BASICS OF THE STENCIL
PDS International - Courtesy of: Peter Kiddell

WHY DO WE KID OURSELVES THAT WE CAN MANAGE WITH SUBSTANDARD SCREENS?

Rant who me! The process that we all have a love hate relationship with is screen printing. By jove, it has become a lot more sophisticated in recent years and surely will continue. If controlled it is a predictable reliable process. If not it's a nightmare. So, why do some (even many) printers use screens which are at best poor and at worst garbage.

The stretched mesh is the foundation of the process. If this is unstable then you are chasing your tail. Excellent meshes are available from the likes of SEFAR, Saati, NBC and G Bopp. These meshes are precisely engineered from finely produced materials. If you have ever been fortunate to see a weaving room and the pre and post treatment that the mesh goes through as well as the quality checks that are made you will treat it with the respect it rightly deserves.

Well where do people go wrong? It starts with the fact that some accountants, (there, I have said that word again), treat stretched mesh and frames as capital rather than revenue items. The frames are purchased and they sit there for years until depreciation deems that they can be replaced. Long before then they have been ground away to uselessness and stand like twisted willows in the stencil room. But don't worry the screen clamps will straighten them out and metallised adhesive tape will pull the split mesh together. You might as well use granny's' knickers!

So what should you do? Start with the frame. The frame must be robust enough to with stand the tension in the mesh such that the inevitable twist on the frame is less than one tenth of the snap distance. Yes, the laws of Physics state that for every action there is an equal and opposite reaction. On a screen frame we are talking about major forces. If a screen was stretched such that it's working tension was 20 Newton cm. The loading on a frame of 1m square would be approximately 200 Kg; 440 lbs. on each side. For a larger frame the loading increase will be directly proportional to the length of the frame sides. So there is a balance here between the strength of the frame and the tension in the mesh. Some people seem to be obsessed with using higher and higher tensions. Across the pond I am aware that manufacturers of self-tensioning frames propagate tension figures of 60 Newton cm and higher. Although they may not think so even they are governed by the laws of physics. Too much tension can make the stencil more fragile and can take the mesh close to or past its elastic limit resulting in irrecoverable loss in tension.

Why do we need tension in the mesh? Firstly to provide a mechanically stable platform for the image and secondly to enable the mesh to pull away from the wet ink film and provide an efficient release of ink from the mesh. Tension is the hidden "designed in" energy of the screen printing process, for it to be effective it must be consistent across the screen, better than 1 Newton cm and consistent from screen to screen in a multicolour set. If the tension varies, the size of the image will vary and the ink lay down will alter. Don't forget to keep the snap distance the same for each colour in a set. If you use peel off keep that the same also. And the same size squeegee. Of course if you have sufficient tension you don't need peel off and the snap can be reduced.

Let us return to the frame, its stability and how it responds to the mesh tension. Firstly unless registration and ink deposit is unimportant don't even think about using a wooden frame. I find it very difficult to justify the use of wooden frames. Although I am sure there are reputable companies that make high quality frames from seasoned wood and screen printers that our happy with them. Their inherent instability provides a variable in the screen printing process that is unnecessary, particularly at higher tensions.

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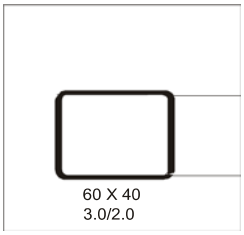
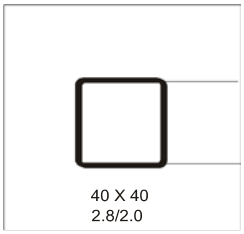
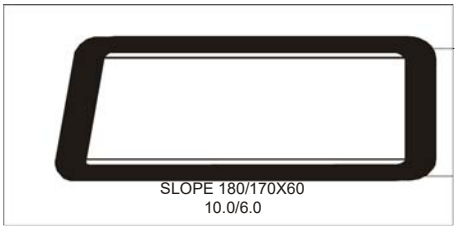
Aluminium alloy provides the most suitable material. There are different profiles available in the market, but the key issue is how flat they remain when under working tensions. If your supplier cannot tell you the how a given frame will perform in terms of deformation then they probably do not understand frames. Frames are normally extrusions, however those in the electronics industry are often castings, the CD industry uses flat steel.







TYPICAL FRAME PROFILES

The question is what amount of frame distortion is acceptable. A simple rule is if you are trying to print close tolerance work and you can see it at a glance, it is likely to be too much. The side bow is an indication that the frame beam is twisted (out of flatness). This twisting effects the off contact distance. The change in off contact (out of flatness) is typically 1/5 of the amount of the bow or arch. How this will effect the print quality will be dependent on the target off contact distance. For most applications a variation of 10% of off contact will not be a major problem. However with higher tensions and small off contact distances this twisting (out of flatness) can be disastrous. It will effect the amount of ink laid down, alter the size of the image and over stress the mesh. It is the flatness of the frame when stretched to the desired tension that is a key parameter.

TENSION

I think it is fair to say that the industry historically has been treated very shabbily when it comes to the issue of providing meshes stretched to a desired tension consistently. It has been so bad that the tension of incoming stretched mesh has not been measured by the user and the supplier has relied on this to provide mesh tensions that were in tolerance more by accident than design. It is impossible to estimate what the cost to the industry has been but I am aware of companies who were losing 20% of their production capacity and creating thousands of pounds a month in rejects because of it. We are talking millions of pounds across the industry. This is simply outrageous! However you cannot just blame the suppliers, if some printers are daft enough to accept poor quality stretched screens and always go for the cheapest, whose fault is it?

So what do you do? You decide what tension you need set a tolerance, agree it with your supplier and measure it. If the stretched screens are out of tolerance when they arrive send them back. The instrumentation you need is at minimum a mechanical Tensiometer covering your working range. It should be regularly calibrated and checked against your suppliers' instruments, costs start at £250.00.

Ideally it should be an electronic Tensiometer costing some £1,700. The mechanical device is really only a comparator but is adequate if you are a small volume user of screens. You need to measure the tension over the image area of the screen, typically on each corner and in the middle. Two readings should be taken at each point once along the warp and once along the weft.

Deciding on the tension is not just a figure you pluck out of the air it is dependent on the tack of the ink and the size of the frame. Sometimes a mesh manufacturer states the maximum tension for the mesh. This is not what you use as a printer. This is the tension a stretcher should take it to. Once stretched and glued it will decay to your target tension. A rule of thumb for deciding the maximum working tension is two thirds of the maximum recommended tension. Recommended tensions are based on a 1m square frame, for frames up to 2m reduce the tension by 15-20% and for up to 3m 20-25%. Remember that the deflection of the mesh by the squeegee increases the tension, as does the application of peel off. This is all too apparent when a screen bursts on set up or during production. The mesh has been taken outside its elastic limit, into its plastic stage and on to failure. To do this you would have increased the tension to nearly twice its recommended tension. If you took the tension into its plastic stage without actually splitting it you will see a dramatic loss in tension 25-50%. Attempts to raise the tension back up again by increasing the snap or winding on a self-tensioning frame will just exacerbate the problem.

Another key aspect of mesh stretching is the time lapse between stretching and manufacture for use on the press. 48 hours is the minimum, ideally 4 days. Any less than 48 hours and the mesh and frame have not stabilised, resulting in the mesh being unstable and your target tension being compromised.

The sequence of selecting a stretched mesh is:

- Determine the image size.
- Determine image type. Fine line, tones or bold text, background.
- Decide what ink film thickness you want. This will determine your mesh specification. If you are using direct projection you will have to use white mesh, for all others use coloured mesh.
- Know whether it is a high tack ink or a low tack ink. This will guide you to the tension range you will need to overcome the tack.
- Decide on the tension and stay with it. It is better to be constant.
- Set the tolerance on the tension of a screen and between different screens in a set.
- Set the angle of the mesh. (Only if conditions warrant).

The above will determine the frame construction. A good supplier will recommend the most suitable frame.

This sequence may seem a little over the top and it may well be for a single colour poster printer. For a large format printer with a four or five colour line or anyone where close tolerances are essential it is fundamental. Consistency is what we are all aiming for.

There is a lot more to stretching mesh than meets the eye hopefully other authors will be forthcoming.

A cynical (realistic) supplier of stretch frames was heard to say. “Stretching mesh is easy. Just give your customers wonky tension meters!”