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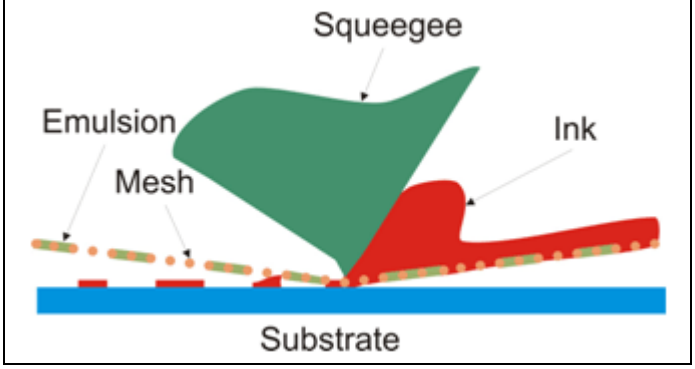
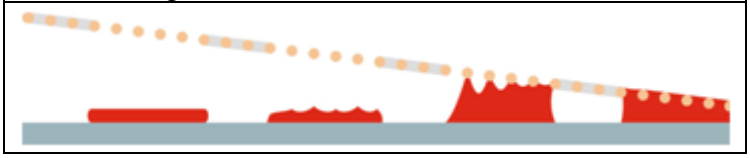
SQUEEGEE BASHERS BEWARE

Jon Barrett, the main man in our editorial team said to me “This month it is about your favourite subjects Squeegees and Flood coaters.” Not quite my favourite subject Jon, they don’t have a pulse! What they should have is a smooth gentle action that caresses the stencil and causes the ink to be transferred from the top to the bottom and onto the substrate. At this point the stencil that has been deflected by the squeegee to bring it in contact with the substrate, the stencil is pulled away from the substrate by the tension in the mesh. This happens after the squeegee has passed. The surface tension of the ink and the surface energy of the substrate form a temporary bond that pulls the ink out of the mesh openings and leaves an ink film on the substrate.

Squeegee Action



Ink Leaving Mesh



There has been a great deal of study on these actions, hours of mathematical modelling, pages of formulae and many a written thesis. Being a pragmatist I am guided by what I observe and what I see corresponds nicely to what the scientists theorise.

The flood coater also known as flood bar, flow coater and spreader is used to distribute ink across the image on the stencil and charge the mesh openings with ink. Not all screen printing presses are fitted with one, sometimes the squeegee acts as a squeegee and a flood coater, normally only on hand benches. Virtually all semi-automatic and automatic machines are fitted with an automatic flood coater.

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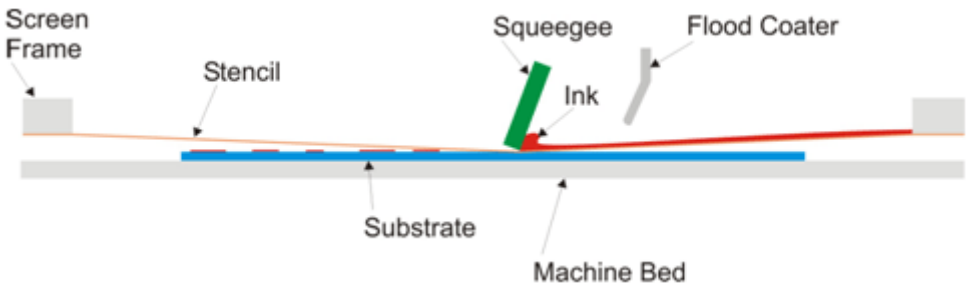
Basic Screen Printing Assembly



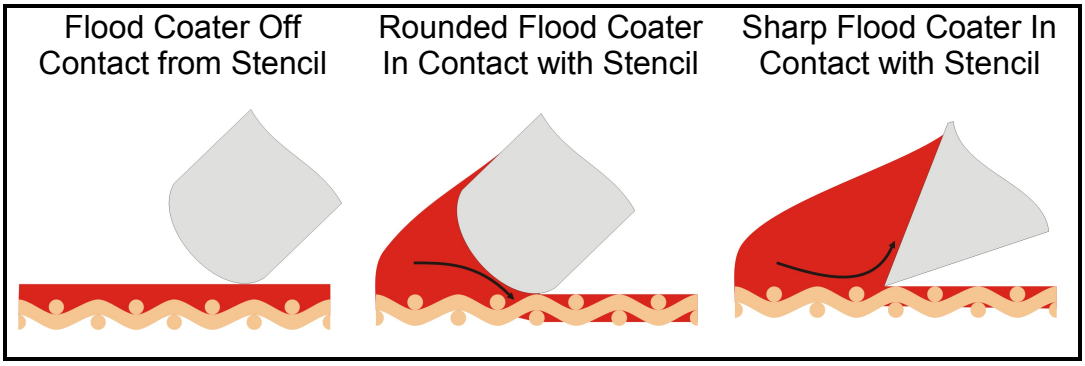
The importance of the flood coater is not recognised and is treated as a spreader. It should be that is given as much consideration as the squeegee.

At the start of the printing cycle is the movement of the flood coater across the stencil, pushing the ink in front. The aim is to charge the mesh openings with a controlled amount of ink that the squeegee causes to flow through the mesh onto the substrate.

Traditionally printers have set the flood coater away from the stencil and left a thick layer of ink on the stencil. For precise control of the ink deposit the flood coater should be in contact with the stencil.

Flood coaters are normally made of aluminium and get damaged. The greatest problem is the condition of the contact edge. This is often dented and bent. For correct operation the edge should be level and the profile of the edge constant along its length. With care it should be possible to maintain the condition of a flood coater for several years. Abrasive pigment may wear the contact edge and it can either be made of stainless steel or fitted with a steel strip. For increased abrasive resistance the steel can be hardened. The aim is to maintain the edge profile and flatness of the contact edge. Composites are also used.

The edge profile used depends on how much ink you want in the mesh before the squeegee stroke.



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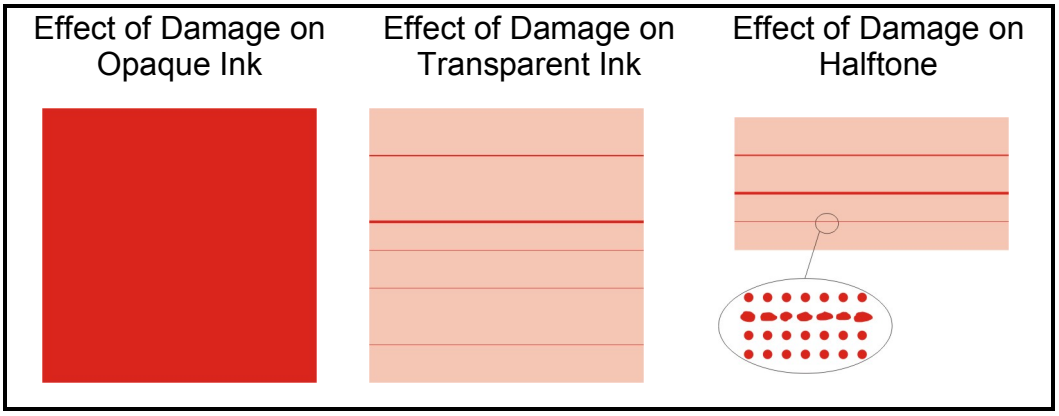
The graphic demonstrates with the coater off contact mesh charging is minimal. The rounded profile charges the mesh more than the sharp profile. Generally printers tend to use a rounded edge for large solid areas and the sharp edge for four-colour process work. If the ink is opaque then the condition of the flood coater is not so important because the effect is not visible. However if the image is a halftone or the ink transparent then faults in the flood coater are very apparent.



The flood coater characterised above has nicks in it. A nick in the edge produces a line in the print because of the altered angle at the point of contact with the mesh. (You see the same effect with a damaged squeegee). A bent flood coater will produce greater or less pressure on the stencil and result in a change in film thickness where the bend is apparent.

The angle of the flood coater is not as important as the edge profile.

A flood coater is supplied with a protective extrusion fitted on its edge. Use it whenever the flood coater is taken off the machine.

Set the flood coater so that it is just in contact with the stencil. Excessive pressure will quickly wear the stencil and over fill the mesh, whereas no contact will mean that it does not fill the mesh consistently. The contact edge must be flat and level with the stencil and machine bed along its length.
The flood coater cycle starts just before the image and lift just after the image.

Ink runs outside the print area and collects at the forward end of the print stroke. This ink becomes stagnant and has to be pushed back in by the printer. To reduce this the flood coater can have wings on the ends that help, causing the ink on the ends of the coater to flow inwards.

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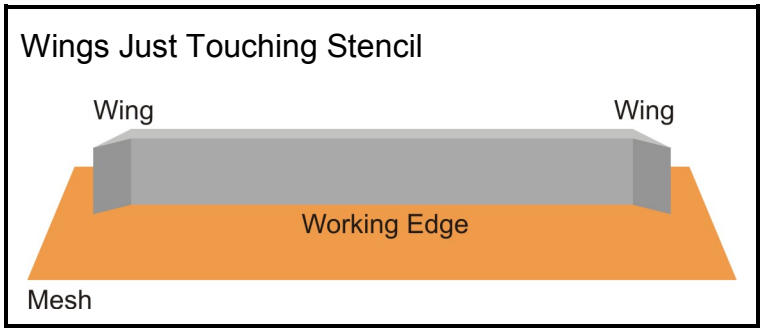


The flood coater with wings has to be machined very accurately as the bottom of the wings needs to touch the stencil but not damage it.

- Make sure the coater is fitted level in the machine
- Set it just in contact with the mesh
- Rounded thick deposit
- Sharp thin deposit
- Take great care of flood coaters
- Replace protective extrusion when not in use
- If is bent replace it
- Any nicks or dents should be machined out
- If aluminium wears try stainless steel or composite

SQUEEGEE

The actual dynamics of of ink flow into and leaving the mesh are very complex and this article does not pretend to go into detail. The aim is to show how the operation and condition of the squeegee can affect the process in practical terms. The ink leaves the mesh after the squeegee has passed. When printing halftones the gasket seal between the bottom of the stencil and the substrate will reduce or exaggerate the effects of a poor quality squeegee. The gasket seal is dependent on the surface finish of the substrate and the roughness known as Rz of the print side of the stencil. My colleague Professor Stephen Abbott expostulates with aplomb about this area.

The squeegee is the **engine of the process** and it has three functions:

1) Brings the stencil into contact with the substrate.
2) Assists the ink to flow into and through the open areas of the mesh.
3) Removes excess ink from the top of the stencil.

If the squeegee does anything else it will have an adverse effect on the process, for example;

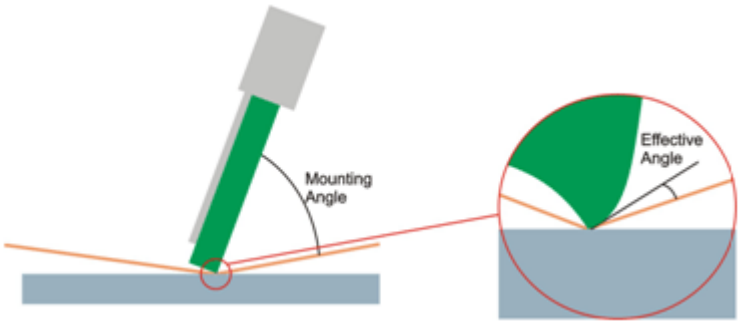
- Split the stencil
- Stretch the image
- Smudge the print
- Create dot gain
- Abrade the mesh

- De-laminate the stencil
- Damage the substrate
- Alter ink film thickness
- Destroy profits
- Etc.

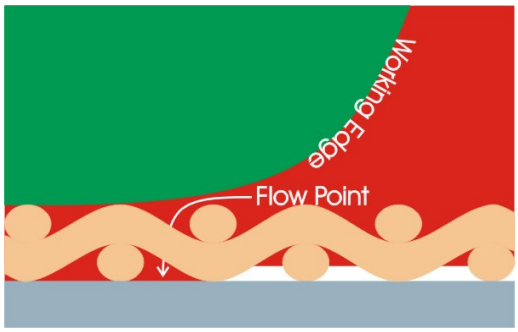
All these effects can be achieved by misusing the squeegee. If these negative factors can be eliminated, the process can reach its full potential.

There are issues of squeegee hardness, speed, material selection, configuration, unsupported height etc that affect the performance of the squeegee. The aspect that this article will explain is the “Effective Angle”

Mounting Angle V Effective Angle



The Working Edge of the
Squeegee in Contact with the Mesh



As the squeegee moves through the ink across the top of the stencil, it creates a wave in the ink. Within this wave, the ink is circulating with the bulk of ink rolling in front of the squeegee across the stencil.

As the ink rolls, the pressure system within the wave keeps the majority of the ink in motion but not flowing through the mesh openings. The ink flows into and through the mesh openings at the point where the tip of the squeegee is in contact with the open mesh, best described as the **Working Edge**. The amount of ink that flows into the mesh

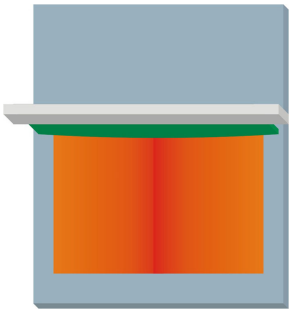
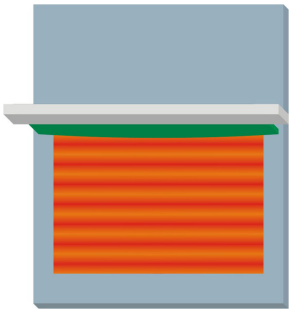
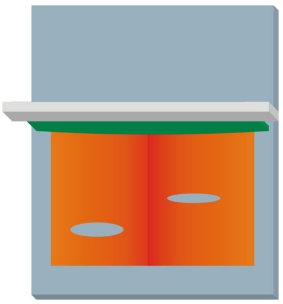
is affected by the angle created by the shape of the tip at this point. The angle is that created between the mesh and the tangent to the curvature of the tip, in simple terms this is the **Effective Angle**.

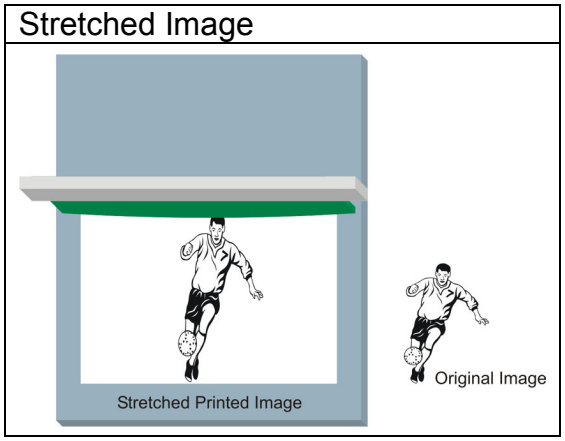
As the angle gets smaller the amount of ink increases up to the maximum that the mesh will permit. For the sake of simplicity the point on the squeegee at which the ink is caused to flow into the mesh openings should be known as the "**Flow Point**". The squeegee removes the ink that remains on top of the stencil to the end of its stroke.

The printer has the solution to the problem of unstable squeegees in his or her own hands. The biggest problem is that **squeegee pressure settings on the machines are often too high** or the machine is badly maintained so the pressure (loading) on the squeegee varies.

All too often you can see various effects:

- Corduroy effect on the print parallel to the squeegee caused by the squeegee shuddering as it traverses the machine.
- Colour changes across the length of the squeegee because it is not parallel to the bed
- More colour in the middle of the print due to excessive drag in the middle of the squeegee
- Colour change during the print run because the working edge of the squeegee is wearing
- Image missing due to no contact with substrate
- Streaks in the print because the squeegee is breaking down

More Colour in the Middle	Corduroy Effect	Missing Print
		



None of these are “because it happens” they are all cause and effect.

**“Bad printing is about accepting
the problems not resolving them”**

To find all the answers use the internet based e-learning program at www.worldofprint.co.uk the most comprehensive resource available. This could change how you think about screen printing.