of papers is a great game for the enthusiast but fraught with pitfalls!

When trying to decide upon a paper (but to some extent a printer also) you have to work your way through a number of options and find your way down through a family tree of the characteristics, cross-checking your choice against the capabilities of your selected printer.

Critical Questions about Printing

1. First you have to decide upon the print size you wish to make. This always limits your choice of printers, depending upon the throat size, but may also limit your paper choices.
2. Decide how many prints you wish to make so that you can assess whether you need a roll-feed workflow or can cope with a sheet feed or even a single-sheet system.
3. Depending upon the choice of printer, decide between matt or non-matt surfaces – hence perhaps a matt black or photo black ink set.
4. Decide if you are prepared to tolerate OBAs in your media.
5. Decide upon the surface texture: glossy, ultra-glossy, smooth, lustre, satin, semimatt, watercolour, canvas and so on.
6. Decide if you want 100% cotton rag or an alpha cellulose base and check to ensure that it is acid free if you require archival properties.
7. Decide upon the paper caliper and cross reference the printer capabilities, some have a smaller thickness limit than others.
8. Decide upon the paper weight. Fine Art Trade Guild for example, demand 250gsm minimum for limited edition print production.
9. Double check upon sheet, roll or board stock and that it is available in your chosen surface and size. At this stage you might allow cost to come into the equation.

When making your paper choice, the one thing you should not do is be seduced by examples of other photographer’s prints before you, and allow the ‘content’ of the image to determine your choice. Just because you are looking at a magnificent print does not mean that this other photographer’s paper/printer/workflow choice is right for you. Your work might be fundamentally different and fundamentally unsuited to their approach. On the other hand the quality of the print may show you just how much depth you can invoke in an inkjet print!

The other thing you should avoid is making side-by-side comparisons of matt and gloss/lustre prints. The two types are so intrinsically different that matt will always look a little ‘flat’ alongside its flashy, high-Dmax cousin. However, if you allow the matt image to stand alone it can import wonderful subtlety to the viewer. It is highly unlikely that an image file prepared for a gloss paper will print perfectly to a matt paper, especially in the deeper tones. The slightest tendency to over-saturate the matt paper with too much ink can bring unexpected and unpleasant surprises; a light touch may be needed. If you imagine that such finesse can always be achieved with profiling and instruments you may be in for a shock. It is far more likely that you will have to make occasional proof copies and experiment. One advantage of inkjet over silver halide is that

you can anticipate much greater print-to-print consistency. Providing you archive the correct file and keep notes about the settings, it is most likely that you will be able to produce identical prints for some time after the first-offs. Your biggest long term danger is that your printer will be superseded or the inkjet changed. Although it will most likely be an improvement, it will not necessarily be the same!

So far we have avoided answering the question about which is the best paper! Any of the baryta-type papers will create an excellent mimic of an air-dried silver halide fibre-based paper. Our favourites amongst these are Epson Traditional Photo Paper (TPP), Canson Photographique, Innova Ultra Smooth and almost any of the Hahnemühle baryta papers. Epson TPP is particularly flat and well behaved in the printer and, for the Epson 4900 at least, holds the record for colour fidelity. Some of the Hahnemühle products also carry the well-respected Photo Rag tag. Their Fine Art Pearl 285 is one paper that stands out in our minds. Ilford Galerie has a strong following and performed well in our tests as well as being most competitive on price.

Outside of the baryta papers our favourite is Epson Premium Luster for it achieves high brightness without the use of OBAs, is quite resistant to marking and has a delightful silk sheen.

The matt papers present even wider choices and even greater problems in making a selection. Hahnemühle Photo Rag is a recognised standard, against which others are judged and is available as a re-boxed variant from a number of suppliers. It has few vices in use, although there are some brighteners in the mix and we have noted some yellowing with age. It is also available in Ultra Smooth and Bright White guises. The Ultra Smooth we are fond of, along with the weighty 350gsm Museum Etching. Museum has a little texture but held detail well and is impressive to hold as an un-mounted print. Hahnemühle Bamboo also performed very well for the ecologically conscious. The Museo papers have a following in the USA although we found them slightly more challenging to use, they do however also make a special panorama paper.

Epson have most recently introduced a group of four papers under the banner Signature Worthy. These are the hot and cold pressed, brightened and natural finishes. They performed spectacularly well in our audit tests and between them they cover the needs of many fine art and exhibition requirements.

Another important venture is that of Epson Digigraphie which has started to take off in the UK having gained a strong following on continental Europe. The Digigraphie list of approved papers now includes the following:

- Epson Traditional Photo Paper 300g
- Epson Water Resistant Matte Canvas 375g
- Epson Premium Canvas Satin 350g
- Epson Smooth Fine Art Paper 225g
- Epson Somerset Velvet Fine Art Paper 255 / 505g
- Epson Velvet Fine Art Paper 260g
- Epson Textured Fine Art Paper 225/ 425g
- Epson Ultra Smooth Fine Art Paper 250g, 325 / 500g
- Epson Watercolor Paper - Radiant White 190g
- Epson Doubleweight Matte Paper on Diasec™ process 180g

- Canson® Infinity Rag Photographique 310 g/m²
- Canson® Infinity BFK Rives 310 g/m²
- Canson® Infinity Edition Etching Rag 310 g/m²
- Canson® Infinity Arches Velin Museum Rag 315 g/m²
- Canson® Infinity Arches Aquarelle Rag 310 g/m²
- Canson® Infinity Montval Aquarelle 310 g/m²
- Canson® Infinity Artist Canvas Water Resistant Matte 390 g/m²

- Hahnemühle Photo Rag® Bright White 310

- Hahnemühle Torchon 285
- Hahnemühle William Turner 190 /310
- Hahnemühle Albrecht Dürer 210
- Hahnemühle Photo Rag® Pearl 320
- Hahnemühle Photo Rag® Baryta 315
- Hahnemühle Photo Rag® 188 /308 / 500
- Hahnemühle Museum Etching 350
- Hahnemühle Photo Rag® Satin 310

If you are looking for something to mark you out from the crowd with a really weighty paper, Hahnemühle make Photo Rag in a 460gsm weight. St Cuthbert's Mill also used to produce a similar weight in Somerset Velvet (it is textured and we are not sure it is still around). Both, though, are mighty papers, which are impressive when you hold an un-mounted print. Innova also produces the Smooth Cotton High White in a 450gsm (IFA18).

For a plain and simple approach, Epson's Archival Matt and Enhanced Matt are well regarded in the specialist monochrome forums. They have a very smooth surface which holds detail well in a mono image. They make excellent first-proof papers.

Looking back over the last few paragraphs we are conscious that we have mentioned quite a number of papers. Despite this they represent but a small fraction of what is available and many of those we have not mentioned have considerable merits. This is the problem you are confronted with, the choice is wide and good; we are blessed with abundance! On the following pages we discuss the pros and cons of matt versus glossy or lustre papers.

How to Test a Paper

Although making instrumental measurements on a printed test sample are the best way to obtain objective performance data, you always have to make prints to finalise your choice. There are a number of reasons for this. Firstly, as the size of a print is increased any subtle lack of neutrality will become obvious, judgement of such matters depends upon the field of view presented to the eye. Secondly, the 'feel' of a print changes as you change the size, a lack of Dmax may look OK in a small test piece but may show glaringly in a wall print. Thirdly, some effects such as gloss differential may not show at small scale because the eye simply cannot detect them at that size.

These effects present the printer with a dilemma. Most trial packs contain a couple of samples only of each surface, so you have to plan your testing carefully, make notes and be vigilant about testing details. Try not to change more than one thing at a time. If you can home in on one or two candidates from a couple of trial packs you are doing well. That is the time to make a selective choice and buy 25 sheets of your candidates for further testing.

A final piece of advice. Buy a hard-backed notebook, maintain it, put dates in it, stick samples in it and make fulsome notes. It is amazing how you forget how you printed something a year ago when the need suddenly arises. We cover the details of additional testing later.

Matt and Gloss The differences

Matt papers have been used in both art and photography for centuries but have remained a slightly specialist product in the bulk consumer market, probably due to their rather subtle charms. The pros and cons of matt versus gloss can be summarised as follows:

Advantages	Disadvantages
An 'art' feel	Less vibrant colour
May be signed	Smaller gamut volume
No distracting reflections	Lower Dmax
Often less expensive	Easily marked

Despite all these disadvantages matt papers have a strong and loyal following and the paper makers have responded by providing a massive range of surfaces, weights, tones and qualities for us to choose from.

While the matt paper can never match the gloss papers (and we always include the lustres in this category) for tone depth, they retain an artistic feel when the print is in the hand, important if the client is able to hold the print before a purchase decision. It should also be said that the right image can look quite stunning on matt in spite of any lack of statistics from under the measuring instruments!

What is the 'right' image for exploiting a matt finish? Well, for starters it should not depend upon rich blacks that the eye can fall into, along with brilliant whites – the type of image typified by the Ansel Adams' school (or should that be f64 school?). The Dmax of matt papers rarely gets above 1.6 compared with 2.2 as a ballpark for lustres and 2.3 to 2.4 for the newer baryta-like papers. While this may irritate some of the 'zone freaks' who seem to have an unhealthy attitude towards Dmax ('look at the print for goodness sake!'), the eye accommodates a lack of final Dmax so well that it does not really matter after a few seconds of viewing, providing there is differentiation in the shadow areas. In the main the 'flat', calendared media reproduce photographic-style detail better than the more undulating art surfaces with their heavier textures. Many of the matt surfaces are slightly cream (warm-toned) in base colour that can be particularly attractive in toned landscapes or portraiture. Look on the websites listed for papers described as 'smooth' or 'ultrasmooth'; papers described as 'textured' are not likely to fall into the category we are discussing. Papers carrying the prefix 'soft' are likely to be quite absorbent and will hold detail poorly for 'photographic' images.

Matt surfaces are easily marked and should be handled with great care. A finishing coat of varnish or 'fixative spray' (as the artists tend to call it) will assist in protecting the surface with little change in the surface texture. To service this requirement many of the paper suppliers also offer fixatives and varnishes of various types. Putting a matt print behind glass or giving it a gloss giclée varnish seems a waste to us, you might as well go right to a gloss material or a lustre.

The Makers

The listing shows those makers, mills or suppliers who deal with matt papers. There are many cross-over, re-packed products, as the number of paper mills is limited. Base paper-making and coating may be carried out at different makers or locations. The market is in a continuous state of flux, with products being refined, changed, introduced or dropped almost on a monthly basis – at various times, all but a few have passed over the desk of Paper Chase. This list is not even complete, there are more that we are aware of and probably many we are not aware of!

Arches (Canson)	www.arches-papers.com
Breathing Colour	www.breathingcoloruk.com
Canon	www.canon.co.uk
Canson Infinity	www.cansoninfinity.com
Crane Museo	www.museofineart.com
Epson	www.epson.co.uk
Fotospeed	www.fotospeed.com
FujiFilm	www.fujifilm.co.uk
Hewlett Packard	www.hp.com/ukstore
Hahnemühle	www.hahnemuehle.com
Harman	www.harman-inkjet.com
Ilford	www.ilford.com
Innova	www.innovaart.com
Kentmere	www.kentmere.co.uk
Kodak	www.kodak.com
Lana Edition d' Art	www.lanapapier.fr
Legion	www.legionpaper.com
Lumijet	www.patersonphotographic.com
Lyson	www.marrutt.com
Magiclee	www.magicleeinkjet.com
Moab (by Legion)	http://moabpaper.com/
Olmec	www.ici-imagedata.com
Paper Mill Direct	www.papermilldirect.com
Permajet	www.permajet.com
Pictorico	www.pictorico.com
Premier Art	www.premierimagingproducts.com
Prüf	http://ecomm.paper-graphics.com
Red River	www.redriverpaper.com
Schoellershammer	www.schoellershammer.de
Somerset/Bockingford	www.inveresk.co.uk
Tecco	www.tecco-photo.de
Tetenal	www.tetenal.com