autotype

Product Information

Capillex Exposure

Definition : *' On exposure to UV light the sensitiser within the photostencil materials reacts to crosslink the molecules in the colloid to produce a layer insoluble in water'.*

The practical mechanics of exposure are fairly simple. The photostencil material is held in intimate contact with a film positive and exposed to an ultraviolet light source for a pre-determined time.

The screen printer is mainly concerned with metal halide lamps, mercury vapour lamps, UV fluorescent tubes and even sunlight. Neither the photo flood nor the quartz-halogen lamp has an output sufficiently high in ultraviolet to be worth considering for photostencil applications.

Stencil adhesion

The amount of exposure given to a photostencil system dictates how the stencil will behave as regards its adhesion to the mesh whether it be at the washout stage or during the print run.

Exposure level = light intensity x time

Light intensity is governed by the power of the light source and its distance from the photostencil film. The effective intensity of the light is also governed by the output of the light source related to the spectral sensitivity of the photostencil material.

Exposure level effects on capillary, stencils

Once Capillex has been adhered to the mesh and dried, it is ready for exposure.

The main concern here with exposure is to penetrate the photostencil material all the way through to the mesh to ensure a degree of hardening around the filaments and thus ensure good stencil adhesion.

If exposure is insufficient and the whole layer is not penetrated by UV light the stencil may wash completely off on washout. Or, the stencil may be intact after washout but break down or become tacky during the print run - both of which are symptomatic of under exposure.

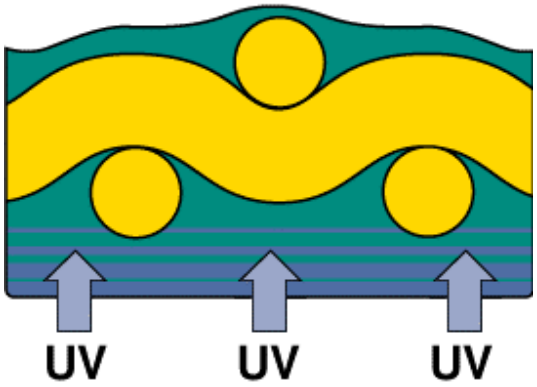
Over exposure is not a concern with these systems as regards producing too thick a stencil, in fact the thickness of the final stencil is predetermined at the adhering/ coating stage. Once you have a certain amount of stencil proud of the mesh before exposure, over exposing is not going to make that layer any thicker.

As a general rule, "direcrt" systems do not suffer from a lack of flexibility on over-exposure, in fact, if anything, the adhesion to the mesh is improved.

However, the resolution and definition of the image are also affected by the exposure itself (ie the exposure level, the light source geometry and the degree of contact between the positive and the stencil material).

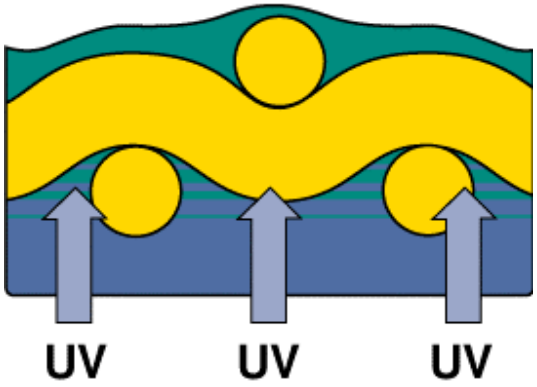
The following diagrams outline the effects of under-exposure at 1/4, 1/2 and 3/4 of the optimum exposure for a direct stencil.

1/4 optimum exposure



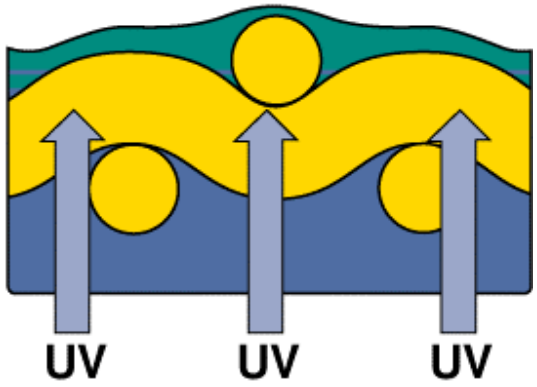
EFFECTS: During washout the image would appear and the stencil would probably start to come away during washout.

1/2 optimum exposure



EFFECTS: The stencil would probably be damaged by a strong washout spray. The emulsion appears soft on the squeegee side.

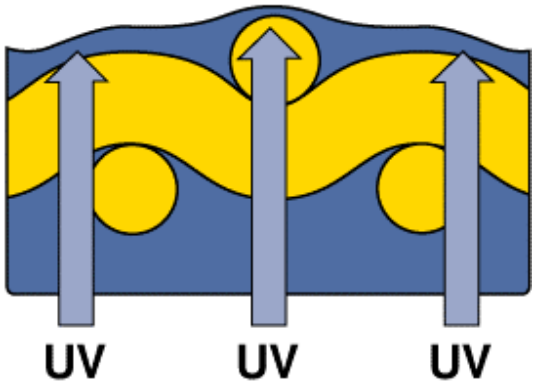
3/4 optimum exposure



EFFECTS: Emulsion appears slightly soft on squeegee side.

Stencil will scum of not washed out properly. Durability is compromised. Stencil is harder to decoat.

Optimum exposure



EFFECTS: All the emulsions is fully hardened and the stencil will provide the optimum resistance and durability.

Capillex Exposure Guidelines

Autotype Exposure Calculator

What is the Autotype Exposure Calculator ?

The exposure calculator is a film positive comprising of five columns, each with a resolution target, a set of halftone tints and lines of text. Each columns are backed with a grey neutral filter of different density. This concept enables five different exposures to be made simultaneously.

Why use the Autotype Exposure Calculator ?

Incorrect exposure is one of the most frequent causes of stencil failure. The Exposure Calculator provide quick, accurate determination of exposure times with all photostencil systems to alleviate this problem. It can also be used as a printing aid to optimise print quality, or as a means of process control.

How to use the Autotype Exposure Calculator

1. Estimate the correct exposure time using the guidelines available for all Autotype photostencil materials, then DOUBLE it.

2. Expose the photostencil to the Exposure Calculator in the normal way, washout and dry thoroughly (Note: For indirect films dry the film unmounted).

3. Examine the stencil to determine the correct exposure time. Interpretation of correct exposure depends on the stencil system.

Reading the results of the exposure test - Capillex

The stencil will show variations in colour from one factor to the next. Follow the colour change from the lightest to the darkest until it stops. The factor where the colour change stops is the column that represents optimum exposure.

Once the correct factor has been chosen, multiply the factor by the test exposure time. This gives the correct exposure time (or number of units) for that particular stencil/mesh/light source combination.

Example: 0.7 x 10 minutes = 7 minutes

Correct factor x test exposure = Correct Exposure

If there is still a colour change between Factor 0.7 and Factor 1, this indicates an under-exposed stencil, DOUBLE the original test exposure, and repeat the test.

The Exposure Calculator as a printing guide

The exposure calculator can be used to assess printed edge definition (straightness/ clarity of the printed edge) and print resolution (fineness of detail achievable).

The target is designed to allow the user to select the best angle to position the film positive stencils in order to avoid " saw tooth" and mesh interference. Resolution is checked by assessing the degree of "filling in " at the centre of the target.

Halftone tints

The 10% and 90% areas can be used to gauge the degree of highlight dot loss and flooding of shadow areas respectively.

The use of a square dot configuration means that the corners of the dots just meet at 50%. Examination of a print will show at a glance whether there is dot loss or dot gain in the mid-tone.

Failure of the corners to meet indicates dot loss. This may be due to undercutting caused by over-exposure, poor light geometry, drying in of ink, or the choice of a low resolution photostencil.

The merging of dots, or thickening of the join between dots, indicates dot gain. This is due to flooding which may be caused by over-thinning of ink, or by the use of a photostencil with poor edge definition.

Before starting a print run with halftones, it is always recommended that a test strip is printed, which contains a full range of tone values in the selected dot count.

NB: Positives with square dots are not recommended for fine halftone printing.

Change in exposure time for new lamp distance

Once the exposure has been fixed for a specific film it should be maintained. If there is a desire to do higher or lower resolution work, use the appropriate film.

If the distance between the light source and the film changes, the exposure must be changed accordingly, unless of course, an integrator is used and the exposure time is changed automatically.

The inverse square law states that the intensity of illumination decreases with the square of the distance.

So if you double the distance between the lamp and the vacuum, you must increase the exposure four times.

Conversely, if you reduce the distance by half, the exposure must be reduced to one quarter.

Choosing the right light source

As a general rule the minimum distance between the exposure lamp and the vacuum frame should be equal to the diagonal of the area to be exposed. This will ensure fairly even illumination over the exposure area.

Depending upon the exposure area and the size/power of the lamp, the light intensity will fall off at the edges of the exposed area because of the increase in distance between the lamp at the centre and the edges of the vacuum frame. This becomes more critical the nearer the lamp is to the vacuum frame.

Since the photostencil materials have a fairly wide exposure latitude, variations in intensity of up to 30% can be tolerated.

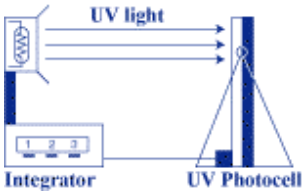
A test stencil will soon show the maximum area that can be effectively exposed by a given light source.

Light sources

Most modern light sources are based on gas discharge each type having specific advantages and disadvantages.

Spectral output of light sources

In general terms a light source with a spectral output in the region of 340-440 nM (nanometers) is suitable for exposing photostencil materials.



Some light sources have a continuous output, whereas others have a discontinuous or line emission.

Modern light sources such as metal halide lamps have a line output and it is important that these emissions coincide with that portion of the sensitivity curve of the photostencil materials giving the best results in terms of tanning and image contrast ie diazo bulbs of photopolymer bulbs.

Choosing a light source

Factors in selecting a light source:

a) spectral output

b) consistency and power

c) geometry of the source (ie its size and position relative to the image area)

d) evenness of illumination over image area

e) capital and running costs

The following is a list of the more popular light sources that are used today:

(A) UV Fluorescent Tubes

These are used in some printing down frames and have the advantage of pure UV without producing heat. But because their output is very low they have to be used in banks very near to the photostencil with consequent problems of light undercutting.

If considering UV fluorescent tubes as a source, ensure that their output is suitable, ie between approximately 340-440 nM, since some types emit very short UV or blue light.

(b) High pressure Mercury vapour lamp

The HPR lamp works by vaporising and ionising mercury which normally takes 2-3 minutes from switch on. Once the lamp has been switched off the mercury condense before it can be vaporised again.

The HPR lamp has a relatively low output and a line spectrum with high peaks in the ultra-violet and blue regions.

When exposing large areas a number of lamps must be used with consequent undercutting problems and areas of uneven exposure.

The HPR lamp normally has a life of about 1000-1500 hours, after which the UV output tends to fall off. A practical light source for small stencils and inexpensive to install.

(C) Metal Halide Lamp

Metal Halide lamps are now the industry standard and are recommended by Autotype as the most practical light source to use. They consists of a quartz envelope containing mercury through which a current passes, vaporising the mercury.

Like the HPR lamp, it has a discontinuous line spectrum and requires a similar starting time, although instant start models are now common.

With the addition of metal halides it is possible to adjust the spectral output within the UV and blue parts of the spectrum.

The lamp has an average life of around 1000 hours.

It is ideally suited to the exposure of photostencils - clean, efficient and fast because of its relatively high power and high UV output.

(D) Sunlight

Although difficult to control, sunlight is a suitable light source in hotter countries, with a high UV content with perfect light geometry. Difficulties in monitoring output at different times of the day and providing good stencil/film contact are the main drawbacks.

Type	Shape, Configuration & Size	Re-ignition time	Spectral Emission	Intensity	Consistence of UV output	Capital cost
High pressure mercury vapour	Compact 10 cm diameter bulb or tube	Requires cooling before reigniting therefore continuous burning needing forced cooling and shutters	Line spectra with max. at 365 nM	Medium	Good	Low to medium
Fluorescent tube	Tube with large diameter which inhibits good reflector design	Instant. Cool burning	Mercury spectra overlaid by continuous emission of phosphor	Low but multiple units required	Good	Low to medium
Metal Halide	Compact	May require cooling before re-ignition. Can be run at low power during stand by	Line spectra 410-430 nM	Medium to high	Good	Fairly High
Sunlight	-	-	Continuous High in UV	High	Good	Zero

Light integrators

Timing an exposure is not the most accurate way of ensuring that the stencil has received the correct amount of light.

A light integrator will compensate for these variations since the exposure is controlled by the amount of light falling on a photocell placed on a vacuum frame.

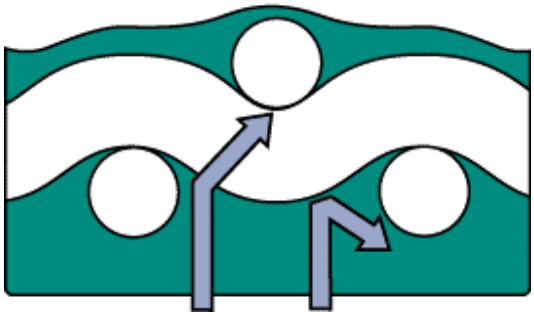
An additional advantage of the light integrator is that regardless of lamp position, once an optimum exposure level has been found no further adjustments are required.

Mesh effects on exposure

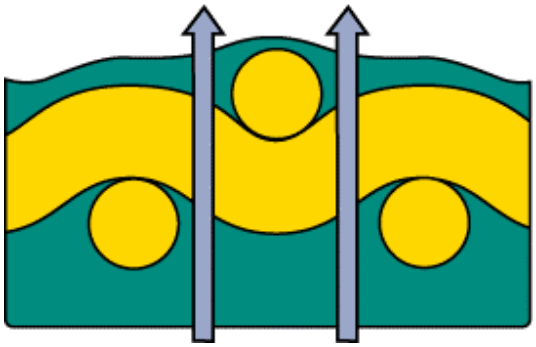
When exposing Capillex, treat the photostencil and mesh as a complete entity because of the influence of the mesh on light

scatter. This affects both resolution, definition and exposure level.

The diagram below shows the light scatter caused by white mesh. Scatter increases with the increase in mesh count and exposure time. As this can cause considerable loss of resolution and definition it is recommended that dyed meshes are used, especially when reproducing fine detail.



Dyed meshes absorb the UV light, thus minimising light scatter hence exposure times have to be increased by 50-150% over the times used for white mesh.



Vacuum Frames

The contact between the positive and the photostencil should be as perfect as possible, as inadequate contact results in light undercutting.

Particles must not be trapped between the two surfaces and if using large vacuum frames fitted with flexible rubber blankets allow sufficient time for all the air to be exhausted.

In some cases the blanket can become stretched, especially after processing direct stencils.

It may be necessary to use a piece of string near or around the positive and connected to the blanket vacuum inlet to insure proper air evacuation by channelling the air.

Although use of a vacuum frame is always recommended a passable result can be achieved using a weighted glass and a foam backing. This method is not suitable for the accurate reproduction of very fine detail.

Light Source Geometry

A photostencil's ability to resolve an image depends on its formulation, ie the choice of

pigment colour and particle size, the sensitiser, the nature of the emulsion, etc.

The photographic properties of photostencils which are influenced by exposure are resolution and definition.

Resolution is taken to be the limit of reproduction achievable. Definition is the reproductive quality as regards, for example, the straightness of edges of print.

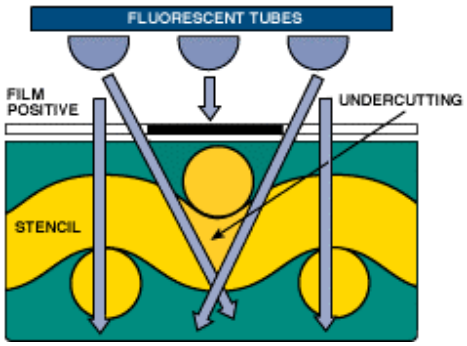
Light spread

Photostencils are designed to obtain a specific resolution, but once they are over-exposed, light spread in the emulsion will reduce this resolution ; ie open areas will start to close in.

So make sure you choose the right product for the job.

Light source geometry

If the light rays passing through the positive and photostencil material emulsion are not parallel, changes will occur in the image reproduced in the photostencil. This is often referred to as light undercutting



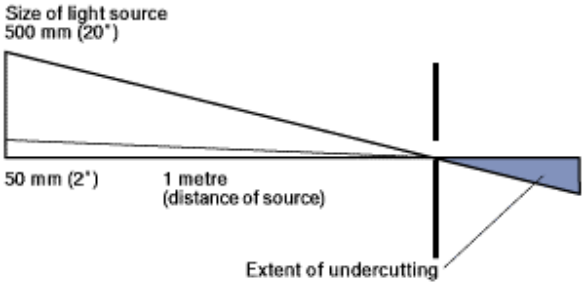
From a practical point of view poor light geometry effects do not present a problem when processing general work, ie lettering down to about 6 point and halftones of 65 lines (25 cm) or coarser.

It is only when trying to accurately reproduce very fine line halftones or images, that attention must be paid to light geometry.

Factors influencing light geometry

(a) Size of the light source. The larger a source the greater becomes the angle of light rays travelling from its edges and therefore the degree of undercutting.

(b) Position of the light source. The nearer a light source is to the vacuum frame the greater is its effective size. Conversely if the lamp is moved further away, so its effective size is reduced. If is good practice to increase lamp distance when exposing very fine detail work to reduce the effect of light undercutting (naturally the exposure time will have to be adjusted)



Positive quality and the absorption of film bases

The film positive determines the image quality of the stencil and often influences stencil thickness. For optimum results use single-layer positives with the emulsion side in contact with the base support of the photostencil during exposure.

This ensures that light undercutting will be restricted and that the stencil will be uniformly exposed.

It will be noted that a normal 100 micron (0.004") polyester film base absorbs a high proportion of the UV light. So when using stripped up positives with two or more layers of film plus adhesive tape, considerable variations in stencil exposure will result.

Exposure times have to be adjusted accordingly for the best overall result. Multi-layer positives increase the amount of spotting-out time so careful consideration should be given to the real cost differences between single and multi-layer positives.

Multi-point light sources can help reduce spotting-out because of light undercutting.