# nontoxicprint

Nontoxic Printmaking, Safe Painting & Printed Art

*This free online manual, begun in 1994,*
*gives an extensive overview of the intaglio medium*
*from a contemporary perspective. It is as yet unfinished.*

*Best us it alongside our individual pages on intaglio,*
*especially Hard and Soft Ground,*
*the Beginners Compendium, and the Etching and Intaglio Type sections.*
*Or consult some of the excellent Books on the subject.*
*These sources may provide additional up-to-date*
*information and advice on current*
*research, methods and materials.*

*for reference please quote this source,*
*(nontoxicpaintandprint.info), and its origins.*
*Artist website (click)*



*edited by Jennifer Helen Shaw,*
*many thanks to Keith Howard for his vision and support*

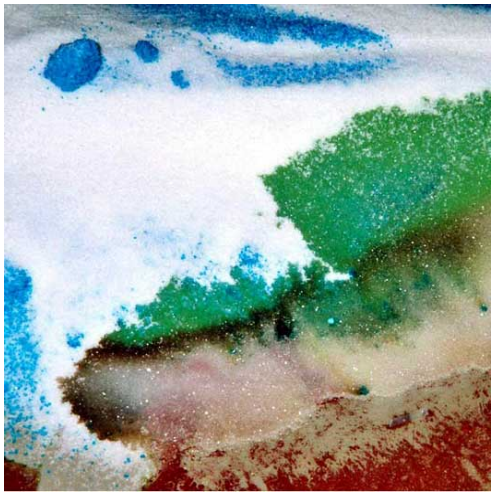


## Intaglio Manual
## Acrylic Resist Etching

**CONTENT** | **SEARCH**

*Introduction*

This overview of Acrylic Resist Etching is the result of a number of years of research
begun in the early 1990s and added to since then through
continued practice and investigation.
Key sections have appeared in a number of publications and periodicals and extracts were regularly reproduced as workshop worksheets.
It is reproduced here in full for the first time.



When I began writing about nontoxic printmaking methods they were still relatively unexplored, except by a few dedicated and innovative individuals and institutes. Since then new ideas, materials and processes have emerged or been refined. The body of this manual remains valid and, where appropriate, links have been inserted to direct readers to the most recent developments. The aim of the website will be to continue to provide useful updates.

The Saline Sulfate Etch: Copper Sulfate + Salt

**SCROLL** through the manual or **CLICK** on a subject heading to go directly to that section.



Copper plate produced using Edinburgh Etch

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## 1. Etching: A Sculptural Way of Creating Images

### A brief historical perspective
### The toxicity of traditional etching

In etching a blank plate becomes the arena for creative events, for the penetration and alteration of the surface of the metal. This is done by various means such as scoring, scratching, scraping and of course as the term *etching* implies, by using corrosive chemicals to eat into the depth of the plate. The grooves, indentations, scars and scratches produced by etching turn the once flat plane of a plate into something resembling a landscape eroded by the elements - a structure beneath the surface commonly referred to as *intaglio.*

The term **intaglio** is derived from the Latin *in-tagliare* meaning *to cut into*.

The term **etching** is often used to describe all intaglio techniques.
Strictly speaking, it should refer solely to processes that involve a corrosive action.

The more correct generic term for the broader range of incisive processes is **intaglio printmaking**.

Once a plate has been worked and is ready for printing it is covered with a generous deposit of ink. After wiping, just the deep recesses still hold significant amounts of ink. An etching is printed by laying the plate on the bed of an etching press, covering it with a sheet of damp paper and set of felt blankets, then running it through the two heavy steel rollers. The massive pressure exerted by the press pushes the paper firmly into the grooves of the plate where it picks up the ink. In this way, a reverse copy of the plate's 3D topography is produced as a two dimensional image consisting of lines, textures and tonal areas.

The inking, wiping and printing of any intaglio plate is essentially the same, but the ways of creating the intaglio are many and various.
Historically, etching plates have been made using three types of intaglio method:

1. The mechanical or **cold techniques** such as drypoint, engraving or mezzotint where the plate is physically shaped using specially designed metalworking tools.
2. The etch, or **hot techniques** that include hard ground etching, aquatint or open bite where etchant resistant grounds are applied to the plate and exposed areas of metal are eroded by a mordant.
3. The less frequently used **collagraph** techniques where an intaglio plate is made by building up a relief surface rather than eroding it.
4. And now, the new **photopolymer** processes represent an important extension to this canon.

## A brief historical perspective

The sculptural nature of etching finds its origins in the ornamental engraving of objects. Goldsmiths, tool and weapons makers and other craftsmen were proficient in decorating their wares using engraving techniques long before the age of mechanised printing. The first intaglio prints were reputed to have been taken from such objects. By the 16th Century the invention of the intaglio printing press enabled artists like Durer to take impressions from metal plates and intaglio work increasingly came to be seen as the means to create a matrix for the reproduction of linear drawings.

The creation of an image on a plate using mordants and resistant grounds was well known to master engravers of this period but another century would pass before acid etching was widely adopted as the preferred means of producing the intaglio groove. Artists began to favour the way that etching allowed them to work much more quickly, spontaneously and with a greater range of marks than the hand held burin would permit. Rembrandt with his unrivalled intaglio work would firmly establish etching as a supreme medium of artistic expression capable of conjuring up exquisite imagery full of life, depth and vibrancy.

The artistic excellence that Rembrandt achieved should, however, be appreciated in conjunction with his ceaseless exploration of new technical possibilities. He experimented with different mordants, etching tools, etch resistant materials and printmaking papers; he even designed his own wooden etching press. Any enthusiast for the art of intaglio printmaking would be well advised to visit Rembrandt's house in Amsterdam which gives a vivid impression of the master's working practice. Although Rembrandt's aesthetic genius has inspired generations of printmakers, his spirit of inventiveness seems to have been somewhat less influential. Many have been content with the end result - the fluid, linear drawing - without the urge to continue to explore the means of production.

Over time, various mechanical stippling and mezzotinting methods were devised to give a degree of tonal quality to intaglio prints but it was not until Jean Baptiste Le Prince invented the technique of aquatint in the middle of the 18th Century that etching acquired a much more satisfactory painterly process. Le Prince discovered that a fine dust of rosin particles melted onto a metal plate became acid resistant, enabling the artist to set down areas of granular dots that would appear as luminous tones on the print. Many painters were intrigued by the new method. Francisco de Goya, in particular, made extensive use of the technique, taking it to levels of virtuosity that have rarely been equalled. The 18th Century also brought the introduction of the soft ground or *vernis mous* method, first used in France to emulate the textural qualities of crayon marks in an intaglio print. This further extension of the mark making vocabulary was quickly embraced by artists across Europe. By now, a sufficient arsenal of methods was available for commercial printmakers to be able to produce faithful intaglio reproductions of paintings.

## The photographic revolution

At the very beginnings of photography, in the early 19th Century, the photo sensitised etching plate was considered a serious contender to the silver-emulsion based systems that are in use to this day. Photo etching, commonly known as photogravure or helio gravure, as a viable artistic and industrial process was devised by Karl Klic. His process is the foundation of rotational intaglio printing which is used for the production of high volume print runs such as glossy magazines. Sadly, the photo-reprographic potential of the intaglio medium was not exploited by most artists working in the first half of the 20th Century. With a few exceptions, rather than investigate new possibilities, most seemed content with proven and tested methods. In general intaglio printmakers were content to continue with the established methods rather than be at the forefront of new developments. A kind of conservatism started to prevail in both technical and pictorial terms and although many great 20th Century artists have produced interesting intaglio work, often under the auspices of master printers, the emphasis has been on commercial reproduction. Few artists used the medium as their main form of

expression. Stanley William Hayter, with his rejuvenation of engraving and development of intaglio color printing is perhaps the one exception. Moving in illustrious circles that included Picasso and Miro he promoted a climate of sharing and accessible working practices in which no *trade secrets* were to be kept - an approach that stands as an example of good practice for today's printmaking community.

In the 1960s, printmaking experienced something of a renaissance, but mainly in the new medium of screenprinting. This new method captured the spirit of the time as it offered the aesthetic of the emerging pop and media culture with ease of execution. Warhol's soup cans were screenprints, not etchings. Intaglio had lost touch with the avant-garde and was increasingly seen as traditionalist and craft orientated. An increasing awareness of environmental and health related issues didn't help the popularity of etching either. Artists and students were favouring safer, simpler, more modern-looking modes of printmaking.

## Etching today

In the eighties I was fortunate to be taught by an enthusiast of intaglio printmaking. At the time etching was still in something of a general decline, not only in Germany but also across most of Europe. I discovered that the medium *could* be contemporary and to my delight found that it continued to flourish in the UK in an abundance of open access, editioning and college workshops. Thankfully, etching now seems to be shaking off its old fashioned image and many artists are once again investigating the technical possibilities and exciting new aesthetics in a new era of intaglio printmaking.

Thanks to the pioneering efforts of artist-innovators such as Keith Howard, today a new intaglio system has become available. Acrylic Resist Etching introduces a whole new range of technical and creative possibilities whilst being much safer and easier to practice than traditional etching. In aesthetic and conceptual terms there is also a sense that intaglio printmaking can once again become an innovative and relevant medium. Notions of reproduction and simulation and digital technology are defining the current age and its image making. Printmaking has always enjoyed a natural affinity with the mechanics of each age. Matrix, copy, reproduction, encoding, simulation are all familiar terms and any etched metal plate is as much a repository of condensed information as a computer disk. The use of digital working methods in conjunction with the depth, tactility and sumptuous sensuality that is the special hallmark of intaglio printmaking offers a rich field of contemporary artistic investigation and production.

## The dangers of traditional printmaking

The amazingly rich and varied art of intaglio has, historically, come at a price. The traditional methods used by many artists and workshops to the present day involve a cocktail of toxic, harmful and potentially dangerous chemicals and processes unrivalled by most other artistic disciplines. Each ingredient can in itself have a damaging effect on the health of the artist; but used in conjunction with each other, they present a very serious threat to those practising printmaking on a regular basis.

In chemical terms, by the 19th Century, intaglio printmaking had been built on hazardous foundations:

- Firstly, in its reliance on an ever increasing range of **oil-based materials** used as acid resists, substances such as asphaltum, bitumen, modified waxes, rosin dusts and shellac varnishes.
- Secondly, intaglio had come to make extensive use of a variety of **volatile organic solvents**, starting with distilled turpentine in earlier times and graduating to synthetic hydrocarbon compounds around 1850 when modern chemistry was established.
- The third component of this type of printmaking was the use of **strong acids** such as nitric acid, hydrochloric acid and acetic acid.

A casual awareness of possible health risks existed even in centuries past but it is only in more recent times that hazards have been fully understood and only very recently that improvements have been made to the practices of intaglio printmaking and genuinely workable alternative methods proposed.

## Hooked on Solvents?

The traditional intaglio system is essentially oil-based. Most of the acid resistant grounds and materials are petrochemical products such as asphaltum varnishes, shellac, mixes of tar and wax, resins and so forth. A great number of these materials are proven carcinogens. Many contain organic solvents - also known as hydrocarbons - that give them the required properties but which also quickly escape into the workshop atmosphere during use. Ironically, the solvents prevalent today cannot have been, as sometimes asserted by traditionalists, an essential part of the established intaglio repertoire because they are the products of relatively recent chemical development. It is in fact quite likely that Rembrandt and his contemporaries used a range of cleaning agents such as Marseilles soap made from olive oil and other non-volatile solvents. These are much safer than the aromatic hydrocarbon solvents heavily promoted by the petrochemical industry.

Short-term exposure to these solvents often causes headaches and nausea (the body's first warning signs!) and prolonged contact can lead to damage of the liver, kidneys and nervous system. Typically this is accompanied by a reduction in the body's production of blood cells which translates into a weakening of the immune system. Organic solvents are not only contained in the oil-based varnishes, they are also in constant use in the traditional print studio in the removal of varnishes and the cleaning of plates after printing. Hydrocarbon solvents such as white spirit can easily enter the body through inhalation and absorption through the skin.

Strict safety precautions such as the use of gloves, respirators and fume extractors should be observed when using these materials but very often sufficient measures are not taken. In shared workshops and educational environments, the level of protection required can be difficult to achieve and maintain. The enforcement of more strict regulations in Europe and elsewhere marks a great change from the laissez-faire attitude of the past - any contamination of the water supply with solvents can be prosecuted and solvent-based products must now carry drastic health warnings like those found on cigarette packets. As a result of the measures, white spirit sold in the UK for DIY has acquired a warning that pneumonia and lung damage may result from the use of this chemical.

Another major threat to the health of the traditional printmaker comes from the use of various acids. The most common of these, nitric acid, used to be popular with many etchers as it erodes a range of metals very quickly (even though its biting

action can be erratic and somewhat coarse). Nitric is a very strong acid in its most corrosive neat form. Inhalation of strong nitric fumes can lead to eye damage and pneumonia; it can even be fatal. The nitrogen dioxide gas emitted during biting can lead to reduction in the blood oxygen carrying capacity, chronic lung disorders and death. Nitrous fumes can also cause damage to the reproductive system i.e. birth defects, impotence and alarmingly, in conjunction with chlorine based cleaning products, can even produce mustard gas! Surprisingly perhaps, the hazards of intaglio printmaking are by no means a recent discovery. In the early days of the medium it was common practice to pour nitric acid over the metal plate until the grooves were deep enough. This extreme exposure commonly caused impotence, a condition which is reputed to have been called the *etcher's disease* in mediaeval Germany.

Due to new health and safety regulations the use of nitric acid in industry is now subjected to strict safety measures. A metal finishing company in the UK was instructed that nitric may only be used in fully enclosed and sealed glove boxes of the type used in the processing of radioactive material. This company, like many others, subsequently invested in etching facilities using ferric chloride as a safe alternative.

In addition to health risks there are also a number of safety hazards connected with traditional etching materials and processes. The dust particles of a traditionally used resin aquatint are known to be highly explosive (as well as proven to irreversibly clog up lung tissue). The use of a gas flame to melt the resin onto the plate could hardly be called safe practice. There are numerous documented cases of fire and explosions in etching workshops which were a result of the inherent fire hazard of resin aquatint. Plate smoking, solvent fumes, hot plates and oil-based inks and varnishes present similar fire hazards. The reader might be wondering;

**Aren't these just worst-case scenarios?**
**These materials have been used for centuries, surely they must be OK for me to use?**
**Is there really any evidence of damaging effects?**

Sadly, the medical evidence is compelling. There are documented cases of impaired vision and pneumonia as a result of contact with acid fumes; instances of nerve damage due to long-term solvent exposure; birth defects in offspring etc. Like many professional printmakers I personally know of a number of colleagues whose health has seriously suffered as a result of long-term exposure to toxins. I myself often experienced headaches when I was still practising traditional etching. I developed allergies to many oil-based chemicals and experience a severe bout of conjunctivitis while working with nitric acid.

So why is it that despite the profound risks, so many artists have worked in the intaglio medium when they could have opted for safer means of expression? The answer is simple. Artists who were fascinated by the creative possibilities of intaglio printmaking had to make do with the oil-based system due to the absence of a viable alternative. Perhaps there is also a romantic - if irrational - attraction to the mastery of a practice involving mysterious and dangerous substances and processes. No one could have expressed this appeal better than William Blake in the famous passage from *The Marriage of Heaven and Hell*;

***If the doors of perception were cleansed everything would appear to man as it is infinite ... This I shall do by printing in the infernal method by corrosives ... melting apparent surfaces away, and displaying the infinite which was hid.***

The attitude towards toxic process has now shifted from a policy of hazard management to one of hazard avoidance. Instead of trying to contain and control high-risk processes, the new move is to use methods and materials that present much less risk to begin with. This change of approach is easily achievable in practical terms. However, change cannot only be a simple technical shift. It also necessitates a shift in the attitude of printmakers, some of whom feel a *devil-may-care* affection for the old alchemical ways even though they are no longer justifiable by necessity.

**It is hard to give up smoking!**

Some may say that Health & Safety restrictions are choking the life out of the practice of etching. Not at all! A progressive etching workshop does not need to use any of the kind of volatile chemicals we have been discussing. Modern alternatives have become available which can deliver the same end results, are a lot safer and even open up exciting new creative possibilities. This research sets out to demonstrate that the new techniques are just as suited to Blake's romantic quest to reveal the infinite beneath the surface as the corrosive ones that preceded them.

For more information about printmaking hazards click on the following links:

**Health + Safety** **The Toxicity of Solvents**

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## 2. Metals used in Etching

### Copper, Brass, Zinc, Steel, Aluminum

The most common metals used for intaglio printmaking purposes are steel, copper, zinc and aluminum. These different

kinds of metal can be equally stimulating to the artist's imagination as they each offer quite distinctive mark-making possibilities.

Plates suitable for etching can be obtained from professional printmaking suppliers, most of which have a range of good quality metal plates in popular sizes; or from sheet metal dealers who will be listed in local directories and on the web. If you are planning to do quite a lot of etching the local dealer is by far the cheaper option.

Metal plates of 0.8mm to 1.5mm thickness are recommended for intaglio printing. If the thickness is described in gauge this equates to a range from about 20 to 16 gauge: remember that the higher the gauge number the thinner the plate. If plates are thinner than recommended they can become awkward to wipe and are unsuitable for long etches. Plates thicker than 1.5mm should not be used as they can easily damage paper and blankets during printing. As metal is sold by weight a thicker plate will also be more expensive and more difficult to cut. However, a heavier plate does have a more tactile and object-like quality if you are looking for a more sculptural approach to etching.

With acrylic based etching it is not essential to buy the most expensive kind of highly polished plate so long as you make sure that there are no deep scratches or corroded patches on the metal. Any minor scratches and blemishes will be removed as part of the plate preparation process and deeper grooves can be levelled out with a scraper or sander before preparing the plate.

NOTE: In contemporary intaglio printmaking, non-metallic plates such as sheets of plexi are now also being used for drypoint etching and monoprinting and as the substrate for photopolymer film.

## Copper  Etch Copper and Brass (The Edinburgh Etch)

Copper has traditionally been the preferred metal for etchers as it facilitates an extremely detailed and accurate intaglio reproduction of lines and other marks. Copper plates are hard enough to withstand editions of thirty prints or more without significant wear but if very delicate mark-making techniques are employed (such as aquatint or drypoint) or if a much higher number of prints is required, it is advisable to have the plate steel-faced; an electrolytic process that can be carried out by some professional print studios. Copper will print most colored etching inks without discoloration, but again, steel-facing would be necessary to guarantee perfect results. Copper is suitable for all intaglio techniques; ideal for both linear and tonal work, and in open bite the eroded areas remain as smooth as the plate surface.

If you buy the reddish copper plates from a sheet metal dealer they should be labelled half hard cold rolled. Never buy hot rolled kinds of metal as they are hardened and very difficult to etch. In some cases the rolling texture of the metal can appear as parallel lines during etching, but this tends to be more common with zinc plates, very rarely with copper and does not occur at all with steel plates. If a totally uniform plate is required (e.g. for engraving) it may be worth investing in hand-hammered plates that are still available from some printmaking suppliers.

When working with copper, bear in mind that this metal wants to be guided into shape by the artist. Its temperament is precise and delicate, so if it is to reveal its more powerful side it should be encouraged by appropriate means such as multiple etches, drypoint etc. If treated in this way a copper plate can convey a whole symphony of marks, textures and tone as was so masterfully demonstrated by Rembrandt.

## Brass  Etch Copper and Brass (The Edinburgh Etch)

Brass is a superbly suitable material for intaglio etching and printing. The metal has a golden, mirror-like finish, and usually lacks the more or less pronounced rolling texture of other sheet metals.

It is often supplied by the same sheet metal merchants that sell copper and is only marginally more expensive. The Edinburgh Etch method now allows for this noble metal amalgam to be etched as easily as a sheet of copper. Arguably, brass surpasses any other metal in terms of its versatility of marks, its faithfulness to etched detail, and its overall aesthetic expressiveness.

Brass can be etched in the same solution as the one described for the Edinburgh Etch for copper. The golden aesthetic of this very hard alloy of zinc and copper combines the delicacy of copper intaglio with the robustness of etched steel; due to their hardness, plates do not suffer from wear in large editions. Brass plates yield unique textured effects in conjunction with the various acrylic wash and open bite processes, for instance when a combined Speedball screen filler and carborundum wash medium is used as an etching resist.

## Zinc  Etch Zinc, Steel, Aluminum (The Saline Sulfate Etch)

Another popular kind of metal used in etching is the silvery looking zinc. Even though zinc does not conjure up alchemical connotations quite like copper and is mainly known in the practical world of building and plumbing, it is a very good material for intaglio printmaking. There are several factors that commend this often underestimated material to the etcher. Due to its predominantly mundane application, zinc is usually a lot cheaper to buy than copper. But zinc has creative as well as cost benefits. As it is more impure than copper, zinc reacts with other substances more easily and more vigorously, a characteristic which can be exploited for etching purposes. Zinc has a crystalline texture and when etched the bitten surfaces will bear a certain roughness that produces tone on the print. As the zinc oxide deposit producing this tone gradually wears off during printing it is advisable to use aquatint when tonal areas are desired.

The Saline Sulfate Etch now allows a greater crispness and evenness of bite on zinc, something normally only associated with copper. So the lines and indentations etched into zinc can on one hand be rendered as delicate and precise as on copper or the etch process can be manipulated in such a way that the marks produced are rugged along the edges. Deeply etched intaglio areas for dark expressive areas on the print or heavy embossing are easily achieved on zinc plates.

Zinc is the most malleable metal suitable for intaglio work. This means that all mechanical processes such as drypoint, scraping, burnishing and so forth can be executed with great ease. The disadvantage of this material's softness lies in the fact that the tremendous pressure of the etching press can flatten delicate areas of the plate - especially drypoint, aquatint

or mezzotint - after a number of prints have been taken. The wear of zinc is sometimes exaggerated however, most plates would yield at least 10-20 successful prints and whilst editioning is considered an advantage of the intaglio medium, many artists are quite happy to explore the potential of a plate in a number of good artist proofs without ever using the zinc plate for mass production. As most kinds of zinc on the market are actually an amalgam rather than the pure element its durability will vary. Plates that are manufactured for the printing industry have a finer grain and are much harder than the plumbing zinc and also come with a mordant resistant backing. Zinc is not ideal for color printing as it can alter the appearance of some etching inks, especially yellows and bright colors. However, too much emphasis is sometimes placed on this and many etchers successfully print with a wide range of inks from zinc plates with negligible contamination. Zinc can be used for all acrylic resist etching techniques and it lends itself to large-scale work as the plates etch best in trays.

## Steel  Etch Zinc, Steel, Aluminum (The Saline Sulfate Etch)

Etchings taken from steel plates tend to be somewhat more expressive in nature than those taken from copper or zinc. The reason for this lies in the fabric of the material. A steel surface, even if highly polished, has a fairly coarse and granular crystalline structure.

The porousness that characterises steel makes it particularly well suited for intaglio printmaking as the main idea behind etching is to create surfaces that are capable of holding ink deposits. Etchings printed from steel hardly ever look faint or lacking in definition, and if required, a plate tone can be left on the surface giving a richness which is unsurpassed by any other plate metal. Despite its eagerness to absorb ink and transfer it to paper, steel plates which have been burnished are also able to produce white backgrounds, which is why it is the preferred material in industrial intaglio printing. Even today, bank notes and stamps are printed from steel plates.

Steel is the ideal metal for color printing as it has no contaminating effect on any kind of etching ink and as its industrial use suggests, its hardness also makes it the ideal choice for editioning. Literally hundreds of prints can be taken from the same steel plate without any significant wear and even those techniques that produce a mark by means of a raised burr such as drypoint can safely be employed for editioning.

Any mechanical and abrasive work done on a steel plate by firm scratching, scraping, incising etc. will produce lines and textures of great vigour and density. It demands a certain decisiveness from the artist but steel is equally capable of yielding painterly effects. Unlike other metals, steel will by itself provide a tonal quality when exposed to the action of an etch solution. This tone which, contrary to zinc, is not caused by a deposit but is actually etched into the metal itself, will increase with the length and depth of the bite. An open area etched on a steel plate will not appear as a light patch with an outline as with copper, but as a dark patch that stands up as a positive mark by itself. The tonality can be enhanced with aquatint. If, however, a very fine spectrum of greys through to the richest black is required, then copper is still the best choice of metal.

Steel is one of the most common metals used in construction and engineering which means that sheets of steel can be obtained easily from most local sheet metal dealers. It is important to ask for cold rolled mild steel which usually has a slate grey, sometimes reddish, tinge and a coarser surface than zinc. The plates available today do not consist of pure iron but, as the term steel suggests, are iron with a carbon content. If by chance you have obtained hardened varieties of steel (such as hot rolled) the increased carbon content will make satisfactory etching impossible. Also, be careful not to purchase plates which are excessively scratched or rusty - it is best to ask for plates that are cold reduced, meaning that they have been coated with a protective layer of grease.

Steel can be used very successfully for most acrylic resist etching techniques, but in the application of the different grounds, the porousness of the metal has to be taken into account, necessitating a thicker deposit of acrylic varnish. As with zinc, the Saline Sulfate Etch is best for steel. It is well suited to large scale work.

## Aluminum  Etch Zinc, Steel, Aluminum (The Saline Sulfate Etch)

Due to its softness and its coarse atomic structure, aluminum is somewhat less suited for the entire spectrum of intaglio printmaking than other kinds of metal. However, since plates are cheaply available from sheet metal merchants (you may even get them for free from commercial printers) many printmakers use them for straight dypoint work or as a substrate for photopolymer work. Previously, this lightweight metal was rarely used for intaglio etching; but now, by using the Saline Sulfate Etch, it provides unique benefits and qualities.

In etching, aquatint is normally used to fill open areas on the plate with durable tones or a black. The Saline Sulfate Etch for aluminum is self-aquatinting. During etching a very distinctive and durable surface roughness occurs in the open areas, this crystalline texture can produce a beautiful black on the print all by itself. As a result, there is no such thing as open bite in this process since all etched areas become carriers for etching ink, thus enhancing the graphic potential of the process.

Unusually, neither of the basic components of the Saline Sulfate Etch, i.e. copper sulfate and salt, have any corrosive effect on the metal by themselves. But etching becomes possible when both substances act on the metal in combination. While all other metals easily erode as long as they are grease free, the surface of aluminum plates is best treated with fine wire wool to make the surface more susceptible to the etching process. This should be done before any acrylic grounds are applied to the plate.

As with the zinc process, the Saline Sulfate Etch for aluminum involves the production of a very loose coppery sediment which floats to the surface and should be removed regularly. However, the continuous rising of small hydrogen bubbles also indicates that etching is in progress (these are not considered a hazard).

*Tip: When stripping acrylics off an etched aluminum plate, ensure that plates are not left in the soda ash stripping solution too long as this will etch the plate further.*

**Spelling Note**
**USA Aluminum**
**UK Aluminium**

**The different etch techniques of acrylic based etching can produce very different kinds of marks and effects when used on copper, brass, zinc, steel or aluminum. It is well worth the effort investigating these possibilities to gain a varied aesthetic repertoire which can then be deployed for any etching project.**

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## 3. Plate Preparation

**Cutting metal plates**
**Filing/Bevelling the plate edges**
**Sanding the plate**
**Degreasing**

In etching it is necessary to go through a certain set of preparations before the actual mark-making process can begin. In keeping with the tactile nature of the medium these processes are quite physical and more akin to the field of metalwork than to other paper-based image making. Preparing the plate is the first opportunity for the artist to engage in a relationship with the material he has chosen to work with to produce an art object.

### Cutting metal plates

Most metal plates available from industrial sheet metal dealers are fairly large - single sheets of zinc or steel are usually about 4 ft x 8 ft - so in most cases cutting will be required to provide you with the required plate sizes. Industrial suppliers usually have their own cutting facilities and are often quite happy to cut large sheets into manageable sizes at hardly any extra cost. However, in any professional etching workshop, a sheet metal guillotine is a piece of equipment that is almost as important and as frequently used as an etching press. It enables etchers to cut any size of plate from larger sheets as and when required. Most freestanding guillotines are designed to cope with metal plates up to 1.5mm thick if the blades are kept sharp and properly aligned. A good guillotine should also come equipped with a clamping mechanism and a blade guard.

**MATERIALS**
**Products and equipment needed to cut metal plates:**

- sheet metal guillotine
- drypoint needle
- measuring tape or ruler
- heavy-duty gloves
- goggles

**METHOD**
**Cut metal plates as follows:**

1. Measure and mark out the perimeter of the required plate size with a ruler and sharp drypoint needle or the tip of a Stanley knife. This produces an incised mark that is much more precise than an outline drawn in marker pen.
2. Check right angles with a setsquare as the metal guides on a guillotine may not be accurate. Cutting plates with right angles and of matching size is particularly crucial in color etching as two or more plates are overprinted in exactly the same position on the paper.

Always handle plates very carefully and wear heavy-duty gloves for protection from sharp edges.

If no guillotine is available plates can also be cut either by repeatedly scoring the perimeter lines into the metal along a ruler until the sheet can be broken, or by using an electric jigsaw or band saw with a metal blade. Make sure that the plate is firmly clamped down, wear goggles and lubricate the saw blade with plenty of oil. This way of cutting will produce a slightly serrated edge which needs to be removed by filing. There is a hand tool called a *plate nibbler* which can also be used to cut plates.

In workshops where sheet metal is being regularly handled minor cuts are almost inevitable. A first aid kit must always be readily available and include disinfectant which should be used on

any cuts from rusty steel plates.

### Filing/Bevelling the plate edges

The edges of plates used in intaglio printmaking must always be broken and bevelled at a 45 degree angle before printing. This applies to all hard materials that you may use i.e. metal plates, Perspex, hard board or even thick pieces of card that are used for collagraph techniques. The enormous pressure exerted by the etching press during printing will cause any sharp edged object to cut right through the paper as well as the felt blankets which are expensive to replace and should be treated with great care.

**MATERIALS**
**Products and equipment needed to apply a bevel:**

- metalworking file with fine and coarse sides
- plate bevelling tool
- sturdy metalworking bench or other work surface
- three-sided scraper
- power drill with sanding disc
- clamp
- sandpaper
- gloves
- goggles

**METHOD**
**Apply a bevel to metal plates as follows:**

1. Lay the plate down on the work surface and press down firmly with one hand.
2. Push the file in a downward motion along the plate edge at a 45 degree angle.
3. Repeat this action a number of times using the coarse side of the file first on all four sides. Lift the file away from the plate during each upward stroke - it is less effective to move the file up and down like a saw and doing this can damage the metal teeth of the tool.
4. Repeat this process with the fine side of the file.
5. Remove any remaining sharp edges by running a piece of sandpaper over the bevel.
6. A quick way to bevel very thin plates (under 1 mm) is to repeatedly run a three-sided metal scraper along the plate edge at a 45 degree angle. Many printmakers now make use of a plate-bevelling tool instead of a file.

For projects involving a large number of plates, the bevel can also be applied using a power drill with a sanding disc attached to it. Precautions must be taken if you are going to apply the bevel this way - wear goggles and gloves and make sure that metal sparks do not come into contact with any flammable materials that may be present in the workshop.

### Sanding the plate

Some but not all of the mordant resistant grounds used in acrylic resist etching (such as liquid hard ground or photopolymer film), require a slightly roughened surface in order to bond firmly with the metal of the etching plate. This roughness is achieved by sanding the plate with medium grit sandpaper suitable for metalworking purposes. This process not only gives a tooth for the acrylic varnishes to adhere to but also removes minor scratches from the plate surface making the metal more susceptible to the corrosive action of the mordant in which it is etched. A sanded plate may produce slight plate tone in printing, but a white background is easily achieved by buffing up the plate after etching or by printing directly from the smooth surface of an acrylic resist.

**MATERIALS**
**Products and equipment needed to sand a plate:**

- sturdy metalworking bench or other work surface
- electric sander (ideally a palm sander with dust extractor)
- medium grit sandpaper
- G clamp
- goggles
- heavy-duty gloves
- dust mask

**METHOD**
**Sand metal plates as follows:**

1. Put on a dust mask, gloves and goggles.
2. Secure small plates to the workbench using a G-clamp.
3. Unless you have pre-cut sandpaper, cut sandpaper sheets to fit the sander. Insert a sheet into the clamping mechanism and, if needed, punch dust extraction holes into the paper.
4. Switch on the sander and apply it gently to the plate in a rotating motion. Do not apply excessive pressure as the weight of the sander is sufficient to roughen the surface of the metal.
5. Keep sanding the whole of the plate in regular orbits until you have produced an even, misted looking surface. The whole process should take no more than 3-4 minutes for a medium sized plate.

Be careful not to over sand the plate as the aim is to roughen it rather than polish it. To avoid this, it is necessary to change a sanding sheet for a new one as soon as it begins to appear worn.

Sanding can of course be done by hand, but this is more likely to leave unwanted marks on the plate.

Use a finer grit wet and dry sandpaper (e.g. 360 grit) for copper and zinc plates.
Use a coarser grit (around 250 grit) for steel plates.

If a plate is designated for mechanical work only such as engraving, drypoint or mezzotint, without the involvement of any etching, no sanding or degreasing is necessary.

When steel plates are used it is necessary to remove the protective grease deposit from the plate before sanding. This does not have to be as thorough as the main degreasing process and can be done quickly by wiping the plate with a rag using blue degreaser, then drying it.

## Degreasing

There are two reasons why all grease has to be removed from plates before any mark making can begin. In areas of the plate surface which are covered by an acrylic resist, even a very thin layer of grease can cause the varnish to lift off in the etchant, thus leading to unwanted biting. On the other hand, grease can in itself resist the corrosive action of the etch solution so that traces of grease left on blank metal areas that are meant to be eroded will actually stop this from taking place.

Degreasing in the acrylic resist etching system should ideally be a two-stage process:

Stage 1. Treat the plate with a powder degreaser mixed to a thick paste.
This absorbs grease even from the crystalline depths of the plate.
Stage 2. Degrease again with a liquid acidic degreaser as a final rinse.
This both ensures perfect degreasing as well as a slightly acidic plate climate which is favourable for the adhesion of all acrylic etch grounds and absolutely essential for photopolymer work.

Marler-mesh degreasing powder, which was originally developed for screenprinting is very effective. Its very fine powdery consistency means it can even be used on burnished surfaces without scratching. Any domestic cream cleaner such as COMET is equally suitable as well as the slightly coarser magnesium carbonate powder.

An ideal product for the second stage is the blue CPS degreaser - an innovative and very powerful degreasing liquid which is slightly acidic and water/detergent based. This liquid which dilutes 1 : 10 parts water, is also well suited for all localised degreasing tasks on the etching plate i.e. just wipe a greasy surface with the CPS on a clean absorbent tissue. Alternatively, diluted vinegar or citric acid can be used in the second rinse. Many workshops use concentrated dish soap as their main degreasing agent.

**MATERIALS**
**Products and equipment needed for degreasing:**

- degreasing sink
- drying facility
- degreasing powder - ideally use Marler degreasing powder, alternatively use domestic cream cleaner, magnesium carbonate or whiting powder

- degreasing liquid - ideally use CPS liquid degreaser, alternatively use pure vinegar (with no added sugar) or concentrated dish soap
- small window squeegee
- latex or vinyl gloves
- roll of kitchen towel

**Facilities Suggestion:**
The degreasing sink should ideally be a separate sink from those used for etching, rinsing or stripping purposes to avoid contamination. Traces of alkaline stripping solution left in a sink can break down the acrylic grounds when subsequently applied to the plate. The sink should have hot and cold water supplies from a flexible shower hose and be fitted with a wooden grid.

**METHOD**
**Degrease metal plates as follows:**

1. For a medium sized plate, mix about 1 tsp of degreasing powder with a little water to make a paste and apply this to the plate.
2. Use a clean pot scourer to work the paste into the plate surface using orbital strokes, applying firm pressure. (If a shiny rather than a sanded plate is being used, use a soft cloth or sponge instead.) Using the rotating motion, cover the whole plate as evenly as possible for between 2-5 minutes.
3. Rinse off all the remaining paste with plenty of hot water, making sure the front and back of the plate are thoroughly rinsed.
4. Rinse out the pad and apply a small measure of blue CPS degreaser (or alternative) and rub the plate before rinsing once again.
5. Stand the plate against the back of the sink and let water run over it. Water running evenly across the surface of the metal indicates a successful degreasing. If, however, the water meanders down the plate, some more degreasing will be needed.
6. Now the plate needs to be dried quickly to prevent any oxidising - especially on steel plates.
7. Squeegee off all excess water then dry off the plate using a hot air drying facility. Alternatively, the plate can be blotted dry using grease-free absorbent paper (e.g. kitchen towel).

From this point until application of a ground, be careful not to touch the degreased surface.

Never use a hair dryer in an environment where wet processes are taking place. Wall-mounted dryers are a safe solution.

**At this stage you have completed all plate preparation and can now move on to the application of one of the acid resistant grounds.**

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## 4. Hard Ground

**Liquid hard ground**
**Pour-on hard ground**
**Spray-on hard ground**
**Drawing into a hard ground**
**Roll-on hard ground**

A hard ground is a corrosion resistant coating that covers the entire surface of an etching plate. Once this acrylic varnish has dried it can be worked into using an etching needle and other implements so that the ground is penetrated and areas of metal are revealed. The grooves which are then etched, provide a very accurate, crisp impression of the inscribed marks. Often this way of working has the character of a pen and ink drawing. Hard ground etching evolved from burin engraving which is entirely line-based, but has the capacity to be much more versatile.

### Liquid hard ground

A hard ground allowing line work of the highest quality can be obtained by using the type of acrylic floor varnish that is

widely available for domestic use. It took Keith Howard's lateral thinking to discover that a superb nontoxic hard ground may not necessarily have to be developed from scratch, because it was already out there on the shelves of his local hardware store. The brand Howard used, called *Future*, pointed optimistic to an alternative way ahead for printmakers. Future acrylic floor polish (made by Johnson, a giant of cleaning agents), has now been firmly established as a standard hard ground for North American etchers. Products with similar properties can be found in most countries - in the UK Johnson's Klear (Klar in Scandinavia) makes a good substitute. Other manufacturers also produce viable products so when doing your own research, look for products that are described as *waterbased metallised polymer emulsion* in the product safety information.

The liquid hard ground created using these products is very fast drying and during etching in the metal salt solutions it completely retains the crispness of edge given to it by the drawing utensils. It is suitable for the whole spectrum of linear work, ranging from the most delicate line to the boldest and deepest bite. It also meets another crucial requirement for a hard ground - its ability to go through multiple etches and overlapping cross-hatching without any breaking up in the intersecting intaglio areas.

There are two different ways of applying the liquid hard ground; it is normally poured directly onto the plate but if a spraying facility is available it can be applied by means of a spray gun which gives the most even result. At one time it was not recommended for the ground to be brushed onto the plate (unless for stopping-out purposes) as this produced an uneven finish, but the method does work if a paint pad is used. (See HARD AND SOFT GROUND for further details.)

### Pour-on Hard Ground

The hard ground is applied in one or two stages, depending on the kind of metal being used, the length of the bite and the kind of floor polish available. The thicker Future varnish gives good etchant resistance on most metals even with only one coating; whilst the thinner varnishes available in Europe give the best results with two coatings of the plate. This involves laying down a pure initial coat of varnish to ensure maximum resistance, followed by a second tinted coat which contains pigment and enables the artist to see drawn lines more clearly. Usually, a liquid acrylic hard ground requires a slight roughening of the plate surface in addition to degreasing to guarantee perfect adhesion of the acrylic to the metal (see PLATE PREPARATION). This slightly toothed surface ensures an ideal etch and the faint plate tone that is produced is quickly removed before printing. Despite this roughening, even delicate line work registers faithfully on the liquid ground.

Acrylic resist etching also offers various hard ground options for etchers wishing to work on a polished surface as traditionally practised. Both Future and Z-Acryl hard ground emulsion tolerate being used on polished plates, as do the various combined soft and hard grounds (see SOFT GROUND).

**MATERIALS**
**Products and equipment needed for pour-on hard ground application:**

- acrylic floor varnish

US/Canada: Johnson's Wax Future
UK/Europe: Johnson's Klear, Carefree etc.
Z-acryl hard ground emulsion can also be used

- Koh-i-Noor 3080-4 universal drawing ink, black airbrush ink etc.
- plastic tray (should be larger than the plates being used)
- funnel
- absorbent paper

**METHOD**
**Mix the pour-on hard ground as follows:**

Coat 1
For maximum resist use pure acrylic floor varnish.
Do not mix with other ingredients.

Coat 2
Gradually add a small amount of Indian ink (or alternative) to the acrylic floor varnish.
Stir continuously until the liquid looks sufficiently opaque.
Do not add too much ink as this may affect resist.

**METHOD**
**Apply the pour-on hard ground as follows:**

1. Prepare a metal plate as described in previous sections.
2. Hold your plate in a horizontal position above a tray.
3. Pour a generous amount of hard ground (coat 1) onto the middle of the plate.
4. Swivel the plate around until the whole surface of the plate is covered. Allow excess varnish to drip into the tray.
5. Pour more varnish over areas that have not been covered.

6. Lean the plate upright for up to 30 seconds to allow excess ground to drain off. Place blotting paper underneath to improve drainage.
7. Place the plate in a flat position in a drying cupboard for 15 minutes (if the thicker Future has been used, leave upright). Gentle but not excessive heat (approx. 35-40 degrees C) is ideal for curing the acrylic ground. Drying time without heat will be up to 30 minutes.
8. Pour excess hard ground from the tray back into the bottle using a funnel.
9. When the first coat has fully dried repeat the process using hard ground Coat 2. This will provide sufficient thickness for a deep line bite.
10. The ground is ready to use when the second coat is dry.

For copper and zinc plates it is possible to apply only one coat of hard ground (Coat 2) if no deep etch is required. The more porous steel plates however necessitate the two-coat process. If line work is to be applied to existing intaglio areas again the application of more than one coat of varnish is essential to ensure full coverage of the modulated plate surface. In this instance it can be useful to work just with pure liquid hard ground so that existing marks remain visible through the clear film.

### Spray-On Hard Ground

A sprayed liquid hard ground fulfils the same purpose as a poured one but has the advantage of being extremely even. This is particularly useful on plates which are meant for printing directly from the acrylic surface to obtain a crisp white background to the print.

**METHOD**
**Products and equipment needed for spray-on hard ground application:**

- a ventilated spray booth (aquatint booth)
- If possible, use an industrial grade spray gun rather than a designers airbrush.
- spray mask
- liquid hard ground coat (1)
- liquid hard ground coat (2)

**METHOD**
**Apply a spray-on hard ground as follows:**

1. Prepare a metal plate as described in previous sections.
2. Lean the plate against the back of the spray booth.
3. Spray on liquid hard ground coat 1 in even horizontal strokes, gradually moving down the plate.
4. Now spray in a vertical direction until the plate is sufficiently covered. Do not overspray but remember that unlike spray aquatint, here the aim is to produce an even cover not a fine mist.
5. Place the plate in a flat position in a drying cupboard for 15 minutes. Gentle but not excessive heat (approx. 35-40 degrees C) is ideal for curing the acrylic ground.
6. Apply the opaque hard ground coat 2 in the same fashion.
7. Clean the spray gun with soapy water and let the plate dry.

### Drawing into a hard ground

Once the hard ground is dry the artist can begin to draw and incise marks into the acrylic surface. The most obvious choice of drawing utensil would be an etching needle made from tempered steel which enables the artist to create any number of lines, strokes, dots and textures on the plate to suit their pictorial vision for the print. An etching needle is still an essential instrument in etching and is recommended as an inexpensive investment. However, more makeshift tools like sewing needles inserted in a holder are equally well suited for the task. Any tool that is sharp enough will cut into the acrylic ground with ease. It should be held in a fairly upright position and guided with fair but not excessive pressure. Pressing too hard will produce a drypoint burr which will be attacked by the Edinburgh Etch during biting. All incised marks should be highlighted by the shiny metal surface visible through the hard ground. If some areas look insufficiently opened up it is likely that the etching needle has become blunt and needs sharpening.

**Possible drawing utensils:**

- sharp drypoint needle (have sharpening stones at hand for frequent use)
- traditional etching tools such as roulettes etc.
- sewing needle inserted in a retractable pencil
- razor blade

- scraper
- sandpaper
- coarse steel wool
- wire brush
- small saw blade

Working with an acrylic hard ground is in no way restricted to the use of just an etching needle. Many instruments or materials can be used to make marks on the smooth surface. A seemingly endless range of effects can be produced by drawing with pieces of steel wool or sandpaper, scraping away the ground with a razor or by using implements like saw blades with which bundled lines can be conjured up in a single stroke. When the ground is broken in this way you should remember that a scraped area, for example, will etch as open bite, whereas anything making narrow marks results in a line bite similar to that caused by an etching needle. Improvised techniques can often enhance the sometimes rather dry character of pure line work.

Another way of producing intaglio marks of different depth and tonal value is to control the length of bite - an option much favoured by Rembrandt. A very faint and delicate line drawn into the hard ground only produces a very faint, delicate, greyish looking mark on the print if the plate is etched for a short length of time - say 5-15 minutes. The quality of this line changes as a result of any further immersion in the bath - after say 40 minutes the eroded groove will have become deep enough to give a black and well saturated line; and after a further 2 hours the line has acquired a rather heavy quality due to the formation of a wedge-shaped groove that is now deeply cut into the metal plate. Due to a degree of lateral biting it will be wider than the original incision in the hard ground. The importance of biting in successive stages as a creative tool cannot be over emphasised. Working in this way enables artists to turn a flat surface into a multi-layered landscape of marks which in turn produces prints of a tremendously versatile and spatial nature.

In hard ground etching this can be achieved by initially drawing the more delicate areas of a design, etching them for a short period then rinsing and drying the plate. After stopping-out these areas i.e. covering them with a mordant resist to prevent further biting, more work can be drawn into the ground and etched for longer to produce richer and darker passages of the overall composition, one step after another.

Stopping-out is usually done by painting stop-out varnish onto the bitten intaglio lines using brushes of a suitable thickness. If areas are stopped-out with floor varnish this gives the artist the added advantage of being able to draw more layers of precise line work onto areas of the plate that have already been etched. The thin acrylic floor varnish does have a tendency to creep into bitten intaglio lines while a thicker stop-out varnish will stay where it is applied.

Very dense cross hatching or similar meshed networks of marks are best produced by etching several successive layers on top of each other rather than by etching in one stage. In this instance, the hard ground would be reapplied in several coats before each stage of drawing and biting. A multilayered bundle of marks will always appear richer and denser on the print than a single layer and is much less likely to turn into shallow open bite in the intersecting areas during long etches. The creative use of a pure hard ground can make a seemingly simple intaglio method into something much more complex, demanding and exciting.

The liquid acrylic hard ground has several advantages over the traditional wax based method. Aside from the elimination of solvents and airborne carcinogens (from hot plates and plate smoking) there are also creative benefits. The durable acrylic surface is much less prone to the kind of foul biting often found using the wax method. Hard ground plates can be worked on over a period of time and carried around between successive bitings without the surface becoming damaged. Despite its durability, the acrylic hard ground still presents artists with a surface that is easily broken into by any tool or process and allows a free-flowing drawing action akin to drawing with pen or pencil. All of the soft rolling ground mixtures described in the next section are suitable for use as a malleable hard ground. The ORONO GROUND, developed in collaboration with the University of Maine, in particular has properties remarkably similar to the conventional wax ground.

### Roll-on hard ground

The roll-on hard ground also serves as a ground with which areas of a plate that have been under etched can be reworked and deepened. For this purpose the etched plate is oxidised and then rolled-up all over with roll-on hard ground. The stiff acrylic ink will only be deposited on the plate surface while the lower intaglio areas are unaffected by the new coating of resist. After drying, the plate can be immersed in the mordant once more to obtain the required depth of bite.

Some etchers favour a combination of the liquid hard ground and the roll-on hard ground.

**METHOD**
**Apply a roll-on hard ground as follows:**

1. Lay on a very thin coat of liquid ground and allow to dry.
2. Roll a thin coat of black roll-on ground on top. Allow to dry.

**The resulting plate allows the drawing of very fluid and delicate line work into a deep black surface and yet guarantees maximum corrosion resistance.**

For more information on Hard Ground click on the following links:

**Hard and Soft Ground** **Etching Ingredients**

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## 5. Soft Ground

**The Orono Ground**
**Soft Ground drawing**
**Soft Ground impressions**

### The Orono Ground

This innovative nontoxic ground was developed collaboratively by myself and Professor Susan Groce at the University of Maine in Orono - hence the name. Susan had many years of experience of mixing traditional grounds and acquired exacting standards at Stanley Hayter's famous Atelier 17. She writes about our collaborative work on the Orono Ground as aiming;

***to duplicate and excel the conventional oil based grounds***

She goes on to say

***... this ground proves to be remarkably sensitive to all materials pressed into it, whether through thick or thin applications ... it is remarkable acid resistant, and used as a hard ground gives superb flexibility in drawing curvilinear marks ... even weeks after application.***

In the technique of soft ground etching the surface of a metal plate is made so sensitive that any textural material impressed onto it will be accurately reproduced in the intaglio print. It is predominantly used to emulate the pictorial qualities of pencil and crayon drawing and to transfer the patterns and textures of found objects into the intaglio medium. The roll-on grounds used for the acrylic resist soft ground method also function as a more malleable hard ground alternative, allowing greater fluidity in drawing than is possible with the liquid hard ground.

The suitability of Graphic Chemical waterbased relief ink as a substitute for the traditional wax/asphaltum based soft ground was discovered by Keith Howard. His original method using this ink works well on copper plates etched in ferric chloride, but was less successful when used with other metals as it gives insufficient etchant resistance and inconsistent results. Whilst attempting to remedy this, I came across various substances which when added to the ink, dramatically improved its reliability, ease of application and mordant resistance. This research culminated in the development of the Orono Ground, an admixture of acrylics that represents the best soft ground and wax-like acrylic hard ground available to date.

**MATERIALS**
**Products and equipment needed for standard soft ground application:**

- prepared metal plate
- BASE: graphic chemical waterbased relief ink, No 1659 black or No 1661 crimson red for maximum definition
- BINDER: Golden GAC 200 or Lascaux clear gloss varnish No 2060 or Johnson's Future floor varnish
- THICKENER: W/B Silkscreen Printing Medium/Paste
- medium or hard ink roller, preferably larger than the width of the plate (nitrile surface is best)
- spatula
- glass or Perspex slab
- concentrated detergent
- bowl containing detergent, water and sponge

**METHOD**
**Apply a standard soft ground as follows:**

1. Dispense three parts of the ink onto the slab with a spatula. Now work 25-50% Lascaux No. 2060 varnish into the mix. This enhances the resist, improves rolling and imprinting properties and reduces drying time. The more varnish added, the quicker the ink dries but the more resistance it attains. If using acrylic floor varnish as a cheaper and slightly weaker modifier, bear in mind that the mix should not get too runny for rolling.
2. Now roll out the fortified ink from various directions until the plane looks evenly covered. A well mixed soft ground ink should make a distinct rolling sound similar to rolled out relief

printing ink.
3. Roll out a second plane of ink next to the first by repeatedly collecting a thin deposit from the first plane. Do not add extra ink.
4. Once the second plane is sufficiently rolled out transfer ink from it onto the surface of the prepared metal plate; repeatedly rolling over the surface by alternating vertical then horizontal strokes. Rolling is complete once the plate is fairly thinly and evenly covered. Remember that a thin ground has the best sensitivity but that zinc and steel plates will need a slightly thicker coating for best resistance.
5. The ground is now ready to use and the plate should be handled very carefully as anything coming into contact with it will register on the image. You can assess the ground using the finger print test - when you press your finger into the surface it should leave behind a perfect imprint, thus exposing the metal.
6. The working time for transfer methods ranges from 20 minutes to several hours depending on the amount of binder that was added to the slow drying relief ink.
7. Before proceeding further with your soft ground remember to soak the roller in neat detergent to keep it from drying out before it is properly cleaned. At the end of a soft ground session the ink slab and tools are easily cleaned with a sponge and detergent; any dried ink deposits can be removed with Ajax.

Many workshops make up batches of Orono Ground and keep them in sealed containers, ready for use.

### Soft Ground Drawing

Soft ground etching or *vernis mou* was devised by French etchers as a means to extend the vocabulary of etching to include marks of the soft quality of pencil and crayon work. Here the ground is not shaped directly by the implement used but by a simple transfer process similar to the old-fashioned carbon paper method of making copies. Even though the lines and marks created by this method have the fuzzy, granular appearance typically produced by soft drawing utensils it is not actually those utensils that determine the character of the mark but the texture of the paper used for the transfer process. So choosing the right texture of paper in soft ground etching is equivalent to selecting an appropriate pencil or crayon in drawing.

The technique can of course also be used to trace existing drawings or images onto the plate.

**MATERIALS**
**Products and equipment needed for soft ground drawing:**

- metal plate with soft ground freshly applied to it
- sheet of tissue paper, larger than the plate
- sheet of water repellent paper (greaseproof or similar)
- various drawing utensils of different widths capable of exerting pressure e.g. pencils (not too soft), biro pens etc.
- masking tape

**METHOD**
**Soft ground transfer drawing works as follows:**

1. Lay the soft ground plate on a hard surface and cover it with the tissue paper. Tissue paper has a matt absorbent side and a shiny side which is less absorbent - make sure that the matt side is face down in contact with the plate.
2. Cover the tissue paper with a sheet of textured paper of your choice and attach it to the work surface with pieces of masking tape. NOTE: If you are using the process to transfer an existing drawing this drawing should be used as the top sheet.
3. Mark the outline of the plate by drawing registration marks onto the top sheet. You can now begin to draw onto the surface. The drawing utensils should be held upright.
4. When the drawing is completed, remove the top sheet and the tissue paper from the plate. You can easily tell whether your soft ground drawing has been successful by the simple fact that all drawn marks should have offset from the plate onto the tissue paper, thus revealing the metal.
5. If the metal has not been exposed, investigate the following possible causes:

    - not enough pressure exerted during drawing
    - soft ground rolled on too thickly
    - top sheet too thick

Before etching, the plate needs sufficient time to dry; about 2-4 hours by itself or half that time in a drying cupboard.
Typical biting times for a copper plate would range between 40-60 minutes.
The soft ground can also be etched and stopped out in successive stages to achieve a varied depth of intaglio mark.
Other kinds of mark can be easily added to the transferred soft ground. Crisp lines can be drawn straight on the ground using a drypoint needle; reticulated washes can be incorporated simply by adding water; and textures can be pressed into the ground using various objects.

### Soft Ground impressions

Making soft ground impressions is very much a *ready-made* technique using found objects and materials. Rather than creating marks by manual means the artist selects suitable textured materials and surfaces which are then pressed into the etching plate. The great sensitivity of the acrylic soft ground allows materials as delicate as tissue paper to transfer their surface texture to an intaglio print and even lightly touching the ground will produce very detailed finger marks that will etch and appear on the printed image. Virtually any material that is thin and soft enough to travel through an etching press without causing damage can be used. Soft ground impressions taken from plant leaves are particularly successful as the image will show the leaf's texture, structure and outline in graphic detail. Other materials typically used include pieces of scrim (tarlatan) or other woven fabrics, wire mesh, feathers, textured papers, steel wool; whatever else the artist considers appropriate.

Materials with a fine dot or mesh can also be used to bring about tonal areas on the plate in a way similar to aquatint. It is not uncommon in workshops lacking an aquatint facility to make soft ground impressions of sheets of sandpaper which are then etched and stopped out in stages to produce a spectrum of greys up to a dense black. Particular care has to be taken when metal objects or other hard objects are used for taking soft ground impressions - a coin can make an indelible impression on an etching press roller!

**MATERIALS**
**Products and equipment needed to make soft ground impressions:**

- metal plate with soft ground freshly applied to it
- etching press with one blanket removed and pressure slightly lowered
- textured pieces of material etc. to be impressed
- sheet of firm coated paper e.g. greaseproof or glossy photo paper

**METHOD**
**Make soft ground impressions as follows:**

1. Carefully place the soft ground plate onto the bed of the etching press. If plant leaves or other organic matter is being used, place a sheet of absorbent paper underneath the plate.
2. Arrange your textured objects on the plate surface.
3. Carefully place a sheet of coated paper on top - do not use any kind of textured or absorbent paper for this purpose as it will register on the soft ground.
4. Cover with a couple of sheets of Mylar or acetate to protect the press blankets.
5. Lower the blankets onto the plate and run this set through the etching press as though you were taking a proof.
6. Pull back the blankets and carefully take off all items covering the plate; so as not to damage the ground you may need to use tweezers to remove the compressed objects.

Before etching, the plate needs sufficient time to dry; about 2-4 hours by itself or half that time in a drying cupboard.
Once fully dried (copper and brass) plates can be etched in metal salts.
Typical biting times for a copper plate would range between 40-60 minutes.
The soft ground can also be etched and stopped out in successive stages to achieve a varied depth of intaglio mark.

For more information on Soft Ground click on the following link:

**Hard and Soft Ground**

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# 6. Aquatint



Intaglio techniques often appeal more to artists with an interest in line and texture than to those seeking more painterly effects. In fact, intaglio printmaking is ideally suited for realising tonal and painterly possibilities.

The most versatile way of creating tonal areas in an etching is by means of a technique known as AQUATINT. Opinions vary as to where the term originates but a plausible explanation is that the term was derived from *aqua fortis* (to etch with strong acid) and *tinta* (tones made by etching). In aquatint, tonal effects similar to those resulting from strokes or washes of pigment in painting are achieved by the corrosive bath. The technique of spit biting even allows the artist to paint with the etch itself.

Aquatint involves the application of an etch resistant dot structure to the metal plate which is then immersed in a mordant. According to the length of bite this creates areas of a varying depth and roughness on the surface which are capable of holding ink deposits which result in printed tones that range from the faintest grey to the blackest black. If aquatint is applied in color etching it can produce a broad range of hues.

With most etch techniques only those marks incised into the plate create the intaglio whilst the largest portion of the metal remains intact as the surface of the plate. The opposite is the case with aquatint. Here the majority of the metal is removed, only the etch resistant dots remain on the surface like little islands in an eroded landscape. When working with aquatint it can be useful to have a different mental approach than to say line etching. Rather than thinking in terms of making direct black marks on a white background, the imagined background is potentially darkly tonal and it is the artist's task to shape lighter areas from it. The image is created by painting with stop-out varnish or by any other etch resistant means such as adhesive tape, litho crayon etc.

If an aquatint grain is applied to the plate as an overall layer, any areas that are stopped out before the immersion in the etch will produce white marks surrounded by a dark tone. Any marks painted on after subsequent immersions will reflect the depth of bite and the respective grey tone at that time - for example, a mark made after a 5 minute etch will print as a medium grey.

A tremendous spectrum of light and tone can be created when aquatint is used in this way of *negative* mark making.

If the aquatint is etched in stages one should not forget that biting times must always be added up. An aquatint plate that has already been etched for 10 minutes and is then, after stopping-out, placed back in the mordant for another 20 minutes has received an overall etch of 30 minutes. So all non protected areas of metal will bear the dark tone of the 30 minute bite whilst the stopped-out ones will bear the grey tone of a 10 minute bite; and if some areas were stopped-out before any biting, these would print as the white of a non-etched area.

The appearance of an aquatint is not only determined by biting times but also by the size and density of the dots applied to the plate. A modulated aquatint consisting of dots of varying density can cover the whole tonal spectrum with only one immersion in the mordant. This is a major advantage of aquatint over the traditional rosin method which was mainly limited to flat and even tones achieved by numerous biting and drawing stages.

Some artists prefer to use the tonal and painterly properties of aquatint in a much more direct way, where the mark you make is the mark you get. The way to achieve this is by use of the lift process. If for example the artist wanted an etching to be composed of bold and delicate black brush strokes, he would simply apply those on the prepared plate by means of a lift medium. This is then covered with etchant resist and after drying, the lift medium is removed, thus revealing the metal where a mark was made. Now an aquatint grain is applied to this area, the plate is etched, and the resulting print will bear the positive brush marks that were applied to the plate at the beginning of the process.

Aquatint is ideal in combination with other etch techniques as it allows linear and textural elements to be fused with tonal areas. The aquatint does not have to be the first step on the plate, it can just as easily be added later to plates that have already been worked on with a hard ground, with open bite, or with other etch techniques. Also, it is not necessary to cover a whole plate with the aquatint dots as these can be applied to a confined area of exposed metal too. As with all repeated biting, it is important to make sure that the plate is free from grease or loose residues before the aquatint is applied to the plate.

## Aquatint in acrylic resist etching

In the acrylic based etching system, the etch resistant dot structure is applied by spraying acrylic varnish onto the plate. A sprayed aquatint offers great versatility; the dot structure can be applied as a perfectly even layer of any required density, or the spraying devise can function as an air-brush, to create lines, blends, cloudy effects etc. On a more improvisational level, a serviceable aquatint can be achieved by using an acrylic aerosol. There are numerous products on the market that would be suitable as a resist. For more professional workshops, an electric compressor with spray gun, preferably used in an enclosed and ventilated spray area or booth, serves as an aquatinting facility. A spray-painting compressor with gravity fed gun is ideal for laying even aquatints whilst designer airbrush equipment is better suited to modulated work. Any workshop wishing to take full advantage of the safe aquatint techniques would be advised to have both these pieces of equipment in operation.

There are a variety of good acrylic sprays for aquatint. Most of these are made up by adding a dark dye or pigment (e.g.

Koh-i-Noor black ink) to a binder (e.g. Golden GAC 200, Future or Lascaux 2060) for better visibility. Acrylic spray ink works on any kind of metal, proves to be outstandingly etch resistant and does not run during application. Diluted Speedball screen filler is Keith Howard's favoured spray ink. This ground breaks up gradually during biting, so the aquatint dot gradually shrinks during biting. Very dense and velvety tones and blacks can be achieved this way. Keith Howard also developed another product - the Badger airbrush aquatint solution - which performs well on all metals and has excellent visibility during application due to its strong black pigmentation.

## Creating a uniform aquatint

### MATERIALS
**Products and equipment needed for a uniform aquatint:**

- prepared metal plate
- compressor and spray gun + airbrush set up in spraying facility
- spray mask
- newsprint
- jug filled with detergent water
- Acrylic airbrush solution
- de-ionised water

### METHOD
**Mix a self-made aquatint as follows:**

1. Add a small amount of pigmented ink (ideally Koh-i-Noor black ink) to the varnish, stirring continuously until the mix looks sufficiently opaque.
2. Do not add too much ink as this may affect etch resistance.
3. Both Lascaux varnish and Hunt Speedball need diluting before they can be used in a spray gun. Add between 15-20% de-ionised water (pre-boiled water will do just as well) to the varnish or Speedball based aquatint ink. Start with a small amount and stir continuously whilst gradually adding more water. A more dilute solution will produce a slightly finer spray mist but is more likely to run.

Even though the acrylic spray inks are waterbased it is not advisable to expose yourself to any sprayed substances; so put on a spray mask and ensure adequate ventilation of the spray booth.

Familiarise yourself with how your spray equipment works and practice spraying on a test piece.

**Apply a uniform aquatint spray as follows**

1. Gently shake the spray ink before you fill the ink container of the spray gun.
2. Position the plate in an upright position at arms length. Use a sheet of newsprint as a background on which to observe and control the spray deposit. The spray will be barely visible on the plate itself.
3. Switch on the compressor and test the spray on the newsprint, well away from the plate. The density of the aquatint grain is determined both by how much compressed air is added to the ink (this is controlled by a screw on the spray gun) as well as by how far away you are from the plate. A good distance between plate and gun is between 1-2 ft; a closer range produces finer spray particles but you are more likely to over spray the plate. The aim is to produce a FINE MIST on the plate rather than total coverage. If areas are over sprayed there will not be enough exposed metal for the etch to work properly - and therefore no tone will be produced!
4. Once you have adjusted your set up to a fine mist you can start spraying onto the plate by passing over it in regular parallel sweeps, gradually moving from the top of the plate to the bottom. Make sure to change direction outside the plate boundaries.
5. A single layer usually suffices on copper and zinc plates.
6. Steel plates should only be sprayed with the varnish mix and work best with a second layer of mist, this time in the opposite direction. Allow a couple of minutes drying between applications.
7. Aquatint plates dry within 20-40 minutes and benefit from being kept in a drying facility prior to etching.
8. The spray gun is quickly cleaned by first running detergent water through it for 30 seconds

and then by rinsing it in clean water. If the gun becomes clogged with hardening acrylics, its detachable components should be soaked in a concentrated solution of soda crystals and then cleaned with a brush and tooth pick.

**Remember:**
The finest aquatints are achieved by adjusting the gun to a very fine spray (higher air to ink ratio) of more dilute spray ink and by applying this in several layers.
Thicker aquatint granules (useful for deep etches) are produced by adjusting the gun to its most powerful spray setting; by using a more concentrated spray ink; and by increasing the distance between plate and gun.

**Quick Pressure Guide:**

| | | | |
|---|---|---|---|
| Strong Pressure | (50-80 psi) | = | fine dots |
| Weaker Pressure | (below 30 psi) | = | coarse dots |

## Creating a modulated aquatint

The process of applying a modulated aquatint does not differ greatly from that of applying a uniform one, described previously. However, with this technique the artist is not aiming to use the spray equipment in an even way but to use it as a creative tool with which to create modulated areas of differing density on the plate. The spray gun can be used to render larger aquatint clouds but a designer airbrush is a more appropriate tool as it offers much greater versatility.

Modulated aquatint can be used imaginatively to create spatial effects in abstract compositions, to conjure up clouds in a landscape; to describe the volume of three-dimensional objects; and for many other purposes where a tonal range or a blend is required. In true printmaking style, this process is characterised by the fact that the densest marks sprayed onto the plate actually represent the lightest areas on the print, while the open ones applied as a fine mist produce the darkest areas of the composition. Areas on the plate that are not touched by any sprayed marks or gestures will of course etch as open bite. If this is to be avoided it might be advisable to start off by layering a faint overall mist on the plate before the main component is sprayed. After drying a modulated aquatint can be stopped-out as usual and even though a single layer of modulated aquatint can already encompass the whole tonal spectrum, etching in stages is another possibility to enhance the illusionistic depth characteristic of this method.

Other creative possibilities with airbrushing include the use of masks and stencils to produce sharp outlines and, of course, using the brush itself to spray clearly defined shapes and lines etc.

## Scraped aquatint

Aquatint not only has a similar name but also has a similar appearance to the mechanical technique of mezzotint which is also used to produce tone on the plate. Where the techniques differ is that aquatint creates an etched dot structure while mezzotint produces a mesh of burrs. Both invite the artist to make use of tools such as scrapers, burnishers and steel wool to work soft tones, marks, blends and light areas into the roughened surface. An aquatint that is scraped and burnished will seamlessly blend in with other features of the composition and an aquatint lightened with steel wool can reveal underlying intaglio marks that seemed to have vanished in the etch process.

The rich quality of mezzotint is often viewed as superior to the blacks that can be achieved more quickly using aquatint. This is probably due to the granular structure of the aquatint which tends to be present even when the aquatinted mark has been eroded so deeply as to print as black. As with etching in general the aquatint will become much richer if used in a multi dimensional way. A truly dense black, without any remaining white specs, can be achieved from an aquatint that is applied and etched twice. Start by applying a coarse grain and etch to a fair depth before applying a finer grain and etching a second time. The dot layers will lock into each other to produce a complex terraced effect, producing a tone that is more saturated than the more uniform aquatint. A more direct way of deepening an aquatint that has already been etched is to rub the roughened metal surface with a soft litho or wax crayon; small etch resistant particles will adhere to the plate and act as a localised coarse aquatint and when re-etched, the result is a lively coarse grain black.

Aquatinted areas can be more vulnerable than other kinds of intaglio after application, during etching and at the printing stage. Some wear may show in larger editions. Aquatints on the relatively soft zinc are particularly sensitive, while on copper it is much more durable and can be hardened for large editions by steel-facing the plate. Copper is also the best choice for very fine aquatints and for etchings where the broadest tonal range is required. As mentioned previously, steel can produce a tonal quality all by itself, but again, the use of aquatint will enhance this natural tonality.

The length of time that an aquatinted plate is etched is crucial to the final result - more so than with other techniques. In a well-activated bath of ferric, just a couple of minutes can make the difference between the required tone and an over etched plate. Due to the changeable nature of the corrosive solution it is recommended that the artist determine typical biting times for an aquatint by making an etching step test before an important plate is etched. Aquatints can be easily over bitten which typically results in a shallow rather than a dark tone because the dots have been completely eroded.

Aquatint plates should not be exposed to excessive oxygenation or agitation in ferric tanks as this may cause damage to the fine grain. Ideally copper and brass plates should be dipped in a de-oxidising solution before and after etching; this is a simple salt, water and vinegar mixture that can quickly remove any tarnishing.

Aquatinted copper and zinc plates etch well in trays but must be rocked during etching to remove sediment. Aquatint plates should not, however, be etched face down as the bottom of the tray may scratch the aquatint.

## Aquatint and spit bite

There is an aquatint technique that does not involve the immersion of the plate in a corrosive bath. In spit bite, which is

sometimes more precisely described as creeping bite, an aquatint grain is etched directly into the plate by painting the mordant onto it. Flowing tones of the most delicate kind can be produced in this way - the intaglio equivalent of a watercolor wash.

### MATERIALS
**Products and equipment needed for spit bite:**

- aquatinted copper plate
- jar of full strength ferric chloride or Edinburgh Etch 45 Be
- tray larger than the plate
- strong acid resistant gloves
- goggles
- brushes of various sizes
- etching and rinsing space in allocated area

### METHOD
**Apply spit bite as follows:**

1. Place a very finely aquatinted copper plate in the tray.
2. Make marks by painting the metal salt solution onto localised areas.
3. The longer the ferric stays in one place the darker the etched tone will be.
4. Sharp edges can be avoided by brushing water around the etched areas to dilute the strength of the ferric.
5. To control the depth of bite the plate can be intermittently rinsed and inspected before more solution is brushed on.
6. If the brushed marks are meant to be more defined, a drop of detergent can be added.

A spit bite usually etches quite quickly and dark tones can result from this fine but shallow etch within minutes.

No gases are produced by the ferric when used on copper or brass, but skin contact should be avoided.

Spit biting can also be executed very successfully on zinc plates using saline sulfate solution.

### Printing an aquatint plate
Etched plates with aquatinted areas should be printed with moderate pressure - especially when copper and zinc plates have been used or a plate has not been steel faced. Repeated printing is likely to flatten the delicate aquatint. The tonal quality of aquatint comes out best on a print if a good amount of plate tone is used. A plate wiped predominantly with scrim or by hand tends to have these softer tones whereas a plate heavily polished with tissue paper will result in a print that shows more of the *dottiness* of the aquatint - something resembling stars twinkling in the night sky. The tonal values of an aquatint can also be enhanced by adding more light copperplate oil to the ink than usual, and, if the plate is printed black, by using a specialised ink such as the very rich Charbonnel Black No. 55985.

For more information on aquatint click on the following links:

**Aquatint** **Etching Ingredients**

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## 7. Mark Making Techniques
**The Chemistry of Acrylics**
**Stop-out varnish**
**Direct Stop-out marks and open bite**
**Stop-out: an essential aid**

## The Chemistry of Acrylics

All grounds used in acrylic resist etching consist of complex acrylic polymer substances that are in a more or less liquid form and contain water as a solvent. They acquire the properties that make them ideal for intaglio printmaking during the drying process. The separate acrylic particles that form a watery emulsion of monomers in the liquid state start to bond with each other as the water evaporates. Polymerisation is complete when these monomers remain firmly linked as long polymer chains, thus creating a very tough plastic-like substance that is both hard wearing as well as perfectly etch resistant. Acrylics brushed, poured, rolled or sprayed onto a prepared plate ultimately form a strong bond with the metal surface. During etching, acrylics do not tend to chip off along the edges of the eroded intaglio and, if required, can even be left on plates during printing. As long as they are in the liquid state, acrylic grounds can be easily cleaned from brushes or work surfaces with soapy water, but become water-resistant once they have fully hardened.

The blending together of the components that make up a self-mixed acrylic ground has to be carried out slowly and with care to make sure that an emulsifying process takes place. Small quantities should be added gradually while stirring continuously. Any water (de-ionised) has to be introduced to the mix in this same gradual manner, and grounds should only be diluted if instructed. Acrylic grounds left unused for a period of time need some stirring or shaking to re-emulsify the mixture. Many acrylic grounds dry very quickly and drying times as well as bonding properties are enhanced still further by using a hot drying cupboard.

It is often believed that plastics are hard to break or dissolve but the acrylics used in this manner of printmaking are easily broken down and removed by alkaline substances. This is essential for reclaiming plates after etching. The chemical process performing this miracle is known as saponification. In layman's terms it means that the alkaline stripping process turns the tough acrylic substances into a harmless soap-like solution.

## Stop-out varnish

Stop-out varnish is often considered a product to be used in conjunction with other etch-grounds but it also represents the most basic means to create etched marks on a metal plate and in the context of open bite it deserves to be regarded as a technique in its own right. Open bite etching is one of the most idiosyncratic intaglio methods and can be used to create unusual and powerful effects. Future floor varnish makes a good stop-out but is quite runny in consistency.

Solid brush marks are easier to make with a custom made stop-out solution. There are an increasing number of waterbased acrylic binders and paints on the market and research has shown that many can be utilised as etching resists. The main criteria these materials must meet is good mordant resistance on the one hand and the capacity to be easily stripped off the finished plate, on the other. A lot of acrylic paints developed for painting make quite a reasonable stop-out varnish for shorter etches but tend to break up during more vigorous biting. Many pure acrylic binders used in painting such as Golden GAC 200, possess great etch resistance but some may be difficult to strip off the plate. A product that is both highly resistant as well as fast and easy to strip is Lascaux clear gloss varnish. This resist is so strong that it survives even hours of erosion in a strong Edinburgh Etch or even a bite going all the way through the plate, without breaking up. It is also one of the few strong acrylic resists that allow clean lines to be drawn into it without the occurrence of dragging or chipping.

For most etching tasks a medium strength or regular stop-out varnish which is opaque, brushes out fluidly and is quickly removed in sodium carbonate stripping solution is recommended. It is made up from equal quantities of black acrylic paint and a strong binder such as Golden GAC 200 or Lascaux clear gloss varnish No 2060. The quantity of acrylic paint in the mix can be reduced to 25% for maximum strength. This lends itself particularly well to those seeking a very deep bite. A clear stop-out varnish that will allow underlying marks to remain visible can be obtained by using pure Lascaux 2060. Normally an acrylic stop-out varnish is used neat but if tonal and textural wash effects are desired it can also be diluted with water.

Keep your varnish in airtight containers (acrylic paint bottles are ideal) because it hardens very quickly. It is also more economical if the required amount can be dispensed sparingly onto a piece of card. Brushes and other implements can be cleaned quickly and easily with soapy water while the varnish is still wet. If bits of acrylic have hardened on a work surface or on tools, these can be removed with Ajax or by soaking in dissolved soda crystals.

Regardless of what kind of stop-out varnish is chosen for a project it is essential to allow the stopped-out plate to dry and cure fully. Often artists who are eager to commit their work to the mordant think that the varnish has hardened when it is infact still be wet beneath the crust. Grounds that have not completely dried can easily be dissolved in the bath as both the liquid acrylic as well as the ferric solution contain water. For this reason the use of a drying cabinet is recommended. Stopped-out plates should be left to dry for at least 2 hours before their immersion in Edinburgh Etch or ferric chloride.

### MATERIALS
### Products and equipment needed to make up stop-out varnish:

- Golden GAC 200 or Lascaux clear gloss varnish, No 2060
- Lascaux studio acrylic paint, or similar
- Variety of brushes

### METHOD
### Make up stop-out varnish as follows:

### REGULAR STRENGTH:

50% Black Lascaux Studio, No 526
+
50% Golden GAC 200 or Lascaux clear gloss varnish No 2060

**EXTRA STRONG:**
best for steel, zinc and any long etches

25% Black Lascaux Studio, No 526
+
75% Golden GAC 200 or Lascaux clear gloss varnish No 2060

### Direct Stop-out marks and open bite

You can compose an image directly on a prepared plate with stop-out varnish. Brushes of various shapes and sizes allow a fluid and painterly way of working. The thinking an artist should apply is typical of many of the processes in intaglio printmaking: regard the plate as a background that will be eroded and from which you will shape islands of light. All the brushmarks applied using stop-out varnish are *negative* marks which will remain raised while the areas surrounding them are *positive* and will be eroded to form a landscape of canyons that will ultimately hold and then transfer ink onto the paper. Larger areas of metal that are exposed or covered but have no narrow grooves are often referred to as open bite as opposed to the more enclosed etch of line bite or aquatint. Open bite produces very distinct results on different types of metal. The resulting image from an open bite will be made up of an eroded ridge around the painted marks.

It is also possible to use stop-out varnish to create narrow grooves and textures. Simply brush out the varnish in a streaky fashion to produce bundles of heavy lines or use dabbing devises like rags or sponges soaked in stop-out varnish to add a variety of tone and texture. After etching and stripping the plate more layers of open bite marks can be added to enhance the complexity and depth of work.

In addition to the stop-out varnish there are many other exciting ways of making etch resistant marks on the plate that strictly speaking are also open bite techniques. The artist may wish to stick pieces of adhesive tape to the metal surface; draw with waterproof felt tip pens or soft litho crayon to give a textured line; or make drip marks with waterbased glue (PVA or similar). Greasy resists such as Vaseline or margarine can be smeared onto the plate - the possibilities are extensive and it is left to the imagination of the printmaker to explore their own open bite vocabulary.

### Stop-out: an essential aid

Despite its own creative possibilities, stop-out varnish is most often used as an aid to other etching techniques. In this instance it does not function as the main source of intaglio mark but as a medium with which marks produced can be totally or partially protected from the corrosive process. The varnishes described earlier are well suited for this task as they bond extremely well with any kind of acrylic ground that has been applied to the plate. The depth and complexity of many Rembrandt etchings is a result of repeated etching of the plate with stopping-out taking place between each etch. Very fine work that is carried out first and etched for a short period would become a deep intaglio if it were not covered by a mordant resist before all subsequent immersions.

Choose a stop-out varnish of an appropriate consistency for different stopping-out tasks. A slightly diluted strong stop-out varnish is ideal for filling in very delicate marks and lines without covering any adjacent areas. The strong stop-out varnish in its pure form is very good for covering areas that are exposed to very deep etches or to cover up deep intaglio that has already been etched. A medium strength stop-out varnish is well suited for preserving aquatinted plates which are to be bitten in stages to achieve a broad tonal range. Owing to their thickness and plasticity most stop-out varnishes are less suited for use as a ground into which lines and other marks can be drawn or scraped but Lascaux 2060 is an exception to this general rule. However, very interesting combinations of the tonal effects of open bite and the decisiveness of line work can be achieved in one stage if marks made with a suitable stop-out varnish are then worked with a drypoint needle or other utensil. For this purpose the linear grounds should be employed i.e. the roll-on or liquid hard ground. If the floor varnish based hard ground is used for stopping out it should be brushed on more thickly than in its normal application, or in two successive coats.

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## 8. Wash Techniques



### Washes and reticulations

Many artists are intrigued if not completely baffled when introduced to the painterly mark making potential offered by acrylic resist etching. In the past, wash effects could only be achieved in intaglio printmaking with great difficulty. Now that the etch resists are based on an acrylic chemistry, washes and other painterly effects have become an integral part of

etching. The aesthetic introduced by these methods resembles those produced through lithography and wash painting but with a distinctly intaglio character.

The globular nature of acrylic emulsion has made this development possible. If acrylics are used in their neat form - as in stop-out varnish - they become perfect mordant resists by forming tough polymer chains. If however the neat acrylic is diluted with water it will turn into what is known as a *permeable resist*. This term is given to substances which have some initial etch resistance, but as the etching process progresses the ground is weakened so that gradually more and more of the metal surface is exposed to the corrosive action. Tonal and textural effects can result from this in two ways: the diluted varnish can create intricate reticulations and dot patterns during drying; or a ground can acquire a fine textured effect with the impact of the corrosive, producing a mark resembling the resistant cover of a stopped-out area which gradually turns into something as permeable as an aquatint. In most cases the resulting tonal area is not flat as with a uniform aquatint, but rich and varied in tone and texture as with an ink wash.

**Continuous tone wash** (Also known as *Destruction Ground*, see Keith Howard's NEW TERMINOLOGY.)
A direct wash technique that produces flowing brush marks of great delicacy and tonal range can be created using Hunt Speedball screenfiller. The wash is used most frequently to produce watery or cloudy flow marks. Owing to the unique permeable properties of acrylics the intersections between tonal areas are not stepped but perfectly continuous. On a copper plate the marks will be surrounded by blank open bite areas, or on a self-texturing plate such as steel, by a grainy area. Where the wash is applied in an opaque layer it functions as a stop-out resist, which will produce white areas on the print. The more the wash medium is diluted with water the darker the resulting tone will be. The darkest tones or black occurs when a 1:6 solution is used and the plate has been etched for a sufficient length of time. Areas diluted further than 1:6 are likely to result in open bite. Experience shows that this technique works best if a lot of metal is still shining through the Speedball wash after application. If the overall thickness of the ground is too great only a few thin areas of the plate will produce a tone. A degree of randomness is in the nature of this playful process.

**MATERIALS**
**Products and equipment needed for continuous tone wash:**

- can of Hunt Speedball screenfiller
- fresh water in various jars
- selection of soft brushes

**METHOD**
**Apply continuous tone wash as follows:**

1. Fill one jar with a mix of one part Speedball to six parts water to produce the Speedball wash medium. The permeable properties of the Speedball acrylic are most pronounced when this diluted wash medium is used.
2. Paint directly onto the plate with the brushes creating areas of varying concentration or dilution.
3. Carefully place the plate in a drying cabinet and leave for several hours to ensure that the acrylic surface is fully cured.

If etching a wash plate in Edinburgh Etch the best results are usually obtained with fairly long biting times - even up to several hours - to guarantee that the ground has been immersed in the mordant long enough for it to go beyond its threshold of permeability. After around 1 hour in an aerated dip tank, the brushmarks on a copper plate painted with the medium will be clearly etched into the metal. This will in turn produce black brush strokes on the print. The tonality of the stroke will resemble an aquatinted area but its very fine dot structure is much less discernible than a typical aquatint.

Contrast can be enhanced by applying an aquatint prior to printing.

Polishing the plate prior to printing can improve the reproductive quality.

The permeable properties that facilitate a continuous tone wash are not unique to Speedball but can be found in many of the acrylic varnishes when diluted with water, especially in the stop-out mixes described previously.

**Reticulated and experimental washes**
An ideal medium for reticulated washes is based on the graphic chemical relief ink introduced previously as a soft ground. When diluted with water this waterbased ink flakes out into very pronounced reticulations which closely resemble those previously only achievable in lithography. This represents another extension of the pictorial possibilities for etching using the acrylic system.

**MATERIALS**
**Products and equipment needed for reticulated wash:**

- Graphic Chemical relief ink
- water
- brushes

**METHOD**
**Apply reticulated wash as follows:**

1. Dispense a small amount of Graphic Chemical relief ink onto a saucer.
2. Using a brush, mix water into the ink
3. Some acrylic binder such as Lascaux No 2060 may also be added for extra mordant resistance, especially on zinc or steel.
4. The mix is ready to be used on the degreased plate as soon as reticulations have formed within the liquid. Marks can be manipulated with the brush and by adding more concentrated ink or water.
5. The relief ink needs to be allowed to dry for a long period - preferably overnight - before it is etched.

For a fainter reticulated wash (e.g. for a background) the plate is best aquatinted then bitten for just a few minutes.
A reasonably long bite will bring out rugged and contrasting intaglio structure.

If Graphic Chemical Black No. 1699 is used the reticulations will be fairly coarse - very similar to lithographic touche.
If Graphic Chemical Crimson Red No. 1661 is used the reticulation patterns will be much finer.

## Carborundum wash

This tonal method, pioneered in Orono, not only facilitates particularly dramatic reticulated effects but also gives a great degree of creative control.

**MATERIALS**
**Products and equipment needed for carborundum wash:**

- Lascaux Black Acrylic No. 526
- Carborundum grit

**METHOD**
**Apply carborundum wash as follows:**

1. Create a stock mixture of the wash by mixing fairly equal volumes of Lascaux Black Acrylic No. 526 and Carborandum grit. The grit size varies from 120-300 and it determines the kind of grainy effect obtained in the wash.
2. Dilute with water to make the wash permeable. The water content should be between 2 to 5 parts water to 1 part carborundum mix. Adding a drop of detergent can help make application more controllable.
3. Use the same drawing methods as in the Speedball wash process.

The quality and darkness of the resulting strokes will be determined by the dilution, the grit size and the biting time.

If this wash is applied to metals other than copper, the acrylic paint content is best supported with a stronger binder such as acrylic floor varnish, for the gritty particles. The process is literally self-aquatinting: the drying acrylic collects around the carborundum particles to form etch resistant dots while the spaces between them become exposed to corrosion in the mordant. This also opens up the possibility of a paint-on aquatint in which the diluted carborundum mix is used to paint a design directly onto a copper plate.

Artists interested in using a vocabulary of washes may wish to set up their own laboratory to more fully explore the tonal and textural potential of acrylics. Other options to be considered are mixing Speedball and relief ink for a wash that has great tonality as well as reticulations, or experimenting by sprinkling droplets of water/ diluted alcohol/ particles etc. onto

the wet wash drawing while wet.

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## 9. Lift Techniques

For information on lift techniques click on the following link:

**Aquatint and Lift Ground**

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## 10. Combined Intaglio and Collagraph

After drying and curing most acrylic grounds are much harder than comparable oil-based grounds. In fact, they are so durable that they can be used directly as a surface to be printed from using an intaglio press. With the acrylic resist etching system there are numerous ways of combining the intaglio etch with collagraph techniques.

If patches of Speedball or acrylic stop-out varnish are painted directly onto a plate, these will print in a manner similar to open bite patches but with a somewhat softer appearance. This direct painting method can be used on a plate that already bears an intaglio structure such as an aquatint or deep open bite. All marks applied to the plate will appear as white highlights or shapes in front of the darker background provided by the etched work. Many over etched plates can be turned into successful compositions using this inverted mark making method.

The mixed intaglio-collagraph method can be compared to mezzotint where the artist works from dark to light. It can even be used as a faster substitute for the scraping and burnishing processes of mezzotint. As opposed to mechanical mezzotint, mistakes are easily corrected - simply strip off the overlaid acrylics from the roughened metal plate and start again!

Printing sizeable editions is possible because of the durability of the acrylic marks. In some cases proofs can be taken from plates that are being etched in stages without having to remove the acrylic ground, something that works particularly well with liquid hard ground plates. After assessing the depth of the bitten intaglio by means of proof printing, the plate can be cleaned and etched further.

Printing from acrylic surfaces also makes it much easier to produce intaglio prints with a very bright background or even a pure paper white. Acrylics tend to have a much smoother surface than metal plates and as a consequence they will print with very little plate tone, or with none at all if sufficiently wiped (wiping from acrylics is faster and easier than wiping from metal). A well-wiped acrylic will print a white background as well, if not better than a highly polished metal plate that has been wiped at length with scrim, tissue and whiting.

Prints made from a combination of intaglio and collagraph techniques show a surprising coherence and can often be indistinguishable from 'pure' intaglio prints.

**Keith Howard's book *The Contemporary Printmaker* includes many more innovative variations in the use of collagraph elements in acrylic resist etching.**

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## 11. The New Etching Chemistry

Since first compiling research on the new etching chemistry I have updated and expanded my writings.
Some methods have been improved, some revised, whilst others have been superseded by new developments.

Click on these links for up-to-date information on my etching research and developments.

**The New Etching Chemistry**

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## 12. Etching the Plate: A Practical Guide

**Backing the plate**
**Applying the handling strip**
**Etching in dip tanks (Edinburgh Etch)**

### Backing the plate

Before a metal plate can be etched the back of the plate has to be protected by covering it with some kind of mordant resistant coating. Plates etched without this protection erode from the back developing heat and causing the grounds applied to the face to lift off. A very quick and reliable way to cover the back of an etching plate is to apply self adhesive tape such as strips of parcel tape.

**MATERIALS**
**Products and equipment needed to back a plate:**

- rolls of parcel tape
- thick sheet of acetate or thin plastic
- blade cutter
- cutting board

**MATERIALS**
**Back a plate as follows:**

1. Place your plate upside down on a cutting board. If your etch ground is very delicate, e.g. if it has been aquatinted, protect it with tissue.
2. Stick parallel strips of parcel tape onto the back of the plate, making sure that the strips overlap and that no metal remains visible.
3. Run your fingernail along the edges and over the overlapping joints to remove air pockets.
4. Cut off the excess tape with a blade cutter.
5. The plate is now ready to be etched if horizontal trays are used.

Plates that are to be proofed without replacing the backing each time, are best covered using a single sheet of adhesive film as this is less likely to retain etch solution underneath which can spoil the print as well as press blankets.

Etchers sometimes prefer to use liquid backings - in this case an even covering of stop-out varnish should be painted onto the plate.

### Applying the handling strip

If the plate is to be etched in an upright dip-tank, a handle has to be attached for lowering the plate into the mordant. This handling strip should be longer than the depth of the tank.

**METHOD**
**Apply a handle as follows:**

1. Cut a strip of acetate about 5 cm/2 inches wide and longer than the depth of the tank

being used.
2. Attach the strip firmly to the back of the plate with several strips of parcel tape.
3. If large or heavy plates are being used, two handling strips are advisable.
4. In busy workshops where multiple plates are being etched, the top of a handling strip should be labelled to make identification simple.

Before etching commences the surface of the plate should be inspected for any greasy deposits. When an artist is working on an acrylic ground over many hours, it is often unavoidable that some greasy marks are made on the exposed metal. As grease resists the mordant it is possible that the biting process will be hindered in these areas. To make sure that the whole plate erodes simultaneously, briefly immerse the plate in a bath of vinegar or citric acid.

### Etching in dip tanks (Edinburgh Etch)

For most acrylic grounds an aerated compartment of a dip tank should be used. This gives a significantly faster and more responsive etch than an unaggitated compartment. Medium to coarse aquatints can also be etched in this way, but particularly fine aquatint dots require the use of a compartment of the dip tank with reduced or no aeration. Alternatively, an aquatinted plate can be etched in a tray to ensure that the acrylic granules are not damaged by the flow of the mordant.

The plate is held by the top end of the handling strip or strips and gently lowered into the etch solution. The back of the plate should, ideally, touch the wall of the tank so that the plate front is facing into the solution. It is best to suspend the plate in the solution rather than let it sink right down to the bottom of the tank where the etch may be slower.

A good way to suspend plates is to clip the acetate strip onto a tank divider using a plastic peg. In an aerated tank, the plate should hang about an inch away from the rising bubbles produced by the air pump - if bubbles are allowed to settle on the plate they may etch craters into the metal. If a number of small plates are etched these can be stacked above each other on a single hanging strip to create more space in the tank. However, it is vital that plates do not touch and should never be sandwiched together as this may scratch the ground and impede the bite.

It is advisable to keep a record of the time when etching commenced. During biting, the depth of bite should be checked at regular intervals. For test purposes the plate is lifted out of the tank, allowing excess solution to drip back into the bath before the plate is carefully rinsed. Most etchers develop their own preferred method of assessing the depth of bitten intaglio, which of course is always judged with the desired effect of the final printed image in mind. A professional intaglio magnifier or a pocket magnifying glass gives a closer view of the indentations.

Another means of testing the depth is to carefully probe a bitten area with a drypoint needle; or a very small piece of the etch ground can actually be scraped off to reveal the eroded metal - these areas can be quickly mended by touching up with soft litho crayon before further biting is carried out. Acrylic hard ground plates are so durable they can even be test printed to assess the depth of bite, without having to remove the ground. After proofing the plate can be gently degreased and etched further.

When the plate is satisfactorily etched, it is rinsed thoroughly under running tap or hose. If more work is to be done on the etch ground, the plate is now dried by placing it in a hot air cabinet, near to a fan or by blotting dry. If the plate has reached its final stage, however, it can be transferred to a stripping solution after rinsing for the removal of the acrylic ground.

The right depth of bite is very much a matter for the artist to determine. When ferric-based mordants are used there is little danger of the kind of foul biting where acid works sideways as much as down. In most circumstances, the Edinburgh Etch or pure ferric can be relied upon to cut a clean wedge-shaped groove which resembles the mechanical cut of a burin.

In etching, always bear in mind that the narrower the opening in the ground, the quicker the etch tends to be. A wider area which does not produce a groove will etch slower because mordants work less actively in less confined areas.

The best way to build up experience and confidence in etching is to produce some test plates on which a variety of marks produced in different kinds of grounds are bitten from a few minutes through to a few hours. Test plates are also very useful when fine-tuning the many variables in the etching process e.g. mordant strength or agitation.

For more information see The Acrylic Resist Etching Workshop.

For printmaking suppliers click on the following link:

**Printmaking Resources**

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## 13. Stripping

**The safest stripping system**
**Making up the sodium carbonate solution**
**Finishing touches**
**Straining and disposal**

The mordant resists used in etching always have to be able to do two things; they must be resistant to corrosive action but they must also be easily removed after etching has taken place. In traditional etching, the reclaiming stage invariably involves the use of volatile organic solvents, the dangers of which have been outlined. In acrylic resist etching, however, the stripping stage is very different. It is founded on the simple fact that acrylic substances although highly etch resistant, break down easily in an alkaline stripping medium. Many of the traditional problems simply do not arise; the workshop atmosphere is kept free from damaging fumes, no rags are needed, and spent stripping solution can be discarded safely and easily. Nevertheless, as with all chemicals, some basic safety precautions should be followed.

### The safest stripping system

A wide range of alkalines can be used for stripping acrylic grounds. The exact mixtures very much depend on the kind of acrylic resists that need to be removed, and ultimately, each artist/ workshop/ educational institute should employ a stripping method or methods best suited to their specific requirements.

Possible stripping alkalines range from agents such as Ajax domestic cleaner and ordinary washing soda through to the very powerful but corrosive caustic soda, the use of which is generally not recommended (it can burn human tissue) unless used with the strictest precautions.

Where a safe and *foolproof* method is paramount - this applies particularly to workshops used by beginners or for artists practising acrylic resist etching in their private studios in a more makeshift environment - the following system is best.

The main ingredient of the safest stripping solution is commonly known as washing soda or soda crystals. Its chemical name is sodium carbonate. Small quantities of this inexpensive alkaline are often used for domestic purposes such as unblocking drains, and can be obtained from most hardware stores or supermarkets. Larger supplies can be ordered from local chemical wholesalers. Once the sodium carbonate has been dissolved in water it can be used to fill a tray or tank where it provides a good stripping solution for any kind of acrylic ground. A plate covered with hardened aquatint, stop-out varnish, hard or soft ground, or photopolymer film is immersed in the alkaline bath and left to soak. Most plates will be broken down in a matter of minutes, whilst thicker deposits of resist may require slightly longer immersions in a hot solution for up to 15-20 minutes.

A slight limitation with the sodium carbonate stripper lies only with the fact that it is somewhat less effective on strong acrylic binders such as Plextol as used in the extra strong stop-out varnish; or on multiple layers of acrylics that have been allowed to cure for long periods of time. In rare cases plates have to be immersed for up to an hour or more to reclaim the bare metal surface.

### Making up the sodium carbonate solution

**MATERIALS**
**Products and equipment needed to make the stripping solution:**

- sodium carbonate crystals - kept in an airtight plastic container to prevent the absorption of moisture
- dust mask, goggles, gloves - wear when handling soda crystals which can give off a fine dust that can be a mild irritant
- warm water
- tray/stripping sink

**METHOD**
**Mix the stripping solution as follows:**

1. Mix the soda crystals into warm water at a ratio of about 2 parts water to 1 part soda crystals. Remember it is good practice to wear protective gear when mixing solutions. The solution can occasionally be refreshed by adding more crystals. Use the solution while it is still warm as it will be more effective.
2. Place the plate in the stripping solution.
3. Once the plate has been immersed in the stripping solution for a while, carefully take it out of the bath, allowing excess liquid to drain off.
4. Rinse the plate with cold water in a stripping sink. At this stage the jet of cold water should simply remove any leftover particles of liquid hard ground or photopolymer film.
5. Thick layers of acrylic ground may require gentle scouring using Ajax and a soft brush before being rinsed with hot water. This usually removes the last traces of acrylic but in exceptionally stubborn cases, plates can be returned to the stripping solution to soak a little longer.
6. Once the eroded metal surface has fully emerged, squeegee all excess water off and place the plate in a drying cabinet or blot with paper towels.

After having come into contact with a variety of chemicals plates often display a certain degree of tarnishing at this stage. This can be particularly true of zinc and aluminum plates which should not be left in the alkaline stripping solution for very long periods.

### Finishing touches
Prior to printing, plates can benefit from being lightly polished with a rag containing some metal polish like Brasso as this brings out all the bitten detail, and in the case of sanded plates even removes the faint surface texture. Fine steel wool, emery paper or fine grit sandpaper can also be used.

### Straining and disposal
If a lot of stripping is carried out, a substantial build up of floating acrylic residue is likely. This should be kept out of the drain both for environmental reasons and to prevent blockages. A simple straining devise (such as is used in kitchen sinks) will collect the waste which can then be removed at regular intervals and disposed of. More elaborate straining systems can be incorporated in the sink design of professional workshops.

For more information see The Acrylic Resist Etching Workshop.

For printmaking suppliers click on the following link:

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## 14. Dry Techniques

**Drypoint**
**Engraving**
**Mezzotint and scraping**
**Removing marks from a plate**
**Power tools**

Etching is predominantly based on the use of indirect processes and their mastery can seem somewhat daunting to artists used to expressing themselves through more direct means. The use of mordants and varnishes is, however, only one strand of intaglio printmaking. Direct or dry mark making plays an equally important part. Historically, dry techniques such as drypoint, engraving and mezzotint preceded the invention of etching but all involve the penetration of a hard surface so that it can be printed as an intaglio print. Any of these purely mechanical techniques can be used by themselves or in combination with each other or with etch-techniques to increase the pictorial possibilities.

A shiny new metal plate is a sensitive base which will register any mechanical activity taking place on it. Anything that in any way marks, scores or scratches the plate surface can be included in the repertoire of dry mark-making. Sharp pointed objects such as needles or nails will score grooves and raise burrs in the metal and are most useful for linear work. Areas of tone and texture can be produced by dragging abrasive materials such as sandpaper, steel wool or a wire brush across the surface.

Apart from the more improvised equipment, there are a large number of tools that have been developed specifically for intaglio printmaking purposes. Some of these, like the hand held burin, are as ancient as the art of embellishing objects with incised designs; while others, such as electrically powered engraving tools are more recent developments.

### Drypoint
In drypoint the artist draws straight onto the metal plate with a drypoint needle. It is a very expressive technique producing lines which can be vigorous, lively or delicate depending on the pressure exerted. Drypoint lines are much less uniform than engraved lines and can be used on their own or in conjunction with a contrasting approach. Rembrandt appreciated the beauty of using drypoint to accentuate other intaglio work - using it to enhance dark tonal areas or to define an outline, whilst Rodin was one of the first artists to use pure drypoint to sculpt powerful imagery on the plate.

When a drypoint needle digs into a plate it throws up a sharp edge called a burr rather than producing a deep groove. It is this burr that holds most of the printing ink and accounts for the unique velvety or blurred character of the drypoint line. It is essential to use a very sharp and durable needle, preferably made from tempered steel. An instrument made from mild steel will quickly become blunt and will not produce the desired burr, merely scratch the plate surface. For the same reason, the needle should be held fairly upright rather than angled like a pencil. A superior but expensive alternative is a diamond-tipped drypoint needle. A fair amount of pressure needs to be exerted whilst drawing as marks made with less pressure will be finer and less velvety. The burr can be removed using a scraper if a line with the quality of an engraving is sought, or an entire area of drypoint work can be completely removed by sanding the plate surface.

Drypoint can be used on all metals suitable for intaglio printmaking and also works on Perspex. The main factors to be considered in the choice of material are whether the plate needs to be editioned and to what extent the metal resists the drypoint needle. Zinc and aluminum plates are easily penetrated and give the option to draw more fluid curves. However, these metals are so soft that only a limited amount of prints can be made before the burr is flattened under the pressure of repeated inking and printing. A drypoint composition drawn on copper can be expected to last for at least ten prints, or for fifty or more from plates that have been steel faced. If steel itself is used, editioning should not normally be a problem but the metal presents greater resistance to the needle and produces more angular strokes.

With acrylic based etch techniques it is usually best to apply drypoint (and other mechanical work) after all etching has been completed so as not to damage the raised burr during plate preparation processes and in the corrosive bath. A plate that is to be printed directly from an acrylic surface such as a smooth hard ground or a photopolymer film, is equally suited

to dry techniques as a metal surface.

Drypoint can be very useful for putting finishing touches to a print. Dark areas of an etched plate may turn out to be a little too faint; some of the etched lines could do to be more prominent; or perhaps the composition requires some unifying element. Rather than having to apply a new ground and re-etch the plate, all these kinds of alterations can be made quickly on the plate with a drypoint needle; without even having to clean the plate after printing.

## Engraving

Despite its decline in popular use, engraving retains a presence through the bank notes and postage stamps which are still hand engraved by highly skilled craftsmen. These familiar images show that the quintessential character of engraving is the clear-cut line. The wedge shape of the intaglio groove produced by a burin is very similar to that produced by etching into a hard ground with ferric chloride. While etched work can be executed quite freely and by anybody who can draw, the proper use of engraving tools is not only much more time consuming but also demands a greater level of experience and proficiency.

Engraving was developed very specifically as a means of reproducing images, and the best way to learn about the qualities (and limitations) of this definitive linear medium is by visiting print archives. Despite the arduous nature of the medium and its somewhat old-fashioned image, a small number of artists have succeeded in using engraving in a contemporary manner. However, the majority of artists who work in intaglio tend to make only occasional use of engraving, as an aid or supplement to other methods.

Burin engraving works best on hammered copper plates or on polished plates of mild steel. Plates with a strong rolling structure are less suitable because they resist the movement of the burin. Lines are not actually drawn as in drypoint but are cut out of the plate by carefully pushing the shaped tip of the burin through the metal surface. Burins come in various shapes and sizes; those with the lozenge-shaped tip are the most versatile. Usually, the plate is placed on a flat surface and held down firmly with one hand. The handle of the burin should rest in the palm of the free hand while the shaft of the burin is clasped between the thumb and the first two fingers close to the tip of the burin. It takes some practice to find the right angle to allow the instrument to push a continuous length of metal out of the plate. If the burin is held too steeply it will stab into the metal and get stuck; and if it is held at too shallow an angle it will slip off, often unexpectedly- hence the importance of keeping the hand which holds the plate away from the direction of the burin. By varying the pressure and the angle of the burin as well as by using different sized tools, a range of lines - from the very delicate through to the most forceful - can be produced. A modulated line that swells from a hairs width to a broad and deep one in a single continuous movement is one of the unique characteristics of engraving. The plate needs to be rotated in order to maintain the pushing action that can create very curvaceous linework and to this end can be placed on a raised base such as a stuffed leather bag. During engraving a spiral of displaced metal is excavated and needs to be cut off at its end with a scraping tool. As in drypoint it is crucial that the artist resharpen his tools at regular intervals; this is done by carefully rotating (without rocking) the lozenge-shaped face on the sharpening stone. Engraved lines can be controlled more easily if the image is predrawn with light drypoint lines which can then be deepened and turned into proper intaglio grooves by the burin. Similarly, the burin can also be used to deepen etched or drypointed lines on a plate.

A variety of electric engraving tools provide a modern addition to the engraver’s toolkit. Artists interested in the more linear qualities of intaglio may find these small hand-held tools a fast and fluid means of incising the plate. The tool is essentially a miniature power drill which can be fitted with a selection of engraving, grinding and polishing drill-bits. These are capable of cutting continuous lines of varying widths and also of making dotted or juddering lines and textures which would not be possible otherwise. Electric engraving tools are particularly useful for engraving linear elements into an existing intaglio structure - a task less easy to perform with a burin.

## Mezzotint and scraping

Loosely translated, the term mezzotint means half-tone. The technique was invented as a way to emulate the depth and tonality found in paintings of the time in a mass-produced intaglio medium. Mezzotint works in the opposite way to conventional methods. Rather than regarding a white sheet of paper or the blank metal plate as the light background onto which dark marks are made, the mezzotint image is actually shaped towards the light from a completely dark background. Before work on the actual composition can begin the entire surface of the metal plate has to be roughened with a mezzotint rocker. This tool consists of a wooden stem with a semicircular steel chisel, the tip of which is cut into fine teeth. The mezzotint tool is held upright on the plate and then rocked to and fro repeatedly while exerting firm pressure. If the rocker is operated correctly, it gradually moves across the plate surface leaving a trail of tiny spikes and burrs in its wake. This process has to be repeated many times and in different directions until the plate has been roughened so much that it prints a totally uniform black. For plates of a reasonable size this can only be achieved by laboriously rocking for many hours. A task that demands a truly determined attitude! There is, however, a faster way to manually create a mezzotint structure, a structure which still has the richness that only conventional mezzotint allowed. Start by incising bundles of vigorous lines and cross-hatching on the plate using a drypoint needle. A sturdy ruler can be used as a guide to speed up this process. Once the plate has been covered in a dense mesh of linear burrs, work the surface with the mezzotint rocker. This action will chop up the straight drypoint lines into a random covering of tiny spikes and burrs which, when printed, will appear as a lively black yet textured surface of the utmost density.

An effect resembling mezzotint can be achieved with much greater ease by etching a very dense aquatint and using this as the dark background to work from. Arguably, a thoroughly rocked place surface will print the softest and densest blacks possible in intaglio printmaking, but a carefully laid aquatint can come very close to it. The latest and fastest method of producing a quasi-mezzotint involves the use of a photopolymer plate that has been roughened by one or more exposures to a random dot screen. After developing and light hardening, the plate can be shaped mechanically just like a mezzotint plate.

Once a plate has been roughened by any one of the methods mentioned previously, the image is created by scraping and burnishing lighter areas into it. If the scraping tool is handled with the greatest care the mezzotint burrs will be reduced by varying degrees so that perfectly continuous tones appear on the finished print. The scraping tool can, however, leave visible scratch marks and for this reason, is often used in conjunction with abrasive or polishing tools (such as a burnishing tool, different grades of sandpaper, steel wool etc.). For very detailed work, scrapers (commonly a triangular steel body with three sharp edges and a pointed tip) of different shapes and sizes are available. Like most mechanical intaglio tools,

these will need to be sharpened regularly. Those areas that are to be highlighted as whites need to be burnished after sufficient scraping has been carried out.

Burnishers - smooth metal implements with a straight or curved tip - are rubbed across the plate surface in various directions using a firm pressure until the treated metal area looks smooth and shiny. A few drops of bicycle or vegetable oil should be added to help lubricate this process. Burnished areas on a plate produce a very bright or even totally white area on the corresponding print.

The usefulness of the mezzotint rocker need not be confined to mezzotint. Rocking tools and other related implements such as roulettes which also create a burr, can be used to add tonality or rich textured effects to plates that have been etched or drypointed. The roulette is a small kind of roller with sharp spikes that can be freely wheeled around the plate to leave dotted marks which on the print will closely resemble the soft quality of pencil or crayon work. As with most mechanical tools, it is available in a number of different shapes and sizes and with a varying coarseness. A similar tool is the moulette, the tip of which is a small rotating sphere which creates a more random pattern than the roulette. All these tools can either be used to carry out direct dry work on the metal plate or into a hard ground.

### Removing marks from a plate

It is a common misconception about intaglio printmaking that once an image has been incised or etched into a plate there is no way of changing or removing those marks. Admittedly, it is not as easy as erasing a pencil mark from a piece of paper, but a considerable number of techniques and tools are at the etchers disposal to achieve this end. The scraping and burnishing methods mentioned previously can be used on any kind of etched, drypointed or engraved plate to either lighten lines/areas or remove them completely. In this situation, the scraping tool is used more forcefully to repeatedly remove shavings of metal from the plate surface. The softness of the metal will determine how long it takes to completely remove a line or texture. This task is quickly done on zinc but takes longest on steel. Once all visible traces of the mark are erased, the burnishing tool is used to flatten and polish the metal surface. Lubricating oil, sandpaper, steel wool and emery paper can all be used to aid the process. In Rembrandt's time, when copper was an even more precious commodity than it is now, entire plates were often scraped and burnished after the completion of an edition in order to reclaim the plate for the next project. The option to mechanically delete or reduce certain parts of an image is essential in intaglio printmaking, and ultimately only the thickness of the metal limits the degree to which this can be done.

### Power tools

Today it makes sense to make use of modern tools that can carry out the work of scraping and burnishing previously done by manual means. One of the best gadgets for the fast removal of metal from an existing intaglio plate is a random orbit sander. The vigorous action of these circular sanders require some basic safety measures. The plate should be secured to the workbench with G-clamps before sanding and even if the tool has built in dust extraction it is advisable to wear gloves and goggles. Any flammable materials should be kept well away from the work area as vigorous sanding can produce sparks. Most sanders allow for the attachment of different grades of sand paper, allowing the artist to proceed from a coarse working of the surface through to a more delicate polishing with fine grit. On a hard metal plate such as steel, even a medium grit sandpaper (e.g. 250 grit) will eventually produce a high polish; while softer metals usually require a very fine grit (from 400 - 1000 grit) for polishing tasks. The slightly roughened surfaces required in some acrylic resist etching techniques, such as hard ground and intaglio type, can also be polished up with this equipment if a plate tone is to be avoided on the print. Plates can also be rubbed with metal polish which, after it is dry, can be buffed to a high sheen using a power drill fitted with a soft buffing disc.

Today, many artists also use a Dremel tool to expand their vocabulary of direct mechanical marks. The wide range of available attachments allow for all kinds of fluid marks to be incised into a plate with ease and speed. Goggles must be worn when using this kind of tool as the cutting process involves the emission of small shards of metal.

**There are many more electric power tools out their - it is down to the artist to appropriate them for intaglio printmaking!**

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## 15. Intaglio Printing



The creative process in etching is by no means over once a plate has been made. Printing a plate involves numerous creative choices that will affect the appearance of the final print. Even though etching is often used for the production of limited editions, this does not mean that the printing process is merely a reproductive mechanism comparable to industrial printing. In etching, key stages that will determine the character of the print i.e. inking and wiping the plate are entirely in the hands of the artist.

By regarding the printing stage as a creative one, the artist will greatly extend the expressive vocabulary of etching.

Printing a plate that you have been engaged with for a period of time and through several processes, can be the most exciting part of the whole process.

(Wikimedia)

## Blankets

The most essential pieces of equipment for intaglio printmaking are an etching press and a set of blankets. The function of the blankets is to make sure that the fibres of the damp paper are firmly pressed into all intaglio grooves thereby absorbing the ink as the plate moves through the press. If the plate and paper were run through the heavy rollers without the springy cushioning of the blankets, the paper would be torn and deep intaglio work would not register on the print. Conventionally the blankets are woven felt of varying thicknesses. Often a set of three blankets is used: a thick blanket known as *swanskin* facing the top roller and two thinner blankets called *fronting* that go underneath against the press bed. The blanket that is in contact with the paper should have a very fine weave so as to prevent any transfer of its texture onto the print. It is advantageous to use a set of felt blankets of the same size as this arrangement allows the blankets to be interchanged which reduces the build-up of moisture during editioning. As most etching papers contain a certain amount of seize blankets should be washed fairly regularly to keep them soft. Use a mild washing powder and fabric conditioner on the wool setting of a household washing machine.

Problems can occur when printing long thin plates. The fibres of the blanket expand and can be pushed forward during printing, causing warps to get trapped under the rollers which may result in the blanket being torn. For this reason printers often work with a second person straightening out the blankets while the press is in operation. Blankets can also be cut by plates that have not been sufficiently bevelled. A good set of blankets is expensive to replace so care is needed, especially in shared workshops.

The use of a foam blanket in conjunction with a sheet of vinyl interfacing as fronting material is a cheap and highly effective alternative to conventional blankets. These dense sheets of foam do not produce the tension problems of felt blankets and are just as suitable for printing a typical etching as a thick collagraph. One kind of foam found to be very well suited to printing is called *K-tex*. It should be of a thickness of 2 inches and a density of 38 ounces per cubic foot and can be obtained through foam and mattress wholesalers. The fronting material - *sewing vinyl interfacing* - is similarly inexpensive and available in fabric or needlecraft outlets. If this blanket combination is used on the etching press the pressure settings need to be somewhat tighter than for felt blankets and the sheet of interfacing should be replaced periodically with a dry piece during editioning to compensate for the build up of moisture.

## Inking up the plate

The intaglio printing process is best conducted in a carefully laid out environment and in a methodical fashion. It is advisable to set up and organise all materials and facilities before you start inking up the plate.

Using etching inks is a rather messy affair! For this reason, old clothes and an apron should be worn. Try to be clean and organised when inking and wiping. Oil-based inks contain pigments and burnt linseed oil, and although they do not represent a major health hazard, should be handled sensibly. Do not allow inks to bake on a hot plate as carcinogenic fumes may be emitted. Inking and wiping can always be carried out cold, and instead of heating, the ink can be modified to make it easier to wipe. Frequent contact with etching ink can make your hands very dry and people with sensitive skin may experience rashes. For this reason it is always advisable to wear some form of hand protection and use a moisturising cream. The use of gloves also makes good sense for the messier part of the wiping process.

The etching plate is ready to be inked up after the mordant resistant covering has been removed from the back and a good bevel has been applied to all four edges. If metal plates look tarnished or show patches of rust or other residues from the etching process they can quickly be polished with a rag and a suitable metal polish such as Brasso. Make sure that no bits of tape or varnish are left on the back of the plate as these may produce unwanted embossing.

## The etching ink

Etching ink is manufactured by numerous companies. Products often have particular properties such as being more or less easy to wipe, best for drypoint, warm or cold blacks etc. It is recommended to build up experience with a variety of inks, to get to know the character of the image they produce: Charbonnel black ink No 55985, for example, is known for producing a very deep black but being somewhat difficult to wipe. The innovative AKUA range of etching inks, by contrast, wipes extremely easily, making it very suitable for education and quick printing.

Etching ink usually comes in a tin and the required amount should be carefully (sparingly) skimmed off the surface with a spatula before being dispensed onto the mixing slab. Tinned inks can quickly dry up if the spatula is used for gouging rather than skimming and the surface of the ink should always be covered with plastic film or sprayed with anti-skin spray. It is now possible to buy etching ink in plastic tubes which can help prevent wastage and drying out.

Even though most inks can be used straight from the tin or tube it is in most cases recommended that the ink be modified with additives prior to printing. These additives, which can be either light copperplate oil or *easy wipe*, improve printing and wiping and speed up the drying time of the print. A few drops of light oil thoroughly blended into the ink will improve the ink retention in the deeply bitten areas and prevent the occurrence of a streaky plate tone. If a strong and even plate tone is desired - especially in color printing - the consistency of the ink should in this instance be such that it runs off the spatula in a long string rather than in lumps. Alternatively, a small amount of easy wipe will help speed up wiping. Here, more contrast is given to the print rather than tonality and care should be taken not to over wipe the plate.

## Blending and making up etching inks

Artists may not want to restrict themselves to the etching ink manufacturers range of colors. Many hues can be produced by mixing and it is also common practice to tint black inks in a particular direction, for instance by adding some burnt umber to make it appear warmer. The darker colored inks, especially, can also print differently depending on how thickly/translucently they are used. An ink that looks warm black in its opaque form can become a reddish tint when printed as a thin film.

It is also possible to make up your own etching ink from pigments and oil, but it takes considerable experience and effort to make an ink which is ground as well as a manufactured one. If you are going to make your own ink, it is important to wear a dust mask to prevent inhalation of pigment particles.

### MATERIALS

**Products and equipment needed to mix your own inks:**

- pigments
- mixing slab
- glass or marble muller
- 2 flexible palette knives
- spatula
- medium and light copperplate oil (burnt linseed oil)
- vinyl gloves
- dust mask

### METHOD

**Make up etching ink as follows:**

1. First dispense a small mound of pigment onto the slab. Create a well in the center.
2. Add some linseed oil of medium viscosity. Heavy oil should only be used if very stiff ink is required or if the environment is very hot.
3. Mix thoroughly using two palette knives in a paddling action.
4. Gradually add more pigment and oil and mix continuously. A few drops of light oil can be added to the stiff mixture at this stage.

5. When all dry particles and lumps have been absorbed into a uniform consistency which should drop off the knife as a viscous lump, the actual mulling process can begin.
6. Scrape up the mass of mixed ink with a spatula and place it in one corner of the slab.
7. Lay down a small amount at a time for mulling. Grasp the muller with both hands and move it backwards and forwards across the ink whilst exerting as much pressure as possible. This process is laborious and each small quantity of mixed ink needs considerable mulling before it becomes serviceable. If too large a quantity of ink is used the muller will fail to grind the ink and merely slide back and forth.
8. Once all mulling has been done, wrap the ink in a sheet of plastic or in an airtight container. It is now ready to be modified for printing in the usual way.

## Inking up

**METHOD**
**Ink up as follows:**

1. Cover the entire plate surface with etching ink using a piece of card or rubber spatula. The aim is to squeegee the ink into the intaglio grooves as thoroughly as possible by dragging the card which is laden with a generous amount of ink gently across the plate. Excessive pressure should be avoided so as not to scratch the surface or damage delicate marks such as drypoint. The new waterbased inks wipe so easily that a lot less pressure is required than with oil based inks. Watch out not to over wipe plates with these soft inks!
2. The first stage of inking up can be followed up by gently pushing the ink into the grooves with an inky pad of wiping scrim using a rotary motion.
3. After ensuring that all grooves are sufficiently filled with ink any of the following processes can be used to remove ink from the plate surface.

Experienced printmakers may speed up the wiping process by using a piece of clean card to squeegee excess ink from the surface before scrim wiping.

## Wiping pads

The material most commonly used for wiping intaglio plates is called scrim or tarlatan. On a more improvised level, scrunched up pads of newsprint can also be used. Before use, cut up the scrim into sheets of a suitable size and remove any starchy coating by prewashing or rubbing against a hard edge to soften it. To make the material suitable for wiping it needs to be folded into a number of scrim pads or *dollies*. These are made by repeatedly folding in the corners of the scrim until an absorbent pad that fits into the palm of the hand is formed. Often a set of three scrim pads is used; one to carry out the heavy cleaning; the next for medium stage cleaning and the third is used when the plate is almost clean. Any scrim used in the later stages of wiping should have at least a small amount of ink on it as clean scrim tends to take too much ink out of the intaglio grooves.

## Wiping

Wiping is a matter of experience and most artists and printers will develop their own particular ways of carrying out this process; the following are some basic examples. Since wiping is an entirely manual process it is important to wipe the plate in a systematic and uniform way, usually without emphasising any particular area. Even though it is possible to achieve tonal differences by leaving varying amounts of ink in different areas of the plate the general idea of etching is to have the bitten work, its grooves and roughened areas, determine the tonality of the print rather than the wiping - otherwise it would be difficult to produce a consistent series of prints and the results may look patchy.

**METHOD**
**Wipe plates as follows:**

**Scrim wiping. Method 1**: One common method of wiping is to move across the plate from top to bottom moving the scrim in a circular motion, without applying much pressure. The bulk of the sticky ink is dragged away by the first scrim pad which should be frequently rearranged so that fresh areas are used to absorb further ink. When the first scrim pad is laden, the second is used, again in a circular motion, until eventually the image begins to appear beneath the dark film of ink. At this stage pay particular attention to wiping around the edges as too much ink is often left in these areas. Finally, scrim wiping is completed with the third pad which is rotated lightly over the plate until the required surface tone has been achieved. All streaky wiping marks should have disappeared at this point.

**Scrim wiping. Method 2**: A second method is to alternate between this kind of rotary action and a wiping movement that guides the scrim pad in parallel strokes across the plate, first in a horizontal direction and then crossing over in a vertical direction. After the final pass of the third scrim, the image should be clearly visible on the plate. However, many etchers have

developed a more intuitive sense of discerning the point at which their plate is ready for printing. Certain metals are also better at giving an accurate idea of the resulting print than others. For example, it is fairly easy to assess the printed outcome from a wiped zinc plate, while the deceptively dark surface of a steel plate or a photopolymer plate can make this more difficult.

**Paper wiping**: There are also a number of specialised wiping methods that can be used in conjunction with scrim wiping. Often pieces of tissue paper are used to take off the plate tone so that a pure white background can be printed. Also the later stages of scrim wiping can be replaced altogether with paper wiping which only effects the raised areas and leaves maximum amounts of ink in the intaglio grooves. Sometimes plates may have localised burnished areas which are intended to produce pure white on the print and these too can be paper-wiped so that all remaining tone is removed.

**Hand wiping**: Experienced printers can also reduce or remove plate tone by using their hand as a wipe - producing a result which can surpass a scrim or paper wipe in clarity and detail. In this instance, the fleshy palm of the hand serves as the wiping tool. During the process, excess ink should be wiped onto a clean rag or the hand can be intermittently cleaned with French chalk; ensuring that no powder is transferred to the plate. To create an extremely rich plate tone a similar technique can be used if sufficient light oil has been added to the ink. After some initial scrim wiping, the ink on the plate is given an even appearance by lightly dragging the palm of the hand across the surface. Because, in this method, the ink is driven into all ridges and indentations it enhances even the finest detail on the plate and can give the print an almost metallic look.

Before the wiped plate is ready to be printed some final attention has to be given to cleaning the bevel and the underside of the plate, both of which tend to collect ink deposits which can spoil the print. Simply clean these areas by running a clean rag along them. Once the plate has been wiped to satisfaction, it can safely be left for a while. It is often assumed that the plate needs to be printed immediately after wiping. Rushing to blot paper and prepare the press can lead to mistakes. In fact, the plate remains printable for quite some time and all print preparations can be carried out with the care and precision they require.

## Setting up a registration sheet

Before an etching is printed some consideration should be given to how the size of paper will relate to the size of the print. The conventional way of presenting an etching is to use a sheet of paper larger than the plate so that the embossed plate mark provides a natural border to the image while the unprinted paper around it serves as a kind of frame or mount. The image can either be centered on the paper or more commonly, a larger bar is left at the bottom edge.

Without registration marks on the bed of the press it is virtually impossible to achieve good positioning, and often artist just wanting to pull a quick proof produce a wonderful print which seems wasted because it is badly aligned. Some etchers actually draw marks on the bed of the press, but a more practical system is to use changeable sheets of cartridge paper covered by clear acetate. This registration sheet has the outline of a particular plate and after having been used for printing can be replaced by another tailor-made for a different plate. A system like this is particularly useful in a busy workshop where a number of artists make use of the press.

## Preparing the paper

The quality of an intaglio print very much depends on the right choice of paper. Even though some cheap types of cartridge paper can be used for proofing purposes the investment in specialised etching papers is nearly always rewarded by the superior impressions produced. Etching papers are *low in seize* (glue) and made from acid-free cotton linter rather than wood pulp. They swell and become soft, malleable and ink absorbent when wet so that during printing they can be cast both into the faintest as well as the deepest indentations of the plate. Other papers, e.g. watercolor papers are unsuitable for intaglio printing because their *high seize* counteracts the softening process.

General purpose printmaking papers such as BFK - Reeves are serviceable but not as good as the specialised papers. In some cases thin papers like Japanese papers may be considered but on the whole the thicker varieties of etching paper tend to yield the best results both in terms of print quality (especially with deeply etched plates) as well as drying.

**some recommended paper brands:**
Somerset Papers - especially Somerset T.P. (UK)
Arches Papers (France )
Fabriano Papers (Italy)
Hahnemuhle or Zerkall Papers (Germany)
American Masters (USA)

Even though most sheet papers show the signs of handmade paper such as the rugged Deckel edge, they are in fact machine-made substitutes. True handmade papers are today quite rare but both professionally produced and self-made sheets are usually very suitable for intaglio printing.

Once a number of different types of paper have been sampled, it is often more economical to invest in whole reams rather than in single sheets.

Of course, prints need not be presented in traditional fashion. Paper can be cut rather than torn; large plates may be produced as bleed-prints where the plate is the same size or smaller than the plate; or a print may be made on a different material altogether.

Unless printing is carried out as a team effort, the artist is likely to have ink stained hands after wiping the plate and must wash them before any paper can be handled.

## METHOD

**Prepare paper as follows:**

### TEARING

The actual sheet size is often too large for most plates so it is necessary for them to be divided up into smaller pieces.
The traditional way of doing this without losing the deckle edge is by tearing.

1. Mark the tear line at each edge with pencil and then place a heavy metal ruler between these points.
2. Hold the sheet by the top corner and quickly tear downwards about 2/3rds the length of the line.
3. Take the bottom corner and tear upwards until the sheet comes away.

### SOAKING

Etchings cannot be printed on dry paper.
The paper needs to be allowed to absorb water for a considerable length of time before it is ready for printing.
It is advisable to have a clear idea about how much paper will be needed for a session of proof printing or editioning so that sheets can be prepared and soaked in advance.

1. Fully submerged the sheets of paper in a tank, tray or bath of water for at least an hour.
2. Warm water can be used to shorten the soaking time.
3. After soaking, remove the papers and blot. The paper is now ready and will allow a fairly satisfactory print to be produced.

**If etchings of the best possible quality are sought, the paper should be immersed for much longer.**

1. After soaking for one hour, remove the pile of papers, allowing excess water to drain off for a couple of minutes.
2. Place the pile of papers between sheets of glass or inside a polythene bag with a heavy board on top and leave it to steep for several more hours (up to 24 hours). It is during this second soaking phase that all the fibres of the paper swell to their full extent and become saturated with water (any seize contained in the sheet will soften and become dissolved).

**Another method of soaking the paper that is mainly practised in Europe involves less equipment but makes slightly higher demands on the skills of the printer.**

1. Moisten each sheet individually with a wet sponge.
2. Stack the soaked sheets on top of each other.
3. Keep the stack between sheets of Perspex or aluminum plates for 24 hours.

If the right amount of water has been applied the whole stack will have the required moisture level on the following day and can then be used for editioning.

### BLOTTING

**The aim of blotting is to absorb all superfluous moisture from the sheets of soaked paper.**

1. Prior to blotting a substantial amount of excess moisture can be removed by placing your sheet of paper on a perspex draining board and gently running a window squeegee from top to bottom. This saves time and keeps the blotters drier for longer.

2. Next place the sheet between sheets of blotting paper and cover with a sheet of acetate.
3. Now brush the palms of your hands over the acetate using firm pressure.
4. Remove the sheet from the blotters and you may wish to repeat the process using the dry side of the blotters.
5. The sheet should now contain the right amount of moisture for printing. If however there are wet, shiny patches still visible on the paper some more blotting has to be done.
6. A soft brush can be used to remove any unwanted particles.
7. Especially in warm weather damp paper can get mouldy very quickly. The best way to safeguard a workshop from mould is to ask all users to always keep damp papers in separate polythene bags.

Prints made with the innovative AKUA inks have different soaking requirements.
Just a quick dip followed by blotting yields the best prints.

### Setting the pressure of the press

If you are uncertain about pressure settings, a dry impression can be taken from a blank uninked plate to assess the depth and evenness of embossing. Good pressure is indicated if the plate completely compresses the texture of the paper to a smooth surface and produces an even impression of the bevel. If the bevel appears weaker on one side the press is likely to lack some pressure on that side. The pressure settings should be altered, preferably with the blankets released. If however the wheel of the press seems difficult to turn and the plate even becomes bent, the pressure needs to be eased off.

Adjusting the pressure of the press is very much a matter of experience and different types and thicknesses of plate require a varying degree of pressure. Deeply etched plates may need more pressure to reveal all their detail while particularly sensitive or soft surfaces such as aquatint, mezzotint, drypoint or non-etch photopolymer plates should be printed with lower pressure settings. The pressure always needs to be lowered if thicker plates such as Perspex or collagraph plates are printed and these also require the use of a foam blanket to prevent cuts and tears.

### Printing

**METHOD**
**Print as follows:**

1. Trap the press blankets between the rollers of the etching press and fold them back over the top roller.
2. Lay the paper registration sheet in the middle of the press bed and cover with a sheet of clear acetate. For editioning purposes the registration sheet can be taped to the press bed.
3. Now lay a piece of tissue paper on top to prevent the registration sheet from being soiled with ink.
4. Place the plate within the smaller rectangle marked on the registration sheet. To adjust simply pull the tissue, thus sliding the plate into place.
5. Pick up a piece of blotted etching paper using hinged paper grips to prevent marks and carefully lower onto the press bed, fitting it to the larger rectangle of the registration sheet.
6. Place another piece of tissue on top of the paper to ensure that ink cannot offset from the blankets marking the reverse of your print. This also prevents moisture and seize from seeping into the blankets.
7. Slowly lower the blankets onto the bed of the press. Gently pull the blankets to smooth out any creases.
8. Turn the wheel of the press at a steady pace until the press bed has emerged at the opposite side of the rollers. The press must be controlled at all times. Never let go of the handle; and slow down the press gently by using one hand as a break. If printing is carried out too slowly or even stops at some point, dark lines are likely to appear on the print. If the wheel is turned too fast the press bed may be difficult to slow down and the plate may not receive sufficient pressure.
9. Lift the blankets over the top roller. NOTE: A set of felt blankets is best folded in half as this stops the press if the wheel is unintentionally turned.
10. Remove the top sheet of tissue. This can be dried and reused.
11. Gently lift the print off the plate, handling it by a corner and using paper grips.

**Press Safety**
The press is a truly wonderful piece of equipment but owing to its heavy construction, accidents involving presses can be quite serious. For this reason some essential safety measures should always be followed:

- Do not let press wheels spin freely.

- Always tie back long hair.
- No one should come near the turning rollers while the press is in operation.
- The press bed must be fitted with effective stops to keep it from flying out of the press.

Some press models are dangerous and have caused serious accidents. If for instance you own a *Brand* etching press it may have hazardous press bed stops. Ask an engineer to remove these and replace them with safe rubber stops.

### Drying the print

If the print is a working proof it may be useful to be able to pin it up for thorough scrutiny. There are numerous plastic clip solutions on the market which will not damage the print but a string with clothes pegs serves just as well. In print workshops the printed images are too often assessed at a distorted angle whilst lying on a workbench.

If prints are dried in the kinds of metal racks used in screenprinting there is no danger of damaging the sensitive ink deposits lying on the surface of the print. The prints will be touch dry after a couple of days but since most papers are likely to warp, they will then have to be dampened from the back and then flattened between boards.

The most convenient method of drying prints makes use of stacks of absorbent boards (*pin board* is ideal) or thick sheets of cardboard. Each print is laid on a board after printing, overlaid with tissue paper and then covered with another board and so on. If the boards are very light some extra support can be given by placing weights on top of a stack.

For more information see The Acrylic Resist Etching Workshop.

For printmaking suppliers click on the following link:

**Printmaking Resources**

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## 16. Color Printing



### General information

In the intaglio medium color prints of great richness can be achieved in the intaglio medium by using a number of different color printing methods. The main advantage of using intaglio techniques is that they can facilitate a range from a highly saturated deposit of densely pigmented printing ink to the faintest translucent layer of color.

In the simplest color printing method known as *a la poupee*, different colors are printed from a single etching plate; while in the more demanding method of multi plate printing a set of plates are made, each plate inked up in a different color and then successively printed onto one sheet of paper. This way of working may be more laborious than the single plate method but often more richly interwoven layers of imagery are produced.

Color etchings can be printed from virtually any kind of plate commonly used in intaglio printmaking. If zinc is used its effect on the warmer palette - yellows, reds, oranges - should be tested beforehand. Copper plates (even steel-faced) rarely affect colored inks while steel or aluminum plates are not known to alter their appearance at all. Sheets of Perspex and other plastic surfaces such as collagraph plates coated with floor varnish or other acrylics, or photopolymer plates are also entirely inert as regards color printing.

All intaglio techniques, such as open bite, line bite or aquatint can be utilised for color printing, but for many projects aquatint is the favoured tool as it ensures an even deposit of rich color and makes the layering of colors more predictable than with other techniques. Often color etching plates benefit from being etched slightly deeper than a monochrome plate because many colored etching inks have a considerably lower opacity and density than the black inks. When a set of the three primary colors is used the addition of a black plate may be considered to enhance the definition and tonality of the image and to intensify the dark areas.

If, for example in a set consisting of a red, a yellow and a blue plate a pure blue is to be printed in a certain area this could be achieved by having a deeply aquatinted patch on the blue plate; while the red and yellow plates bear a polished plate surface in that area. During printing both the red and yellow plates would be wiped extensively with tissue in this area to allow the pure color from the blue plate to come through on the print. In keeping with color mixing, areas of the blue and yellow plates that overprint would produce a green; and where all three colors meet a range of earthy browns, greys and blacks will result.

In multi plate printing it is essential to use a precise registration system and to make sure that all individual plates are

identically sized. This way the artist can produce a colored etching that is neatly framed within the paper as if only a single plate has been used. Discrepancies in plate sizes will lead to a mismatching of the embossed plate mark and spoil the print. Of course, artists make wish to experiment with overlapping plates. If a more conventional result is required, the following is a basic outline of procedure:

**METHOD**
**A basic method for multiple plate colour printing is as follows:**

The most useful system for printing multiple colors is simply to create each colour plate in succession.

The inking and wiping process for multiple plate color etching is similar to the monochrome process, but to safeguard against contamination it is essential to use delicate pieces of scrim for each colour and to keep inking and wiping surfaces for each color separate on the work bench.

Wipe all your plates in their respective colors before printing commences.

1. Etch the first plate using the various techniques available and then print in the usual fashion.
2. Once the print has been pulled, lay the paper face up on the press bed and place the second plate on top, aligning the embossing.
3. When the bed is run through the press the image of the first plate is offset onto the second plate. This can now be used as a precise guide for the production of the second color plate, and so on for all subsequent colors/plates. It is now possible to predict with accuracy which marks and color fields on different plates are going to overlap - producing mixed tones, and which are going to remain pure.

1. Take the first plate and register it on the bed of the press, cover it with a blotted sheet of etching paper, and then run through the press. Once the bed has emerged on the other side, the edge of the paper is kept firmly trapped between the rollers.
2. Carefully fold the blankets and sheet of paper back over the top roller and remove the first plate.
3. Now position the second plate and a fresh piece of tissue on the press bed and lower the paper and blankets before operating the press again.
4. Repeat this procedure until all plates have been used. The resulting image will bear evidence of all the colors used individually and the tonalities created by overprinting.

For more information click on the following links:

**Intaglio Type** **Perfect Registration**

**Useful Tips:**
When using a range of colors, the best printing order is from yellow to red to blue and finally to black.

If inks of varying viscosity are used it is recommended to print with the stiffer ink first.

It can be better to print the most heavily embossed plates last.

Make sure you plan and co-ordinate a swift execution when printing multiple colored etchings as etching paper can quickly dry out and shrink if left exposed for too long. On especially hot days, this can be prevented by lightly spraying the back of the sheet with water.

The registration system outlined earlier is very useful for multi plate printing if the markings are accurate. Some etchers also make use of heavy metal blocks or rulers to aid registration. Before the first plate is removed after printing, its position is marked by aligning the blocks along two adjacent edges. The next plate in the sequence is then simply placed in the resulting L shaped space. When the blocks are removed, the next printing can be carried out.

**METHOD**
**The plate-on-plate color printing method is as follows:**

A very unconventional but nonetheless effective registration system takes a different approach to getting all the plates in the right position.

1. After printing the first plate, lift the printed sheet off and remove the plate.
2. Now place the sheet face up on the press bed (sometimes cushioned by a single fronting blanket) and place the following plate face down onto the image - matching the edges of the plate to the embossed plate mark made by the first plate on the paper.
3. Operate the press.
4. Any subsequent colors are added in the same fashion.

Even though this method seems to contradict good printing practice, the etchings that result can be perfectly registered (with care and precision) and also extremely well printed.

Traditionally, multi plate etchings are printed from etched metal surfaces, but with the introduction of the intaglio type the creative possibilities for color printing are greatly extended. Non-etch photopolymer plates, particularly, have a number of properties that make them ideal for color printing. Photopolymer surfaces do not interfere with colored etching inks like some metals do; and often the crucial job of cleaning all ink off the top surface of a plate is achieved with much less effort than on conventional types of plate. A colored composition can now be worked out with the same ease and control as in the medium of screenprinting; positives for individual color plates are generated by hand or reprographic means and the overall composition can be monitored by overlaying them on a light box. Since the actual plate making process is much faster, a greater number of colors are more feasible than with etched metal plates. In view of the fact that many color plates are made to provide background colors for a main intaglio plate, photopolymer plates exposed with the aid of an aquatint screen provide an ideal alternative to traditional aquatinted color plates.

On a technically advanced level the intaglio type medium can also be used to print photographic four color separations in intaglio.
Keith Howard's recent research shows how it is now possible to match the accuracy of industrial reprographic printing.

## Other color printing methods

The method of *a la poupee* printing is most successful when the plate is divided up into clearly defined kinds of composition rather than by layering colors. The reason for this lies in the fact that every color has to be carefully inked into an allocated area of the plate, then wiped with different pads of scrim. This can be a demanding process and most etchers working in this method develop their own set of makeshift dabbers (e.g. card spatulas, small pieces of scrim or rag folded into dabbers, cotton wool buds etc.) enabling them to ink up even small, intricate areas of the plate. During wiping it is even more difficult to keep the different patches of color apart and often some blending of colors will occur in intersecting areas. In order to ensure that all bitten areas of the plate produce a rich deposit of color on the print, any shallow biting should be avoided and all lines, aquatints or open areas should be etched fairly deeply.

Even though the use of this dabber technique can yield quick and colorful prints from only a single plate, there are disadvantages. An a la poupee print is difficult to reproduce in editioning and in its pictorial appearance it often lacks the depth and complexity of either monochrome or multi plate etching.

## Combined roll-up and intaglio printing

There are other ways in which a single plate can be inked with different colors. One way is for the plate to be inked up with one color - say a dark red - then scrim and tissue wiped as normal before a second colour - a yellow for example - is rolled over the plate with a hard roller in a single pass. This second color is a thin film of color which covers the surface but does not penetrate into the intaglio grooves. It is important for the ink to be thin and for the roller to be larger than the plate size in order to avoid any contamination of colors. After pulling a print the roller needs to be cleaned before the next inking takes place. This method can produce effective color etchings from smaller plates but has limited potential for large plates where the surface roll becomes more difficult to control. Sometimes localised areas of a large plate can be surface rolled in a particular color by using paper masks or stencils on the plate. This technique, however, produces sharp edges which may not suit all types of print.

## Viscosity printing

The idea of printing different colors from different levels of an intaglio plate is pushed to the extreme in the technique of viscosity printing. Here, the etcher takes advantage of the fact that inks of a different viscosity can repel each other, and so can be used on the same plate without significant cross contamination. If three colors were to be used, the stiffest is inked into the very deep intaglio areas and all other areas thoroughly wiped. A very oily ink is now rolled over the surface with a hard roller. Finally, another stiffer ink can be applied to the intaglio areas of a medium depth by passing over the plate with a soft roller. In viscosity printing it usually takes a considerable amount of experimentation with all the variables, such as oils and inks of different viscosity, inking, scrim wiping and roll-up inking with hard and soft rollers, before the desired results are achieved. Very complex colored prints can be made from a single plate but the technical sophistication needed often makes the technique of multiple plate color printing seem a more practical option.

## Colored paper

Apart from pure color intaglio techniques there are other ways to introduce color into an etching. One simple way is to use colored etching paper. Commercially produced colored papers are limited and it is more practical and economical to color your own sheets with waterproof ink or acrylic paint or by dyeing the paper pulp of handmade papers.

Another approach (*chine colle*) is to incorporate pieces of colored paper into an etching. These colored shapes are pasted

with glue on the reverse and placed onto the inked up plate prior to printing. The shapes bond with the main sheet during the printing process and become an integral part of the intaglio composition.

### Crossover techniques

An even greater number of creative possibilities open up when combining etching with other printmaking methods such as lithography or screenprinting. Screenprinting is ideal for quickly generating areas of flat color on a print instead of having to etch an aquatinted plate before printing it in intaglio. The acrylic based inks used in screenprinting dry as a porous surface which accept an etching overprint very well.

If crossover techniques are used, it is common practice to carryout the screenprinting or lithographic stages before the etching. This is due to the fact that the different kinds of ink bond better in this order and because the slightly raised printed image resulting from an intaglio plate can prevent a satisfactory ink deposit from a planar printing technique.

It is important for the first stage of printing to be thoroughly dry before the paper can be soaked, blotted then printed in intaglio. Some paper surfaces may be too sensitive for conventional soaking but can be moistened by spraying from the back or placed between damp blotters. However, many kinds of papers have proven to be surprisingly resilient, even after having been subjected to numerous printings and the results can be of an excellent quality. The main problem with crossover techniques lies in matching up layers that have been printed dry with those that are printed wet. The simplest solution to this registration issue is bleed printing, where the image area covers the entire sheet of paper.

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## 17. Intaglio Type



Intaglio Type is the name given to film-based photopolymer processes developed by Keith Howard. It encompasses any intaglio technique that utilise dry photopolymer film.
There are also other photopolymer intaglio methods using ready-made industrial plates: solar plates etc.

### Photo-etching reinvented

Intaglio printmaking is not so readily associated with the use of photographic materials and processes as is lithography or screenprinting. This is somewhat surprising considering that photogravure, the earliest method established to reproduce and print the photographic image, was invented in 1879. This process which is essentially a photographic aquatinting technique, was to have a huge influence on industrial printing but like other photo-etching techniques since then, it failed to become a major means of artistic expression in intaglio printmaking. The reason for this is twofold. Firstly, the love of tradition has sometimes prevented etchers from assimilating reprographic materials and methods; something that screenprinting, unburdened by historic precedents, embraced wholeheartedly. Secondly, photo-etching processes used to be very technically demanding, time consuming, expensive and often involved the use of a number of hazardous materials.

As a result of the innovative etching methods spearheaded by Keith Howard and others, a range of entirely new reprographic intaglio techniques are now available to artists. These represent not only a straightforward way of transferring photographic material or other prefabricated imagery into etching but they also form the basis of an entirely new intaglio medium. The new techniques are extremely versatile and enable the artist to use any kind of reprographic mark, image or stencil in etching. The high sensitivity of the new processes ensures that every detail and tone registers truthfully on the resulting print.

The photopolymer medium offers great benefits both to etchers who wish to combine the more conventional intaglio techniques with photographic elements as well as to those artists who favour a modern graphic style but were previously deterred from intaglio printmaking because of its somewhat laborious technicality.

The basic materials of this medium are photopolymer films which have been developed by several large chemical companies for use in the circuit board industry. In their original context, these films are laminated onto copper plates and etched to produce circuit boards and microchips. In accordance with the very exacting standards of the electronics industry, the films are extremely corrosion resistant, hard wearing and most importantly, able to reproduce any matrix exposed to it with incredible accuracy. The new materials commend themselves to printmakers for just these reasons and also because they are:

inexpensive
easy to use
extremely versatile
*and*

nontoxic

The photopolymer films are acrylic polymers, which makes them fully compatible with other aspects of acrylic based etching.
Acrylic stop-out varnish and aquatint can easily be used in conjunction with them.
Plate preparation and stripping processes are also similar to those used in intaglio printmaking.

The photopolymer methodology has similarities with the reprographic transfer techniques used in screenprinting.

**METHOD**
**The basic photopolymer method is as follows:**

1. Firstly, the chosen image is generated or transferred onto acetate, tracing paper or another translucent material as a *positive*. As with other reprographic processes, the quality of the positive is absolutely crucial to give the best result on the plate and ultimately in the finished print.
2. Next, the positive is exposed to a plate laminated with photopolymer film by means of ultra violet light. This usually requires a vacuum bed and a UV light source, but for less technically demanding projects even sunlight can be used. The UV exposure hardens all those areas of the photopolymer film that are translucent and not covered by the opaque marks on the positive. At the same time, all those areas that are protected from the UV by those marks remain in the unhardened state of the film.
3. When exposure at a predetermined length of time is complete and any protective layers have been removed from the film, the plate is immersed in a mildly alkaline developing solution. Developing in this instance is very different from ordinary photographic developing processes - it is, in fact, more akin to the eroding etching process. All the marks hardened by the UV light are resistant to the dissolving action of the developer and remain proud on the surface of the plate. All the unhardened areas are simply washed away by the alkaline solution, revealing the surface underneath onto which the film is laminated. Due to the thickness of the film, the plate has now acquired a raised surface of marks and corresponding intaglio recesses.*
4. After drying, follow the usual procedures of using mordant resists as on any other etch ground. Those areas where metal is exposed will be eroded into deep intaglio grooves while areas covered by photopolymer marks will remain as an untouched metal surface.
5. After etching, the film can be either be stripped off and the plate to be printed as an etching, OR the film can be left on the plate thus becoming the intaglio printing surface (see the Non-Etch process).

*A photopolymer plate already resembles an etched plate after developing and can even be used for printing at this stage. In order to do this, the plate may be further hardened by being exposed to UV light once more. This can be done simply be laying the plate in sunlight for 15 minutes or more. During this exposure period the acrylic polymer chains of the film become more complex, creating a surface that is even more durable and mordant resistant. After light hardening, the plate can be inked up as an ordinary etching plate and printed in the usual way. With experimentation, the variables of this non-etch process (i.e. the kind of positive used and the exposure time) can be controlled to produce linear and especially halftone intaglio prints of the most astounding quality.

To anyone used to the physically demanding and time consuming nature of conventional etching, the ease and speed with which intaglio images can now be produced is astonishing. A positive made by using a photocopier, for example, can be processed and turned into an accurately reproduced intaglio print in less than an hour.

A single non-etch plate can print an edition of about 40 to 70 prints, but because of the speed and simplicity of the process, plates can easily be remade to extend the size of an edition. Non-etch plates are also ideal for color printing for this reason, and because they are inert and do not interfere with any colored inks.

## Material, equipment and facilities

### The films

Photopolymer film is widely used in the computer and electronics industry but has only fairly recently been picked up by the suppliers of art materials as a specialised printmaking product. Commonly, the film is manufactured for industry in large rolls. The two main producers used to be DuPont and Omi/Hitachi but today many more films are available for printmakers. Keith Howard's photopolymer films have undergone about 15 years of research and development especially for their use in printmaking.

Keith began using a DuPont film called Riston in the mid 90s. It was a superb material

for all of the new photopolymer techniques. Today, his latest **ImagOn** comes in various thicknesses and sizes.

The Omi/Hitachi manufactured film is known as **Photec** but is only available in Europe.

Other brands specially designed for printmaking include **Puretch**, the **Z-Acryl** photopolymer films, and the **Grafisk Eksperimentarium** films from Denmark.

For suppliers click on the following link:

**Printmaking Resources**

The film can be ordered directly from the manufacturers but minimum orders can be relatively large in quantity and expensive. Orders are often placed by workshops or college departments which can sell on smaller quantities to participating artists or students.

The film is suitable for line and tone work and can be laminated onto any number of hard materials that can be run through an etching press.

Most types of photopolymer film come in three layers; the actual bluish coloured photopolymer emulsion is sandwiched between two layers of clear Mylar film to aid storage, handling and lamination of the material. Both layers of Mylar are removed during the processing stage.

Supplies of film should arrive and be kept in a lightproof cardboard tube, and ideally rolled around an inner tube to prevent creasing.

Photopolymer film is mainly sensitive to the UV part of the spectrum and so its light sensitivity is very different to photographic film. It can be handled in subdued daylight or artificial light so long as no direct sunlight or other source of UV is present. The ideal set up facility is a separate room with yellow lighting of normal brightness. Windows or other sources of stray UV light can be temporarily blocked out with transparent red or yellow PVC sheeting.

### UV Exposure Unit

This piece of equipment is often shared with screenprinting. Extra precautions should be taken to protect the glass top of the unit from photo etching plates by covering it with clear acetate. Also the rubber cover of the vacuum bed needs to be protected from sharp metal plate edges by laying a felt blanket on top of the plate. In larger workshops it makes sense to provide a custom made facility for photopolymer work. Ideally this should be incorporated in an enclosed yellow room (which can also be combined with a conventional dark room) and contain a tabletop vacuum frame with a UV light source suspended from above.

## MATERIALS

**Products and equipment needed for photopolymer printmaking:**

- supplies of photopolymer film
- crushed soda crystals (household washing soda) to make up the developer
- high quality positives on transparent base (line, halftone or continuous tone depending on requirements)
- goggles
- photographic developing trays and rinsing facilities with hot and cold water supply
- tank or container for storing ready-made developer (a plastic keg with tap is ideal)
- blade cutter
- scissors
- masking tape
- tubes for storing photopolymer film
- simple hinged folders, slightly larger than the plates, for transfer of undeveloped photopolymer plates to and from the press
- etching press with foam blanket for laminating
- enclosed room with yellow or subdued lighting (often a darkroom space can be used or adapted)

### Laminating photopolymer plates

Before any work can be exposed a sheet of photopolymer film has to be laminated onto the chosen base material.
In the case of etch techniques the base, for obvious reasons, has to be a metal plate which is prepared in the usual way.

## METHOD

**The BASIC method for laminating photo-polymer plates as follows:**

1. As in the hard ground technique it is crucial to give a tooth to the acrylic resist by roughening the plate surface with sandpaper - ideally using a sander. Use about 350 grit

for copper, zinc and aluminum and about 200 grit wet and dry paper for steel.

2. A thorough degreasing is equally important and a 45 degree bevel can also be given to the photo etching plate at this stage, or prior to printing. It is, however, strongly advised to also apply a slightly shallower bevel to the back of the plate so that no blankets will be cut when the plate is being laminated.
3. The plate surface should now be treated with a mildly acidic degreaser such as CPS degreaser, applied with a clean paper towel, or with a mild solution of acetic acid or similar, to create the right surface climate for good adhesion of the acrylic polymer film.
4. The prepared plate is now transferred to the room/area with subdued or yellow light conditions. Here, cut a piece of photopolymer film that is slightly larger than the plate - an overlap of about half an inch is sufficient.
5. Now the first layer of clear Mylar film has to be removed. With Riston and ImageOn film, stick a piece of masking tape on the inside curling edge of the film. Carefully pull and peal away the soft top layer of Mylar and discard.
6. Once the soft Mylar film is removed, place the sheet of photopolymer film onto the prepared metal surface with its matt side facing down.
7. Carefully smooth down the film and transfer the plate into a light fast folder.
8. Turn the folder upside down so that the plate now rests on top of the film.
9. Carry the folder to the etching press.
10. Open the folder and lift out the plate by holding the overlap of film. Carefully slide the plate onto the sheet of acetate that has been placed on the bed of the press. This acetate sheet ensures that a smooth surface will imprint on the polymer film during lamination. Since the film is protected by the metal plate, no light is likely to touch the UV sensitive surface.
11. Now place another sheet of sturdy acetate (or the discarded Mylar) on top of the plate and lower the press blankets. This acetate will ensure an even transfer of pressure and safeguards against cutting the blankets.
12. The plate can now be run through the press twice or even three times under firm pressure to ensure a firm bond between plate and photopolymer film. Bear in mind that these materials are pressure sensitive so insufficient pressure may result in a badly laminated plate.
13. Slide the plate back into its folder and carry it back to the safe light area.
14. Trim off the excess film with a sharp blade and then heat the plate with a hairdryer or in a drying cabinet. The plate is now ready for exposure.

### Troubleshooting in the lamination process

Most film should laminate without any problems if the above instructions are followed. On occasion, however, it may be necessary to modify this routine in order to resolve certain problems.

If you find that areas of your plate are badly laminated - patches of film coming off/ creases/ bubbles - first check that these symptoms are not the result of insufficient sanding, degreasing or pressure. The manufacturers of photopolymer film also emphasise the importance of creating a slightly acidic surface on the substrate before laminating, so an acidic degreaser should always be used. In industry, photopolymer films are laminated wet under pressure and heat, so you can achieve good adhesion if these conditions are replicated. You may, for example, place the plate and film on a hot plate or in a hot cabinet before laminating them together. The film can also be softened by spraying it with warm de-ionised water before bringing it into contact with the prepared plate. To increase contact of film and plate it is also possible to run a roller over the surface before lamination.

The lamination method first recommended by Keith Howard involves spraying a water-alcohol mist onto the film before bringing it into contact with the plate. This mix can be made from two parts water + one part 70% isopropanol alcohol (the nontoxic ethanol alcohol would also work).

If your laminating is unsuccessful; check:

- Have you sanded the plate sufficiently?
- Have you degreased the plate sufficiently?
- Did you use a slightly acidic degreaser?
- Have you applied enough pressure?

Still having problems; then try the following:

- Place the plate and film on a hot plate/ in a hot cabinet before lamination.
- Spray the film with warm de-ionised water before contact with the plate.
- Run a roller over the plate surface before lamination.

With the latest generation of ImagOn, Keith Howard recommends a wet lamination process to give the best results. This method guarantees a smooth plate surface and prevents small imperfections

that can occur during dry lamination. Details are given in his comprehensive manual, *The Contemporary Printmaker*. It also includes advise on testing the developer strength, making digital halftones for Intaglio Type and many more well researched pieces of technical advice.

For more information on equipment and facilities, go to The Acrylic Resist Etching Workshop.

For more information on Intaglio Type click on the following link:

**Intaglio Type**

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## 18. Etch: Photopolymer Techniques

**Line art**
**Exposing the plate**
**Making up developer**
**Developing the plate**
**Etching and stripping the plate**
**Aquatinting**
**Using rasterized positive**
**Intaglio Type tonal work**
**Etching**

With photopolymer etch techniques, the UV sensitive film allows the transfer of a positive image onto a plate and functions as a mordant resist during the actual etching process. As this method is a *proper* intaglio etching technique i.e. it involves the eroding of metal plates, it can be combined with virtually all other acrylic based etching methods. The possibilities for carrying out creative work on the transferred imagery after exposure of the plate are greater than with the non-etch techniques because any reprographic elements of an etched plate can be overlaid and combined with aquatint, open bite, drypoint etc. The etch methods provide artists with a greater range of artistic tools through the availability of multiple processes; while the non-etch methods very much depend on creative mark making at the stage where the positive is generated.

### Line art

The best kind of positive to use for the photopolymer etch processes is *line ar*t. This reprographic term does not necessarily mean that only linear images can be used, but it denotes any kind of matrix that consists of clearly defined areas with totally opaque marks (no mid-tones). When using this way of working, you should be able to describe marks or areas of the image in simple YES or NO terms: either it is a mark opaque enough to block the UV light or it is a translucent area that will let the light through during exposure of the film. Correspondingly, during the etch process, the plate should have areas that are either covered by a photopolymer resist that stops the mordant from biting, or blank metal areas where a groove can be eroded. Positives that lack this YES or NO; BLACK or WHITE definition are less suitable for reprographic etch techniques.

Maximum contrast and opacity make for the best positives.

**METHOD**
**Make a positive as follows:**

The photocopier is a simple, effective piece of equipment that can be used to generate positives. Ideally, use clear heat resistant acetate that has been designed for this use. Copies can be made from pretty much anything - original artwork, magazines, drawings, maps etc. Laser or ink jet printers can be used in a similar fashion to make positives from digital images.

With any of this equipment, the aim is to produce sharp images from an opaque ink deposit. If copies are faint or lacking in definition, detail may be lost during exposure. Larger marks on photocopies and computer prints can fail to be fully opaque and so in many cases positives benefit from some manual editing in these areas with a marker pen or Indian ink. Editing can also be carried out for creative reasons - copies can be painted and drawn on, creating an amalgam of reprographic and autographic marks; or indeed some areas of the positive can be scratched into or removed.

A useful trick if a photocopier or laser printer fails to produce a dense deposit is to sandwich two faint copies together to make one opaque image.

Line positives of the highest quality can also be made by copying an original onto litho film, a process which in the past required access to reprographic facilities and a copy camera. However, today, high quality reproductive line art is likely to be generated by means of digital imaging i.e. where an original is scanned and then output at a high resolution onto film by an image setter or laser printer.

Positives can of course be made entirely by manual means by drawing straight onto acetate or true grain with opaque pens, inks, masking fluid, crayons etc.

### Exposing the plate

When all creative work on the positive is complete the plate can be exposed using a UV exposure unit. A vacuum frame guarantees perfect contact between a plate that has been laminated with photopolymer film and the positive.

NOTE: If an exposure unit is not available, an improvised exposure can be carried out by sandwiching the plate and positive between two heavy panes of glass and exposing for a few minutes in sunlight.

At this stage a decision has to be made whether or not to remove the second layer of Mylar before exposure. Because this clear layer acts as an extra barrier between the positive and the photopolymer emulsion it can cause a very slight reduction in definition. However, if the Mylar *is* removed, be careful that the film does not adhere to the positive.

**METHOD**
**Expose photopolymer plates as follows:**

1. Place the positive on top of the plate, making sure it is reversed. If there is text on the positive, it should now read backwards. Reversing at this stage will ensure that the image will read correctly after it has been printed. In many cases, the positive can be registered on top of the plate by eye, but if accuracy is required or if printing multiple plates, use a registration system. Good registration can be achieved by incorporating registration marks representing the plate perimeter on the positive itself - these can be easily drawn with a waterproof marker pen or masked out with strips of tape. These marks can then be aligned to the plate on the vacuum bed. The positive can also be prevented from slipping by attaching it to the back of the plate with pieces of clear sellotape.
2. Now close the vacuum frame and activate the suction pump.
3. Any available UV protection such as lightproof doors or curtains must be in place before exposure can begin.

As conditions vary, some testing should be carried out to determine the correct exposure times. Large professional exposure facilities measure the amount of UV actually emitted in light units and allow printmakers to replicate exposure conditions with great accuracy. However, an exposure calculated with a simple timing device can also be relatively predictable if the printmaker keeps to a set procedure. For example, remember to let mercury vapour lamps cool down before using them again in order to exactly replicate the conditions of the first exposure. With line art, the exposure process tends to be more forgiving than with delicate half tone, and usually a satisfactory exposure time is not hard to determine. There are, however, two things to remember:

(i) Under exposure may not harden the photopolymer film sufficiently and delicate areas may be damaged by the developer as a consequence.
(ii) Over exposure may lead to the UV light penetrating the opaque marks causing unwanted hardening in some areas of the image. The risk of this happening is greater on positives that are not of the highest quality, where opaque black marks are in fact grey as a result of insufficient toner deposit from a photocopier or laser printer.

Another factor to be considered when calculating exposure time is the thickness of the material onto which the positive has be reproduced. For instance, if lith film has been used it may require an exposure more than twice as long as a thin sheet of clear acetate.

### Making up developer

Unlike many photographic processes the concentration of the developer should always be kept constant rather than being regarded as a variable. A solution that is too strong would damage and dissolve the hardened areas of the plate. A commonly used ratio of soda crystals (sodium carbonate) to water is 10 grams of crystals to 1 litre of water which results in a 1% sodium carbonate solution. Always make up ample amounts of solution sufficient for the size of plate to be developed. For example, for a densely covered plate of about A4 size, at least two litres of solution should be used to ensure the solution remains active until the plate is fully developed.

As the soda crystals can irritate the skin, wear rubber gloves and a dust mask when handling them. Despite the relatively

low corrosiveness of the sodium carbonate solution, the use of goggles is also recommended as even mild alkaline solutions can damage the eyes if it comes into direct contact.

**MATERIALS**
**Products and equipment needed to make up the developer:**

- soda crystals
- gloves
- goggles
- tray
- jug
- spoon etc. for stirring
- kitchen scales
- hot and cold running water

**METHOD**
**Make up the developer as follows:**

1. Measure the required amount of soda crystals (10g per litre) into a jug.
2. Add a small amount of hot water to the crystals and stir until all solid particles have been dissolved.
3. Now top up with cold water to the amount required. Stir again.
4. Pour the developing solution into a tray or storage container

### Developing the plate

In photopolymer printmaking the term *developing* denotes a process quite different from photographic developing. Here, it is quite a tactile process where whole layers of plastic material are actually washed away and dissolved.

**METHOD**
**Develop the plate as follows:**

1. After exposing your plate switch off the exposure unit and the vacuum bed and remove the plate.
2. At this stage, the remaining layer of clear Mylar should be removed. Push your finger along the edge of the plate until a corner of the film comes away, then simple peel off the film.
3. Ideally the developing solution will have been made up beforehand and is now ready for use in a tray. If a lot of photopolymer work is to be done it is practical to keep a ready supply on tap in large plastic containers or a barrel.
4. Immerse the plate in the tray. The plate needs to remain in the solution for 3 to 5 minutes. Brush and agitate to aid the process. A good way to aid the removal of the film from the unhardened areas is to continually stroke all areas of the plate with your hand. Wear gloves for protection. Alternatively a soft sponge or brush can be used but be careful not to use any abrasive implements as these may damage the polymer marks which are still delicate and vulnerable in the wet state.
5. A well exposed photopolymer plate will soon show bare metal shining through in all areas that are black on the positive. At the same time the developing solution becomes cloudy and will acquire a milky blue tinge, indicating that significant amounts of photopolymer have been dissolved. Even after 3-5 minutes when the plate seems fully developed, traces of this milky blue liquid may still remain on the plate and without further treatment would stop mordant from biting. To prevent this, all spent developer should now be discarded.
6. Gently wash the plate surface with a further quantity of dilute developer then thoroughly rinse under cold running water. A drop of washing-up liquid can be added to the final rinse to ensure drying without stains. Excess water can now be blotted off.
7. Now spritz the plate with a 50%-50%water-vinegar mixture and let this work for 30 seconds. Rinse again and blot the plate with paper towels.
8. Dry the plate quickly in a hot cabinet or with a fan.

### Etching and stripping the plate

Before the plate can be etched any imperfections in the etch resistant photopolymer surface need to be touched up with stop-out varnish or covered with pieces of adhesive tape to prevent foul biting. Often this is necessary along the edges of the film which can show some cracking.

The plate can now be etched as a conventional line bite for any required length of time. Due to the extreme resistance of hardened photopolymer film there is little chance of foul biting and even the deepest etches can be carried out with great accuracy and minimal lateral biting.

Problems may occur if insufficient quantities of developer have been used; if the plate is under developed or if the plate has been insufficiently rinsed. In these cases it is not always necessary to remake the plate; often a post developing stage in a stronger than usual developing solution removes polymer residues from the metal surface; and the plate can be re-etched.

After etching the photopolymer film can be removed in the stripping solution for acrylic based etching to reclaim the plate for further use. Stripping can also be carried out in a concentrated developer solution - about 1 part soda crystals to 4 parts water. However you may wish to leave the film on after biting so that a proof can be taken to assess the depth of bite before reimmersion for further biting (in this case the plate needs a good degreasing after printing). The hardened photopolymer film can also be left on if you are looking for a very pale plate tone which is typical for intaglio prints taken from smooth plastic surfaces.

## Tonal work in the etch technique

### Aquatinting

Any kind of tonal work i.e. the greys and blacks of photographs or drawings, have to be broken into some kind of dot structure in order to translate them into etched intaglio marks on the metal plate. The need to do this also applies to opaque black areas on the positive that are broader than a line of around 1 mm. If these areas are exposed and etched without additional treatment they will print as a shallow open bite patch rather than as a black. The conventional way of filling these areas with tone is by applying an aquatint to the plate before etching it. The printmaker has all the options of the acrylic spray aquatint system at his disposal;

- overall or partial application of a dot structure
- different dot sizes and density
- a range of tones depending on the length of bite

A reprographic AQUATINT can easily be applied by exposing the photopolymer plate to a fairly coarse random dot screen before exposing it a second time. This works best with positives that show strong contrasts. If the positive has a broader tonal range, only part of those tones will register on the metal surface and another more suitable half tone method should be used.

### Using rasterized positive

As photo etching is a reprographic technique, the dot structure or *raster* required for tonal work can already be incorporated in the reprographic stages of making the plate, prior to etching. The traditional, and now largely obsolete way to do this in workshops and in industry was by using professional screens that turn a continuous tone image into one broken up into a dot or half tone structure. Today, the copy camera and gelatine based dot screens have largely been replaced by digitally made screens.

The standard resolution of screens for traditional photo etching was limited to about 85-100 lines per inch which equates to the quality of a picture reproduced in a newspaper. Their use is recommended on normal thickness photopolymer film if the artist wants the dots to be clearly visible for artistic reasons, or if very long etches of photographic imagery is desired. Since a rasterized positive is free from any true grey tones but consists only of black dots it can be exposed and developed in the same fashion as a line positive.

A very straightforward way of making rasterized positives for photopolymer work is to use photocopies of images from magazines or newspapers which already have a dot structure. Tonal images can also be digitally scanned and given a dot structure using a computer program such as Adobe Photoshop and then printed out onto clear film.

### Intaglio Type tonal work

In the past the medium of photo-etching used to be limited to this low definition etch technique unless the highly demanding process of photogravure was used. The most straightforward method of carrying out tonal photo-intaglio work today is the non-etch technique devised by Keith Howard. This can not only convey all the detail and delicacy of an ink wash or a photograph, but even enhances its pictorial depth and richness. The main advantage is that high definition reprographic material can be combined with any conventional intaglio technique such as open bite or line etch, and if a steel faced copper plate is used it is possible to produce a large edition from a single plate. With the Intaglio type process, the dot size is no longer limited to 100 dpi to make an impression on the film.

**METHOD**
**The simple Intaglio Type method is as follows:**

1. Thin the film down to a fraction of its original thickness by placing a ready laminated photopolymer plate in a bath of developer.
2. After removing the protective Mylar, allow the film to dissolve undisturbed for 2-10 minutes, depending on the thickness of the film. The length of time needs to be tested out for different types of film. Use 8/9ths of your standard development time to thin the film. If for example your standard development time is 9 minutes, the film will be thinned correctly in 8 minutes.

3. Now place the plate in a bath of water to stop the dissolution process. Brush any excess dissolved film away with a soft sponge.
4. Carefully blot the plate and leave it to dry fully in a drying cupboard.

The very thinly coated plate produced this way is sensitive to half tone reproduction as with the gelatine emulsion of conventional photogravure. It now allows the use of reprographic halftone positives with a very high resolution for making etched plates - in this instance, halftone screens of up to 500dpi/lpi can be used. The tones produced on a printed etching now appear to be continuous and the actual dot structure that constitutes them is only visible under a magnifying glass.

### Etching

A quick immersion of the dried plate in the mordant will cause oxidisation which reveals whether or not all the detail of the positive has registered on the plate. If some areas have not been fully revealed the plate can be reimmersed in the developing solution to open them up.

The plate can be etched in the usual manner and the tonal range, detail and depth of the plate very much depends on the duration of the bite. Unlike the non-etch methods, this gives the artist greater control over making a half tone intaglio plate because certain areas of the plate can be emphasised or held back by etching and stopping-out in stages. This then produces an intaglio structure of varying depths similar to a stepped aquatint. This process can be further enhanced by including additional reimmersions in developer. As a result, photopolymer film can function as a pseudo permeable resist, comparable to traditional photogravure - but thorough testing and fine-tuning of all the variables is necessary to yield perfect results.

Here is a methodology which on one hand allows for the use of dot screens of up to 500dpi; whilst on the other opening up the option of permeable etching. If the former is used, a double exposure is advisable - first to the half tone screen, then to the continuous tone positive. If the latter is favoured, a single exposure to the continuous tone positive may suffice, especially if this has some grain in itself. In both cases the plate should be post baked before etching begins. Due to the thinness of the photopolymer resist the etch process itself can produce the tonal variation by gradually breaking through layers of resist, depending on their thickness, thus creating intaglio marks of varying depths. This technique requires some experimentation with the variable aspects i.e. thinning, exposure, and biting times - but can produce superb tonal reproduction on the intaglio print.

For more information on photopolymer techniques click on the following links:

**Intaglio Type** **Aquatint Screen**

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## 19. Non-Etch: Photopolymer Techniques



The non-etch photopolymer techniques represent a significant departure from the conventional approach to intaglio printmaking. Here, the acrylic emulsion of the photo sensitive film is not merely used as a secondary transfer medium to facilitate the production of a metal plate etching (as in the etch techniques) but actually becomes the intaglio printing medium itself. The copper plate or any other rigid substrate carrying the film is simply a base.

### Preparation and substrates

All initial stages of the plate making process are identical to the etch techniques outlined previously. If copper or other metal plates are used sanding and degreasing are required to ensure good adhesion of the film. No sanding is necessary if plastic plates such as Perspex, plexi, PETG or acetate are used as the base onto which the film is laminated; and some substrates such as thin wooden boards or collagraph plates will also lend their existing surface texture.

All base material need to have their sharp edges removed on both sides to protect the press blankets during laminating and printing. If very absorbent materials are used, such as particleboard, it may be advisable to seal the back with a double coat of acrylic floor varnish to prevent warping during developing and drying.

## Non-etch line process

Most artwork recommended for the etch techniques, such as line art on acetate or tracing paper, is also suitable for the simpler non-etch processes. Those positives which consist of a clearly defined network of black lines or dots, without any continuous tones are best suited e.g. rasterised printed images or photocopies of engravings; or an image could be drawn by hand directly onto the acetate with pen or ink. All these types of positive can be exposed to the laminated plate as a single step exposure (see previous section). The developing process now provides the crucial stage in which intaglio grooves are produced in the plate - not by etching into the metal but simply by developing the film in the soda ash solution. After developing, the plate is thoroughly rinsed, spritzed with vinegar and heat dried. This stage is more important than in the etch techniques as the polymer surface must be sufficiently hardened to withstand the tremendous pressure of the press during printing. Also, a plate which does not receive a second UV exposure after developing may still contain moisture and as a result the paper may stick to it during printing.

An image can be adversely affected if there are tonal areas on the positive that exceed a certain width. To avoid this, a double exposure is recommended. The non-etch process using a single exposure is also suitable for high definition half tone work (unlike the etch process), given that the positive is already broken up into the half tone grid structure, which then makes it a half tone positive.

## Non-etch halftone process

The amazing potential of the non-etch photopolymer process becomes most apparent when used in the following way. As a double exposure process, the artist is able to make use of any kind of positive for intaglio printmaking - regardless of whether it is crisp line art or the most subtle continuous tone imagery, as in non-rasterized photographs or handmade wash drawings on frosted film (see previous sections on the making of positives).

The extreme sensitivity of the double exposure process also allows the use of any kind of positive. A vast number of direct marks can be drawn or painted onto suitable transparent materials. When pencils and crayons are used, their softness and tonality can be expected to transfer faithfully on the print. Crisp decisive lines are best drawn with pen and ink or black marker pens.

The fundamental difference between a continuous tone positive, regardless of whether it is of a photographic or manual origin, and a halftone positive is that the former has real levels of varying tonality whilst the halftone merely emulates this variation by trickery, using tiny dots that appear as grey tones. The double exposure technique does not require the use of this trickery because it enables the direct transfer of real tones on a positive to real tones on an intaglio print.

## Random dot screens

Before the double exposure process can be carried out a suitable random dot screen has to be made or obtained. These screens are different to the uniform reprographic screens used in the making of halftones and serve an entirely different purpose.
An ideal very fine and dense random dot screen has been developed by ELIZABETH DOVE and artists with reprographic experience can make their own screens by using frosted types of glass to obtain refracted random dots on lith film. A very serviceable random dot screen can also be made in any workshop equipped for acrylic resist etching.

**METHOD**
**Make your own random dot screen as follows:**

Spray several even layers of a fine aquatint mist of black or red acrylic ink onto a sheet of acetate until a dot coverage of at least 50% is achieved. Ideally, use a spray aquatint facility but on an improvised level, a spray can may also suffice.

Artists may wish to create a fine or coarse dot screen depending on the required effect; in either case the dot coverage should be as even and as dense as possible. Plates made with a coarse dot screen will have greater contrast and the deepest blacks. Plates made with a finer dot screen will reveal a greater range of mid tones and very precise definition.

Images printed from a photopolymer plate based on a photographic positive in this manner not only have a degree of quality and definition similar to the original but are also enhanced by the tonal richness and depth of the intaglio medium.

## The double exposure process

To reiterate: this non-etch half tone process should not be confused with other halftone methods in printmaking involving the use of dot screens. According to conventional reprographic thinking a dot screen serves the purpose of translating the different levels of tone in the original into different sized black dots to make them printable. With this method, the transfer of tone from original to print is approached differently. Rather than manipulating the size of dots it directly affects the depth of the intaglio mark that any level of grey on the positive produces in the photopolymer film. So this method takes full advantage of the nature of the intaglio medium in which areas of tone in the printed image always relate to the depth of intaglio marks in the plate.

## Determining the screen exposure

Before a continuous tone positive is exposed to the laminated photopolymer plate, the plate undergoes an overall exposure to a random dot screen. The correct exposure time should be tested beforehand, and once decided, should

remain consistent. This can be achieved by carrying out a step test with a laminated plate; exposing it to the screen for increasing lengths of time. A piece of card can be used to cover up exposed segments. The plate is then developed, dried and printed. The segment on the resulting print that shows a dense mezzotint black represents the correct exposure time for the type of screen being used.

### The basics of the UV exposure

A stepped test strip also demonstrates the fundamental principle underlying the UV exposure: a short exposure will produce a mark or dot that dissolves in the developing process due to insufficient hardening by UV light. Once a certain threshold is reached the exposure enters its ideal range: the marks exposed to UV are clearly defined and withstand the dissolving action of the developing process, while all areas not exposed to UV are washed away. Over exposures that go beyond this ideal range inevitably lead to an increased hardening and filling-in of areas that are meant to dissolve. As a result a faint print is produced in which the lightest tones are burnt out completely while the blacks and dark areas are brighter than they should have been. If prints consistently have this kind of appearance the exposure times need to be reduced to properly replicate the tonal values of the original.

### How to carry out a double exposure

**METHOD**
**Carry out a double exposure as follows:**

1. Place the random dot screen on top of the laminated plate inside the vacuum frame. It is important to place the emulsion side down on the polymer film.
2. Activate the suction pump and the UV exposure will begin.
3. Expose the random dot scheme for a length of time which has been calculated to produce a mezzotint black when developed.
4. After the first exposure, remove the dot screen while the plate remains in the vacuum frame.
5. Now place the positive on top of the photopolymer plate. Remember to reverse the image. If maximum definition is paramount, the positive should be brought into contact with the plate with its emulsion side facing the photopolymer emulsion.
6. The length of image exposure varies from positive to positive, but is in many cases in the same region as the screen exposure, or shorter.
7. After the second exposure, develop, light harden then print the plate.

REMEMBER: The exposure times for the screen and the image need to be tested out for the type of UV unit, dot screen, positive and photopolymer film used. With a little experience the variables of the process become fairly easy to control and adjust.

Many artists and students introduced to this process for the first time are amazed by the superb halftone reproduction; some find it difficult to understand how it actually works. The secret lies with the screen exposure. The initial exposure to a network of random dots creates a virtual mezzotint - an area of maximum roughness and therefore ink retention. If the plate was developed at this stage it would print a deep black. The next exposure, to the continuous tone positive, is in effect a reprographic equivalent to the scraping and burnishing of conventional mezzotint; it shapes lighter areas out of a dark background. The UV light travelling through the different levels of grey of the positive hardens the underlying dot screen mezzotint to varying degrees, depending on how much light is let through. In an area to be black, which is completely blocked out on the positive, the mezzotint is fully retained, while the film hardens fully in areas to be white, thus creating a smooth top surface. Any grey tones will partially fill in the mezzotint black and register on the plate as an area of a certain depth somewhere in between the deep black and pure white levels.

This explanation shows how the double exposure technique is very similar to conventional intaglio techniques that generate tone out of different levels of intaglio groove. The main difference, of course, is that here these levels are exposed into a photopolymer emulsion rather than etched into metal.

All types of photopolymer emulsion are suitable for use in this continuous tone process. Thicker varieties can sometimes be more flexible as regards exposure times and also yield the broadest range of greys and the richest mezzotint blacks. The thickness of the film can be increased by laminating several layers of photopolymer film together.

### Laminating multiple layers of film

**METHOD**
**Laminate multiple layers of film as follows:**

1. Laminate the first layer of film onto a prepared plate in the usual way.
2. Return the plate to the yellow light area and carefully peel off the second layer of clear Mylar, making sure that none of the emulsion is also removed.
3. Cut the next piece of film to size and remove the soft layer of Mylar.
4. To avoid creases and bubbles, briefly dip this second layer of film in a tray of warm water before laying it onto the plate. Gently squeegee off excess water to ensure perfect contact.

5. Now run the plate through the press as before.

Due to the wet lamination method it is necessary to fuse and harden the plate in a drying cabinet before the edges can be trimmed and the plate is ready for exposure.

Theoretically, there is no limit to how many layers of film can be sandwiched together to increase thickness. As an additional aid to lamination the surface of each layer can be lightly sanded before the next layer is added.

The increase in film depth and therefore of the range of tonality on the print can be further enhanced if each layer is exposed i.e. by giving each layer of film an initial screen exposure. The actual image exposure then takes place as the last step of this process.

Exposure times have to be adapted to these types of modified plate.

Many other creative interventions are conceivable with multilayered plates, for instance, by exposing different images to different levels of film to produce a pictorial amalgamation.

## Maximising the exposure

Intaglio Type prints of a very high quality can be achieved with even a basic, improvised set up and a little bit of practice. Those with access to professional equipment can fine-tune the processes to produce unprecedented levels of quality. Even though small, less powerful exposure units can produce excellent results, the scientists who developed polymer film emphasised the importance of an exposure as short and powerful as possible to yield the most accurate results. This is because UV light is of a very high intensity and is less likely to be diffused by the film positive. Another important factor lies in the degree of contact between the photopolymer emulsion and the screen or positive during exposure. An emulsion-to-emulsion exposure always facilitates a well-focussed reproduction, while any exposure where the non-emulsion side of a positive is in contact with the polymer plate leads to a certain degree of diffusion and refraction. To a lesser degree, this also applies to the thin top layer of clear Mylar which is normally left on during exposure. In some cases, especially when high definition photographic liths are used as artwork, it is worth removing the Mylar prior to exposure. The resulting print will tend to have a slightly broader tonal range, the finest detail but less contrast. However, most types of positive other than lith film tend to bond with the bare polymer plate during exposure, which makes the process rather messy and difficult to control. This applies particularly to any artwork involving a toner deposit i.e. photocopies and laser prints.

## Flash exposure

Another way to extend the tonal sensitivity of the non-etch process is by using a sophisticated triple exposure technique which, after a thorough testing and fine tuning of all the variables can enhance the lighter spectrum of greys in the finished print. Follow the double exposure process as described i.e. an initial exposure to a random dot screen followed by the exposure to the image. Now introduce a third exposure to a diffusion screen e.g. a sheet of tracing paper or frosted Perspex or glass. This exposure is so short that it does not produce the overall grey tone that would result from a longer exposure; it should be merely a flash of about 1/10th to 1/20th the length of the main exposures.

## Experimental Intaglio Type techniques

Artistic work carried out using the photopolymer medium can easily become a victim of its own success. Its pictorial language can bear a technological perfection and slickness not normally associated with intaglio printmaking. In a sense, it can sometimes be over developed and lose some of the intaglio characteristics and qualities. For this reason it can be beneficial for photopolymer plates to be worked in combination with non-reprographic techniques. As outlined earlier, this may already begin with the manual manipulation of the positive and can continue with the artist fully utilising the sculptural and intaglio nature of the photopolymer material itself. The film can be drawn into with an etching needle to produce drypoint lines, or it can be scraped to create expressive textures, roughened with sandpaper to produce dark tones or burnished to lighten certain areas. In fact the polymer surface can be treated mechanically just like a metal etching plate.

Small pieces of film can also be collaged together in multiple layers or laminated onto existing intaglio plates and then exposed, developed and printed. All the collagraph and intaglio effects yielded by the mechanical manipulation of the film integrate quite naturally with both the photo-intaglio image projected onto the film as well as with any existing etched or collagraphed marks on the underlying base plate material.

Photopolymer work on wood surfaces has a unique character - combining the aesthetics of woodcut with intaglio features. If photopolymer film is to be laminated onto a textured surface such as a wooden board, a slight modification to the laminating procedure is required. In order for the film to fully penetrate all grooves of the substrate, the plate should be laminated face up and without the use of a protective acetate sheet; foam blankets are ideal for use in the laminating of thicker kinds of base material. After lamination, expose and develop the plate as usual but remember to take care when printing thicker plates. Of course, surface textures can also be manually applied by brushing on acrylic varnish.

## Direct marks on photopolymer plates

Despite its sophisticated possibilities, the Intaglio type medium can also be used on a low-tech level, for drypoint and other direct techniques. Nothing more is required for this but an etching press, a supply of substrate plates, some film and developer. The simplicity and safety of this method makes it ideally suited to school use and introductory printmaking classes.

## METHOD
## Safe and simple printmaking with Intaglio Type as follows:

1. Prepare metal or plastic plates in the usual manner.
2. Laminate photopolymer film onto the plate using the etching press.
3. Draw or paint straight onto the Mylar film using waterproof marker pens, black acrylic paint, litho crayons and any similar drawing implements so long as they leave an opaque mark. Pencils etc. are less suitable because they do not leave opaque marks. Thinner lines will result in a line bite while broader areas will act more like open bite. Black areas can be scraped into to produce white marks.
4. Now expose the plate in sunlight - usually a couple of minutes is enough - and return the plate to the workshop/classroom in a light proof folder.
5. Remove the top Mylar sheet and develop the plate in the soda ash solution. All the drawn marks are now revealed as intaglio grooves.
6. Stabilize the plate with a spritz of vinegar then light harden the plate in sun light then print as an intaglio plate.

### Finishing touches

Before pulling your print, there are a number of finishing touches that can be carried out on the plate.

If you notice some cracking of the film along the edge, simply remove it my running a sander along the plate at a 45 degree angle. Avoid the problem altogether by using a plate that is slightly larger than the required size and using registration marks on the positive. After exposure and developing the plate can simply be trimmed back to the actual size using a guillotine. Slightly dampen the edges for a clean cut. Once the edges are dry, apply a bevel.

Slight imperfections on the plate surface such as cracks or small bubbles can be carefully filled in with floor varnish, which can also be used for deliberate editing e.g. to remove certain areas of the image.

All types of etching ink can be used for printing photopolymer plates but when preparing the ink, be careful to maintain a certain stiffness of the mix i.e. the addition of easy wipe and light copperplate oil should be somewhat reduced. The soft AKUA intaglio ink has been specially developed for intaglio type.

During inking up and wiping greater than usual care should be taken to only use soft materials that will not damage the fine details of the plate, especially those made with the aid of a dot screen. Soft pieces of card or rubber should be used to gently squeegee the ink into the grooves and initial wiping should be done with soft pieces of scrim with the starch removed. Some prefer to wipe Intaglio Type plates entirely with newsprint or tissue paper.

Wiping is carried out as normal but avoid using excessive pressure and vigorous motion. Due to shallower grooves and a smoother surface the Intaglio Type plate typically require less wiping than metal plates so be careful not to over wipe. Using tissue rather than scrim will help prevent over wiping. The plate is ready for printing when the image is clearly visible in areas that are to print as white.

Printing preparations are carried out as usual. Note: Prints with unaccountable open areas have often been underexposed (some detail has been dissolved during the developing stage); while faint prints are often the result of an excessive UV exposure (details have been burnt out and hardened).

### Editioning

Sometimes artists who are not familiar with the new method believe editioning of photopolymer plates to be problematic - preferring to go back to editioning using traditional metal plates. In fact, it is possible to use photopolymer plates for the production of sizeable editions which not only prove to be consistent in print quality but which actually reduce the effort involved in plate origination.

A well-hardened photopolymer plate can easily yield an edition of about 40 consistent prints. If larger editions are required a system similar to screenprinting can be used where a positive master copy always enables the printer to produce any number of identical screens. So long as exposure times are exactly repeated, any number of identical photopolymer plates can now be made from a positive. The intaglio emulsion is stripped off after the first signs of wear, the plate is relaminated and then re-exposed to the master positive. In this way, editioning is very easy to accomplish.

### Color printing with photopolymer plates

The photopolymer system lends itself particularly well to intaglio color printing. In conventional etching methods the rewards of color printing are often arduously attained - the need for several plates takes a great deal of time and effort and the difficulty of matching the colored layers keeps many artists from exploring the full creative potential of color intaglio printmaking.

The photopolymer system can be used to produce colored prints using the a la poupee method but its big advantage lies in the ease with which multiple plates can be generated and the accuracy of registration of the reprographic process. The polymer surface also has no soiling effect on any color etching inks.

In a similar way to screenprinting, it is now possible to create four color separation using reprographic means for the production of a set of intaglio plates which can then be overprinted successfully with process colors to produce a full color intaglio print. This process should be used to take creative advantage of the rich colored ink deposit that only the intaglio medium facilitates rather than to strive simply for photo realistic color reproduction.

All kinds of positive and stencil - drawn or reprographic - can be juxtaposed on the light box with registration marks for each layer and plate to allow for the careful planning of a color intaglio print. For instance, areas of flat printing color, similar to manual aquatint, can simply be generated by painting opaque marks onto acetate and exposing it to a coarse screen using the double exposure process. Translucent layers are achieved with similar ease by making a plate from a positive bearing translucent, tonal marks. Finally, vigorous linear intaglio marks to be incorporated in a colored print are best made from a crisp line positive. By assigning different layers of color to different plates a myriad of mixed colors can be realised on an intaglio print.

It is especially in the field of color printing that a marriage of the non-etch intaglio techniques with conventional etching promises great benefits. In color etching artists often use an etched plate as the main pictorial element of a print, while a second plate is meant to work as a backdrop providing another spatial layer and a color complementing the main plate. Rather than having to generate a second etched intaglio plate the artist can now simply execute this backdrop in the photopolymer method; registration can be made precise and easy by working on the positive (for instance with tracing paper) on top of the original etched plate.

**The methods outlined here are merely a taste of what is possible.**
**There are many more ways to use the photopolymer techniques yet to be explored.**
**It is down to the individual artist to embrace the new methods and materials and to put their own stamp on the medium.**

For more information on photopolymer techniques click on the following links:

**Intaglio Type** **Aquatint Screen**

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## 20. The Acrylic Resist Etching Workshop
## safe, simple, economical

**The etching press**
**Inking benches**
**Print drying**
**Drawing area**
**Ground application area**
**Spray booth**
**Plate preparation area**
**Chemicals / Corrosive area**
**Etching and stripping tanks**
**Drying cabinet**
**Paper area**
**Photopolymer area**

The acrylic resist etching system is ideally carried out in purpose made workshop facilities. It can also be put into operation with fairly limited means and a small budget, making the intaglio medium much more accessible to small set-ups and individual artists.

The materials used in the new processes are so safe that etching is now a viable option for artists wishing to carry out intaglio work in their own studios as well as for schools who have recently found traditional printmaking impossible due to health and safety regulations. With the new system, no costly fume extraction system is needed, no seriously harmful substances are involved.

For the more professional workshop or educational department investment in a number of facility developments is recommended to ensure ideal results and efficiency. These facilities are easily constructed and any expense is quickly recouped by the savings made by operating a nontoxic acrylic resist workshop.

Accommodating acrylic resist etching facilities into an existing set-up can present an opportunity to reassess and redesign all areas of practice to offer a nontoxic facility that is rational, practical, safe and healthy with clearly defined areas of activity allowing artists to move from one dedicated space to another as they progress through different stages of their printmaking. Large shops can easily accommodate all the facilities and equipment but it is also perfectly possible to create a nontoxic workshop in a much smaller space if a multifunctional design is adopted. An acrylic resist etching facility can in fact be easier to accommodate than traditional facilities because the new processes require much less space.

The following is a suggested floor plan. There are many other ways to layout the nontoxic workshop but the aim here is to demonstrate that change does not necessarily require a large budget or major construction work.

### SUMMARY

**Area 1. PRESSES**: The intaglio presses form the nucleus of the nontoxic printmaking workshop. All other areas of activity are grouped around this centrally located area like satellites. The presses are easily accessible from the blotting area, the inking areas, drying racks and boards; and can be supervised by a technician from virtually anywhere in the workshop.

**Area 2. INKING:** Benches where inking and wiping and other messy preparations can be carried out without contaminating clean preparation areas.

**Area 3: PLATE PREPARATION:** A sequence of stations where the printmaker can move from sanding bench to degreasing sink and on to the drying facility.

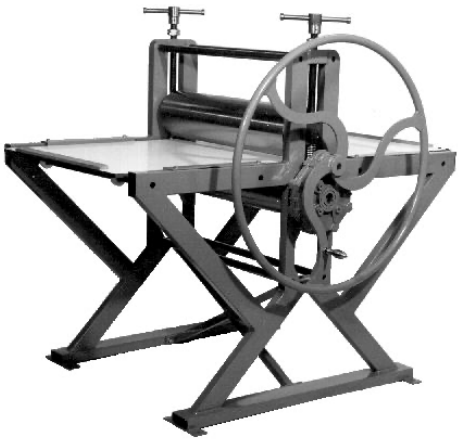
**Area 4: GROUND APPLICATION:** All processes related to the application and curing of grounds can be carried out here.

**Area 5: CHEMICALS and CORROSIVES**: Processes such as stripping and etching involving the use of corrosive chemicals are restricted to an enclosed area in which strict precautions must be followed.

**Area 6: PAPER PREPARATION**: A clean area for the preparation of paper.

**Area 7: PHOTOPOLYMER:** A light proof space (with yellow light filter) featuring a UV exposure unit. Can be combined with an existing dark room.

**All Areas: SAFETY**: All processes or materials requiring caution are labelled with prominent notices and advice regarding their usage. Barrier cream, eye wash station, emergency first aid kit and fire extinguishers are kept in central locations. Gloves, goggles, masks and visors are provided in all those areas where they are needed. MSDS Safety Data Sheets are made available to all users.



## The etching press

**(image: POLYMETAAL graphic art equipment. JW-80 etching press)**

The most essential piece of equipment in a printmaking workshop, especially an intaglio workshop, is of course the etching press. As opposed to other print media like screen or relief printing it is not possible to print etchings on improvised equipment. If there is one item in the intaglio workshop where expense should not be spared, it is the press. For once, the thinking that the most modern equipment is best is not necessarily the case. An etching press should be of a very sturdy construction so it can exert tremendous pressure and absorb tension and stresses. Old etching presses and modern versions built according to old designs can be relied upon to be heavy, sturdy and to deliver sufficient pressure and to provide many years of trouble free service. The basic design always incorporates two heavy rollers suspended within a rigid framework with a press bed sandwiched between the rollers and driven through them by means of a wheel or equivalent mechanism. The pressure is adjustable by turning two spindles attached to either side of the top roller. The earliest presses made in the 16th Century were wooden constructions and were driven by a massive star wheel. Today only a few presses have a direct drive and star wheel, a design which fails to give the printmaker the best indication of pressure. Most presses used today are operated by a flywheel connected to a gear mechanism which makes intaglio printing much less strenuous and therefore more accessible to all. Some presses are even motorised.

**A few tips when buying a press:**

- Look for a press with rollers and a frame that are as heavy and rigid as possible. Lightweight presses frequently have disappointing print quality and may be of poor construction.
- Rollers should be solid or the tread of the two steel cylinders should be as thick as possible. They should be of a fairly wide diameter and normally the bottom roller is larger than the upper one. If the press has hollow rollers, check that they are fitted with internal support structures. Rollers lacking rigidity and girth are prone to bending

under pressure - something that is indicated by a gradual loss of tone and detail towards the middle of a print.
- It is better if the drive is fitted to the top roller. Presses with a driven bottom roller can push plates out of register.
- The press frame should be made of cast iron. Other kinds of frame are prone to small but significant flexing or stretching under pressure.
- The bearings are a particularly crucial element of any press. On the best machines these bearings consist of a solid steel shaft fitted to either side of the roller which runs within a cylindrical bronze inset in the press frame. This type of roller bearing, when frequently lubricated with machine oil, can give decades of trouble free service. It is important, however, not to allow the top roller to tilt as this can cause the bearing to shear off. There are a few good presses that make use of high quality ball bearings which are suspended in a cast press frame but on the whole ball bearings are often the sign of an inferior design.
- Cheap presses (often half the price of a good press) are prone to breaking down or printing poorly. Beware of adverts for inexpensive presses of a *lightweight modern construction*. Even though much more portable, these less robust machines often fail to satisfy the demands of professional intaglio printmaking. This also goes for multipurpose presses that claim to be able to print anything from an intaglio plate to a litho stone.
- The press bed need not be made of heavy gauge steel and in some workshops even compressed particleboard is used to satisfaction. Thinner steel beds tend to become slightly curved with use and need to be reversed from time to time. The press bed should be covered with a thin smooth board such as Formica to provide an even and easy to clean surface and to keep the actual bed from rusting. Any press bed must be secured within the press with stops on both sides. A loose bed can actually run out of its tracks between the rollers and cause serious injury.

In short, this means that a good etching press is a heavy piece of equipment which needs specialised transport and may even require hydraulic lifting gear to be moved about the workshop. For this reason, it is also important to ensure that the workshop floor is strong enough to bear the weight of a press which can often be up to several hundred kilos. On the positive side, due to the relative simplicity of a good etching press, they can be assembled by anyone with basic DIY skills.

## Inking benches

The inking benches form an area of activity in which most of the preparatory work for printing is carried out. It is quite normal for an intaglio printmaker to spend much more time here than on the actual press so these work areas should be well laid out, sufficiently lit and located away from clean areas of activity, especially those in which paper is handled. The inking benches should however be within easy reach of the press.

Inking areas often turn into the messiest part of the printmaking workshop. This fact is often exacerbated if inking and wiping is carried out in gloomy conditions on black wooden jiggers etc. It is impossible to keep dark absorbent surfaces clean. Messy workstations are not only a potential health hazard but also encourage the kind of cross-contamination that can make clean color printing impossible. For this reason it is good practice to cover all benches with thick sheets of acetate which serves as a good mixing, inking and wiping surface as well as one that is easy to clean because ink deposits are clearly visible.

Inking benches should not be too low or too high - the average height of a kitchen unit is a good marker. Benches are often equipped with storage areas under the work surface but often these areas can become cluttered with all manner of materials. It is best to have clearly defined compartments for things like reusable scrim of different colors. Better to keep ink tins, additives, cleaning oil, cleaning spray, card squeegees and tissue in separate containers on raised shelves at the back of the bench.

There are numerous ways to keep this area of the workshop tidy, functional and economical. For example, to avoid wastage etching inks now come in ink guns which dispense in measured amounts. Another useful item is a wall-mounted magnetic kitchen knife holder which can be used to hold spatulas.

It may come as a surprise to some, but the cleaning of rags can result in the biggest part of a workshops expenditure! So, as rags are always in demand, it is a good idea to establish a system for their use and reuse. Because no organic solvents are used in acrylic resist etching, rags can be used several times until they have become saturated with ink and cleaning oil. The *rocket* system makes use of a cylindrical bin with an opening at the top and conical opening at the bottom. When a rag has been used once but still has remaining absorbency, it is put into the rag rocket along with other similarly used rags, ready for reuse. Only when a rag has become fully saturated is it put into a separate bin and the contents handed to a rag recycling company. Clean, pristine rags are kept in a separate bin.

BIN 1: clean rags
BIN 2: used rags with remaining absorbency
BIN 3: fully saturated rags for recycling

Any rags soaked with ink or cleaning oil must be kept in fireproof containers with lids as they are combustible. This is not normally a serious hazard, except in very hot conditions. The same goes for tarlatan soaked in ink. If all rags are used for waterbased clean up there is no such fire hazard.

## Print drying

The print drying facilities should be located close to the etching press. Sheets of pin board are ideal for drying prints and flattening them at the same time. Stacks of these boards do however tend to become very heavy and difficult to sort through. Smaller and more manageable stacks can be created by constructing a sturdy rack with shelves on which several boards can sit on top of each other. A workshop with sufficient space should also have a metal drying rack of the kind used in screenprinting for prints that can be air dried rather than dried flat.

## Drawing area

Due to the amount of bulky equipment, the drawing areas available in a printmaking studio are often limited. However, it can be most beneficial to find some conducive space where artists can go to draw and consider their work etc. Where possible, this should also include a facility for pinning up artworks or proofs. Even the sturdiest tables deteriorate from the

physicality of intaglio printmaking so it is best to cover them with replaceable sheets of acetate which are simply held in place with adhesive tape. Some workshops also make use of color-coded boards which are designated as *clean boards* to be used solely for drawing, paper tearing etc.  Other designated boards include *messy boards* for intaglio work and *cutting boards* which provide a surface for trimming etc.

## Ground application area

**Roll-On Ground**

This should be a glass or acetate topped bench similar to the inking benches which mainly serves as a roll-up slab for acrylic roll-on hard and soft ground as well as for other specialised grounds such as lift ground and wash techniques. This bench should not be used for inking up as all processes carried out here demand an entirely non-greasy surface.
Shelves above and underneath the bench provide ample storage space for all acrylic resist etching paraphernalia such as ground rollers, stop-out varnishes, wash and lift media, cleaning agents, jars, bowls and brushes etc.

**Hard Ground**

In some workshops this area is designed as a bay incorporating a drying cupboard.

## Spray booth

The spray booth is a wooden cabinet with a funnel-like hood and fume extraction. An air tube connects the hood with an extractor fan fitted into a window that generates the required sucking airflow that removes the acrylic spray mist from the workshop area. The interior of the booth is fitted with lights and has a slightly angled backboard where plates are propped. There are often pins or clamps so that newsprint sheets can be hung behind the plate. The front flaps of the spray booth can be extended to accommodate large plates. The bottom front cover conceals the compressors. Adequate ventilation needs to be provided if a compressor is fitted into an enclosed space. Switches for the fan, lights and compressors can be mounted on the front panel of the booth and are best covered with an acetate sheet to insulate them from wet hands and spray mist. Underneath the booth can be fitted with shelves for the temporary storage of plates-in-progress as well as various spray chemicals and cleaning agents.

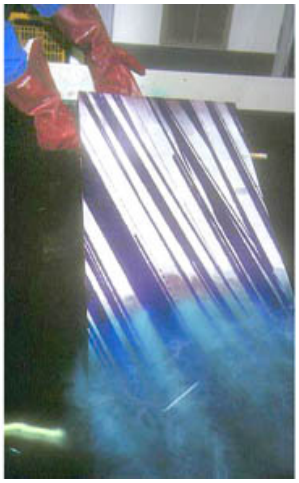
A simple but serviceable compressor with 1.5 horsepower can be purchase reasonably cheaply at most DIY stores. These tend to be quite noisy machines. Much better for a shared workshop is a compressor with integrated air reservoir. These machines run very quietly. A designer's airbrush compressor which is entirely silent uses a different technology and is best obtained at a professional art materials supplier.

The actual spray guns and other attachments are connected to the compressor by means of a pressurised air hose. There are various adapters available. A very long air hose makes it possible to run the compressor in a separate room or area from the spray booth. The large spray gun best suited for working with acrylics is often labelled a *gravity fed gun*, to indicate that the ink container is mounted on the top of the gun. This type of tool is much less likely to clog up than other models. Designer airbrushes with no valves or other intricate components tend to work best.

## Plate preparation area

It makes good sense to carry out all plate preparation processes in one designated area if sufficient space is available. Some workshops lay this area out in a way that allows etchers to proceed step by step from the sanding bench to the degreasing sink and on to the drying facility. A guillotine can also be part of this area.
The sanding bench is the place where all the mechanical processes are carried out and where appropriate tools (files, sanders, sandpaper etc.) are kept. As many of these processes produce metal filings and dust it is best for this to be confined rather than spread across the workshop.
The degreasing sink should ideally be made from robust polypropylene or stainless steel and designed to accommodate the largest plates used in the workshop. It should be equipped with a hose or shower attachment and a hot and cold water supply. Fit a wooden grid into the bottom of the sink. It is also useful to have an adjacent shelf for storing degreasing materials.
Next to the sink, there should be a clean bench for drying degreased plates with room for a paper towel/ tissue dispenser for blotting and a blow dryer. It is important for the dryer to be a properly designed wall-mounted hot air fan - not a plug in hairdryer which, in a wet area, is an electrical hazard. In practice, most workshops *do* make use of hairdryers - these should be fitted with a circuit breaker for safety.

## Chemicals / Corrosive area



In the acrylic resist etching system it is best for all etching and stripping processes to be incorporated in a general corrosive area. This area can be divided into wash and etch sections. Both sides comprise tanks or trays containing the active solutions next to a rinsing facility. The sink units should be made from polypropylene and mounted on a stainless steel stand. The polypropylene is a strong kind of plastic which is unaffected by strong alkalines or acids. These sink units can be fabricated by specialist manufacturers according to the dimensions required by the workshop.

## Etching and stripping tanks

Dip tanks for etching and stripping can be built into this sink design as a compartment or made separately so that they can be removed when necessary e.g. for maintenance purposes. This removable design necessitates the inclusion of a special top rim which prevents any spills. Both sinks should be fitted with rinsing hoses supplying cold water for rinsing off etched plates and hot and cold water for stripping off acrylics. The stripping side should also be equipped with a strainer or other catchment facility for acrylic particles.

Tanks should not sit on top of a sink unit as this heightens the likelihood of splashes coming into contact with the eyes. The sliding of plates in and out of the tank is much more controllable if the top of the tank is at around tabletop level. Metal salt etching solutions do not produce harmful fumes as traditional acid etching does. However, a degree of local ventilation is desirable to extract any salty iodized vapours that may be produced.

The actual casing of a dip tank should be one single leak-proof unit which has been moulded or vacuum formed. The material used needs to be of a sufficient thickness (about 5mm-10mm) and must be proven to resist corrosive chemicals. Polypropylene is the preferred material as it can be cut and welded to any specification. Due to the pressure exerted by the heavy liquid inside a tank it is vital to ensure all seals are leak proof - especially at the bottom of the tank. It is also recommended to construct a wooden frame to support the tank and to absorb some of the pressure.

Dip tanks for etching with ferric/ Edinburgh Etch are best divided up into a number of slots or compartments using slot-in panels (drilled with holes) which allow several plates to be bitten simultaneously. The compartments should be about 2 inches wide to allow the aeration pump to produce the best circular flow within the solution. The option to have slide in/out dividers makes it easier to retrieve plates that have accidentally fallen to the bottom; to pump or ladle out exhausted ferric solution when the time comes; and to carry out cleaning of the tank.

The Saline Sulfate Etch works best in large high-sided trays or tanks fitted with a lid. A wooden grid inside the tank allows the etching deposits to sink to the bottom, keeping the solution clean.

The actual aeration pump is a simple aquarium pump - the more powerful the better. It can be mounted on a wall away from the wet area. These pumps are relatively maintenance free apart from the rubber valves that will need to be replaced every couple of years. The best way to operate the pump is with a safe pull switch. The actual aeration tubes known as air-lines can transmit the pulsing air over several meters without any loss in pressure. The air-lines are fed into the ferric and can be fitted with adjustable valves to allow for the fine-tuning of the airflow in each compartment of the tank.

All these pieces of equipment can be obtained cheaply from any aquarium/pet store.

Other small pieces of equipment to be stored in this area include acetate strips, pegs and clips, goggles, gloves etc.

Dip tanks for stripping are similar in construction to etching tanks but are not divided into compartments. A plastic basket or cradle with handles allows plates to be lowered in and raised out of the tank. Pumps can be used to empty the stripping tank but even a large tank can be emptied quickly and safely by simply using a plastic jug as a ladle.

## Drying cabinet

Drying cabinets can be used for drying and curing acrylic grounds as well as for drying plates after etching and stripping. An electric fan heater blows hot air into the wooden box, passing the hottest air into the plate drying compartment then cooler air into the ground-drying compartment. A bay for carrying out the application of a pour-on hard ground can be accommodated next to the cabinet so that plates can be placed straight into the drying cabinet. Many designs of drying cabinet are available and in smaller workshops, can be accommodated under a workbench to save valuable space.

FIRE HAZARD: Do not use wood to make a drying cabinet!
Make it from fire retardant materials such as steel plates, wire grids or plaster board.

## Paper area

The paper soaking and blotting area should be fairly close to the etching press but isolated from the other intaglio processes, all of which tend to be messy. The most important items are a soaking tank large enough to accommodate large sheets of paper and a clean blotting bench. The tank can, again, be fabricated from polypropylene and should be

equipped with a water supply and plug. Large sheets of Perspex can also be mounted next to the sink to serve as draining boards. Excess water from the soaked paper is squeegeed off and drains back into the tank via guttering fitted at the bottom of the Perspex. A very useful item that can prolong the life of blotters is a ball rack or similar device suspended above the blotting area for hanging up damp blotters.

## Photopolymer area

Photopolymer work is ideally carried out in an enclosed room adjacent to the intaglio workshop. This can be combined with a conventional darkroom but should in any case be equipped with yellow lighting. Painting the casing of existing white lighting with translucent yellow paint should suffice to create a safe light environment for photopolymer work. However, any windows must be blocked out and a lightproof curtain should be fitted over the entrance.

**An exposure unit** is the main piece of equipment in the photopolymer area. In addition, a clean workbench provides space for cutting and handling sheets of photopolymer film and a larger area for developing and rinsing.

The actual UV exposure unit is a cabinet with light fast doors. Beneath it there is often a storage shelf for mezzotint screens. Simple switches operate both the suction pump and the exposure. Inside the cabinet a tabletop vacuum bed with suction pump provides the exposure frame into which laminated plates and positives are inserted. The UV light source is suspended from above or mounted below.

An ideal but more expensive UV exposure source is a metal halide light source used in conjunction with a light integrator. This electronic gadget allows for a very finely gauged exposure in equal light units and the metal halide lamp guarantees a fast and powerful exposure. In UV exposure units that do not have light indicators or a shutter mechanism (see below), it is vital to take the warming-up cycle of the UV bulbs into account for calculating exposure times. During this cycle the exposure times increase in a multiplied rather than an additive way. This is because the bulbs emit a more powerful UV light after say 10 minutes than after the first 10 seconds. However, once a certain warm-up phase of about 15 minutes is completed, the light emission stabilises to a constant level.

Many printmakers make very serviceable exposure units out of cheap security halogen lights or photofloods.

An exposure unit with a light integrator or a shutter system gives absolute control over the exposure but for many photopolymer tasks an inexpensive mercury vapour light source controlled by a simple timing device works perfectly well. Here, however, the control over the exposure is relative i.e. the warming up of the light source will only allow for approximately similar results in repeated exposures. For plates up to say A2 in size, two mercury vapour lamps wired in parallel to the same switch are sufficient but for the even exposure of larger sizes four or more lamps are required. These should be mounted above the exposure table in lightproof conditions, in an enclosed cabinet or with UV filtering curtains. A custom -built cabinet for Intaglio Type exposures can also include a simple pulley-operated shutter mechanism mounted beneath the lamps. This kind of system allows for exposure times as accurate as those possible with an electronic integrator simply by opening and closing the shutter once the bulbs have gone through their warming up cycle. For a self made exposure cabinet it is also recommended to fit an indicator lamp as part of the switching circuit so that users are warned not to open the cabinet doors when exposure is in progress. If a lot of high definition photopolymer work is to be done the best results can be achieved by equipping the exposure unit with a UV light source as fast and powerful as possible, ideally of the metal halide type.

Many of the components needed in a photopolymer area can be obtained cheaply on the second hand market. Due to the move to digital technology many companies in the graphics industry are disposing of reprographic equipment such as vacuum beds, contact tables and suction pumps - all of which can be easily converted into photopolymer equipment. The kind of UV plate making equipment once used by professional lithographic printers are perfect for the exposure of photopolymer plates without even needing modification.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