DON'T MESS WITH MESH

The fact that people still call screen printing silk screen is an indication of the lack of understanding of this precision process. The screen mesh is a model of engineering excellence whose purpose is to accurately meter ink onto the substrate and to support the stencil. To achieve this mesh manufacturer uses highly sophisticated weaving machines that produce this woven material to tolerances of plus or minus 2 microns. When you consider that the threads are an organic material that is elastic such tolerances are remarkable. Once woven the mesh goes through a series of processes to further stabilize it. Finally it is inspected by a vision system that identifies any faults and marks the edge of the fabric. To put the complexity of mesh into perspective there are 14161 mesh openings in 1 square centimetre of 120 mesh and 240 centimetres of thread. In 1 square metre the figures are 143,976,001 mesh openings and 24000 metres of thread.

Having established the quality of screen printing mesh let us examine how best it should be used. It has to be stretched over a frame and adhered to it. The frame must be robust enough to withstand the tension in the mesh without excessive deformation and the stretching must be uniform. Unfortunately many meshes are not stretched correctly resulting in problems during production. It is not just a matter of achieving a tension, that tension must be uniform across the screen ideally better than +/- 1 Newton. Not only has it to be the correct tension but the threads must be aligned to the frame very accurately. Why you may say? As long as the mesh is on the frame what does its alignment matter, MOIRÉ is why.

There are three forms of moiré:

- **Primary moiré.**
  This form of moiré occurs when two halftones (separations of the same image) at different angles are combined during printing, and the respective angles create an undesirable interference pattern

- **Secondary moiré.**
  This moiré is seen when halftone angles and/or line counts (rulings) clash with the weave of the screen mesh to produce a patterning effect

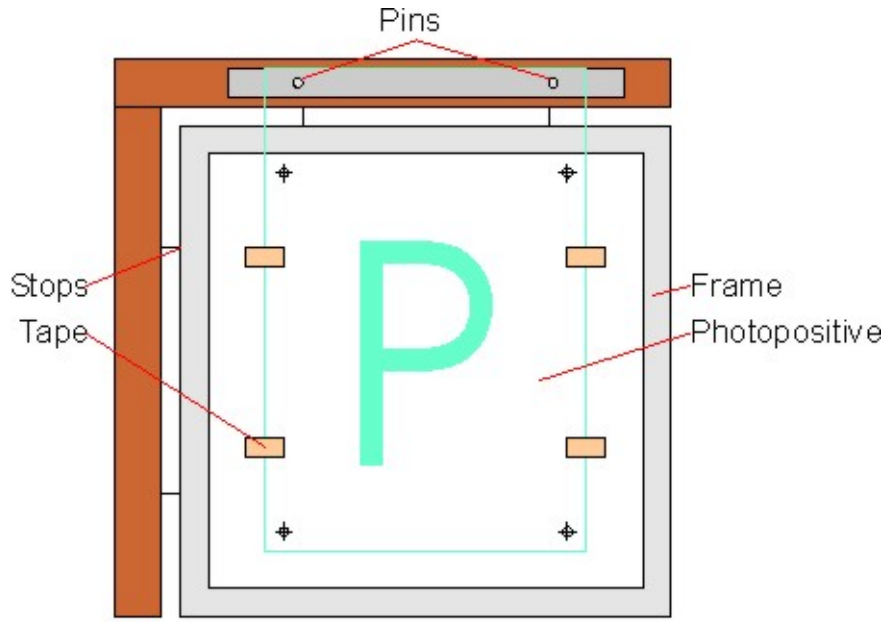
- **Tertiary moiré.**
  The final type of moiré occurs when a halftone is printed onto a texture and the texture pattern interferes with the halftone dots, creating unwanted patterning. This is particularly the case when printing textiles. Moiré can also occur when printing solid colours on top of each other when the mesh marking in each ink film can cause patterning

It is Secondary Moiré that is particular to screen printing because we have to use mesh that has threads at right angles to each other. In four colour printing and when printing halftones it is possible to reduce the appearance of moiré to an absolute minimum. To do this you must maintain a precise relationship between the lines of dots and the mesh this is a mathematical calculation, this calculation only works if you know the precise angle of the mesh. If the mesh is at the wrong angle or distorted, moiré will occur at

different parts of the image. This will be avoided if you know the threads in the mesh are parallel to the frame and the tension is consistent. Unfortunately there are only a limited number of sub-contract mesh stretchers who meet the required standard and a small percentage of the people who stretch their own mesh.

Of course if you are fortunate to have a computer to screen imaging system your image should be aligned correctly to the mesh (assuming the mesh is correct.) If you align it with a six inch rule or just by eye, you are bound to have it misaligned more often than not. You should use a Pin Register System. This is a simple device that is used throughout the printing industry. The diagram below shows how you mount the photopositive on the coated mesh. You also need a punch to punch the photopositive, these are available new and also second hand as general printers move to computer to plate systems.

PIN REGISTER SYSTEM



The frame is placed into stops with pins position to set punch. The punched positive is positioned on pins and taped to screen. The frame is removed with the positive attached and placed in exposure unit.

Always position the image symmetrically in the frame otherwise you may distort the image and have a varying ink film thickness across the image. You also need to keep away from the inside edge of the frame. An image of 21 cm by 27 cm needs at least 15 cm of free area around the image. The greater the free area the more stable the image will be. This is very definitely the case with high precision industrial printing. We take the example of printing electronic components such as capacitors where the free area is greater than the image area.

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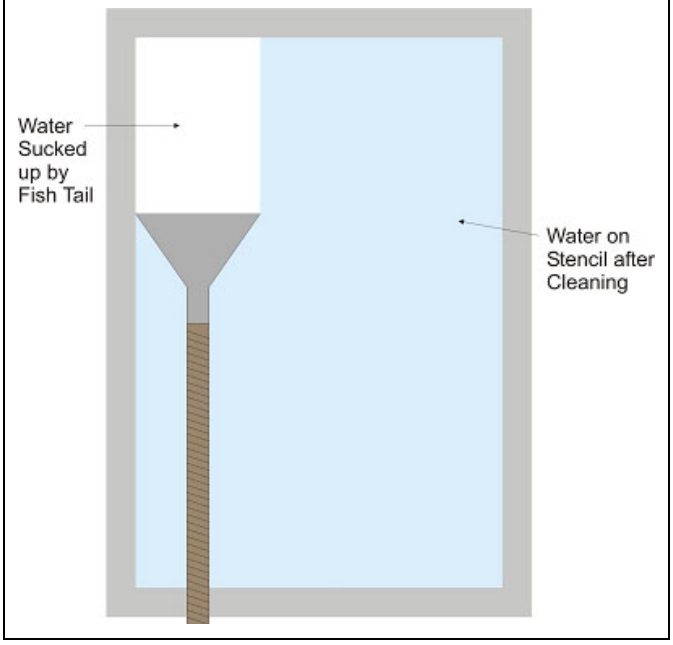
The modern meshes supplied by SEFAR, SAATI, and NBC are superb. The innovation of pretreating the mesh during production to make it easier to prepare, more receptive to emulsion, easier to de-coat and provided a more consistent ink flow is excellent. I do have some reservations about the claim that you do not have to wash the mesh at all before coating. If the mesh were transported, stretched and stored in clean room conditions and had not been handled, then I would be happy with not washing prior to coating, however this is not the case. I will always apply a small amount of degreaser and wash with clean water before vacuuming with a wet and dry vacuum fitted with a fish tail attachment. It is the vacuuming that is the key because that will remove any dust particles that may have lodged in the mesh during stretching and storage.

VACUUMING THE MESH

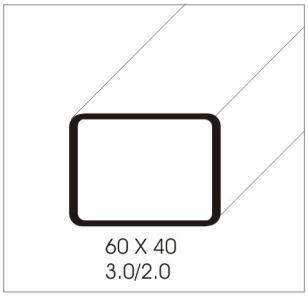


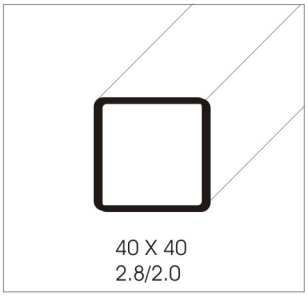
You can take the risk of not doing this but that is up to you. I prefer the security of clean mesh to down time and rejects on the printing press.

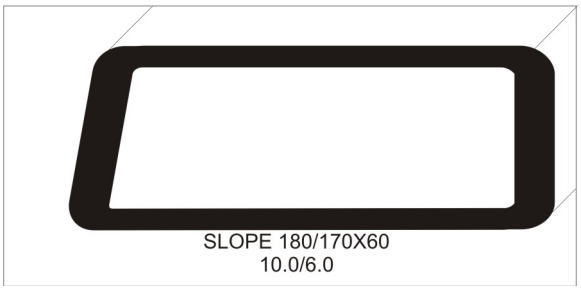
Years ago in an article I described that some stencil departments had more bows than Sherwood Forest, at the time I was describing the state of screen frames. The same rule still applies; if it is easy to see the bow on the frame it is likely to be too much. The frame is the foundation of the stencil. It has to be strong enough to withstand the forces produced by the tension in the mesh without distorting excessively. There will always be some distortion but it must not be sufficient to affect print quality. For this to be so the twist caused by bowing of the frame should not exceed 10% of the off contact or snap distance. The frame must also be light enough to be handled safely. To achieve this it will generally be made of an extruded aluminium alloy profile. Steel frames are still used in some applications but they are heavy and tend to corrode. Wood is best left in Sherwood Forest.

The profile of the frame is very important and as a general rule a frame profile that has a slope is more resistant to the tension in the mesh than a plain rectangle or square.

FRAME PROFILES







Things have improved companies have recognised the importance of a stable frame and now consider them a consumable item rather than a capital item. My preference is to leave the responsibility with your stretched mesh supplier and lease them from them.

No matter how good the frame is if you drop it on its corner with a stretched mesh attached the tension in the mesh could cause the mesh to split or even worse spring the welds on the corners of the frame. There are very high forces involved, with just a 1 metre frame size and 20 Newton of tension, the load on each member of the frame is 200 kilograms. That is a couple of fat lasses sitting on each side. (Ed. You can't say that, say front row forwards.)

This is the month of fools and it would be foolish to say screen printing is doomed however many lessons have been learned over the years and it is crucial that we take heed of them. The application of consistent process control is the key. My work takes me to many different screen printing applications all over the world and I am generally there because they have a problem. The easiest people to deal with are the engineering companies who want to apply best practice and are willing to learn. Their quality requirement takes them to the leading edge of the technology, sometimes they set impossible tolerances that are unnecessary, other times they run the clean room too cold or too dry but they are consistent and once they grasp the strengths and limitations of the process the results achieved are spectacular. Graphics and point of sale printers can have a culture of misunderstanding to overcome where bad practice has become

embedded in that culture. Those that are unwilling to adapt to best practice will fail, others will drop screen printing and try to adopt digital printing as their lifeboat. The good ones want to find ways of getting better, when they do the print quality can be sublime. Instead of digital printing being held up as the pinnacle of print quality screen printing comes to the fore with its vibrant colours and complete lack of banding that is so common in digital print.

April 1st is past now a good screen printer is nobody's fool he is a master of the process and fortunately there are still quite a few out there.