

Decisions that are made by screen printers as to the suitability of a technique, a consumable or equipment are often based on incorrect information. For those of us who need to wear glasses or contacts we will know the expression “Better or worse” as lenses were mounted into a wire contraption placed on ones face. Those words were spoken by a congenital halitosis sufferer or very occasionally a flaxen haired maiden wearing a Janet Raeger slip and Chloe perfume. Both can effect decision making, in either case one can end up constantly seeing slightly offset images without the use of alcohol. The maiden causes one to lie about ones eyesight to deny the effects of age and the oral furnace encourages you to leave as soon as possible. Nowadays in opticians you are sat in front of a computer screen viewing it through an optical sight, the decision making away from you and now you have that nymphet simply caressing her keyboard into printing out the prescription that can be fed directly into a lens processor. The equipment measures the optical performance of your eyes and provides an objective decision, ensuring your lenses are correct whether you are distracted or not. (Editor: Peter forget the nymphet and talk about stencil measurement)

In screen printing the stencil is the image carrier in the process of “Replicating the original image and laying down a controlled thickness of ink.” NEVER in the last 13 years as a consultant has a client not been able to make substantial improvements to their stencil making facility. Knowing what is required and what is happening is Process Control. Get this area of screen printing wrong and the whole business is compromised.

How do you define a good quality stencil? It depends what you want to do with it. Good edge definition and fine detail require the edge of the image on the stencil to be smooth and the smoothness of the underside of the stencil sufficient to form a proper gasket so that the ink does not leak up the undulations in the coated mesh. The tension on the mesh has to be sufficient to over come the tack of the ink with a reasonable snap distance immediately after the squeegee has passed.

Whatever form of emulsion or film you are applying to the mesh to create the image in the stencil the mesh, the mesh determines the thickness of ink deposit. The thickness of the emulsion or film (known as the stencil thickness or emulsion over mesh) only affects the very edge of the image. Of course if you are printing tones or four-colour process the stencil thickness effects the ink film printed in the dot patterns and thus has a considerable effect on the colour.

STENCIL PARAMETERS



Starting with the frame, this has to be strong enough to withstand the loads that are exerted upon it by the tension in the mesh. Every frame will deflect, when it does it will

bow and twist. The twist will be 20% of the bow and the twist must be less than 10% of the snap distance if it is not to effect print quality. The smaller the working snap distance the greater effect of frame twist.

It is a useful quality check on frames during their use to weigh the frame before it is first used and then weigh it before each re-meshing. Every time a frame is re-meshed it is necessary to remove the previous adhesive. When this is done some metal is removed resulting in a weakening of the frame. Weighing will tell you how much has been removed. Re-stretching a substantially weakened frame is a waste of mesh. You may be thinking "This guy has lost his marbles," no it is common sense.

Then we come to stretching the mesh. If you think this is easy you are not taking sufficient care. You need to know the precise characteristics of each bolt of material before you stretch. You would measure the mesh thickness, check the mesh count, thread thickness and probably do a test stretch before producing stretched frames. When you are doing this you need to know the ambient conditions. Measuring tension at this stage should only be done with a calibrated Electronic Tensiometer. Stretching mesh correctly is like tightrope walking, it should be left to the experts.

Once the stretched mesh is ready for processing check the tension, if it has dropped more than 2 Newton cm from the stated tension reject it. It may be that your tolerance is tighter than this. A drop in tension from that specified indicates problems during stretching which will cause problems later in its use. Remember you must not use a stretched mesh within 4 days of it being stretched. Once into stencil production it has to be degreased. (But my mesh has been pre-treated and doesn't need degreasing). Oh yes it does if it has been handled or stored anywhere but in a clean room. Having degreased it use a wet and dry vacuum with a fishtail attachment to remove excess water before drying at close to ambient temperature.

Coat the clean mesh as soon as possible use the coating regime that suits your application. Making sure the emulsion has degassed and the correct amount is put in the troughs. Surprisingly viscosity of the emulsion is not so critical coater settings have the greater effect. You say "I don't use an automatic coater." Well that's tough because unless you are very highly skilled producing a high quality hand coated stencil consistently is nigh on impossible. If you can't use automation use capillary film, although relatively expensive it can give a very good quality stencil even when applied by hand, applied automatically it really takes some beating.

Then we come to drying: "Oh my gawd!" Head in hands, silent primeval scream. A friend of mine (my only reader) said he read last months article and it seemed to be written by "Pissed off from Penge." No it was "Frustrated from Falmouth." Down in Gods Country where we are never more than 16 miles from the sea the humidity is nearly always high. When we hang us smocks out to dry if the wind don't blow us smocks ul' never be dried m'dear. The same applies to coated mesh.

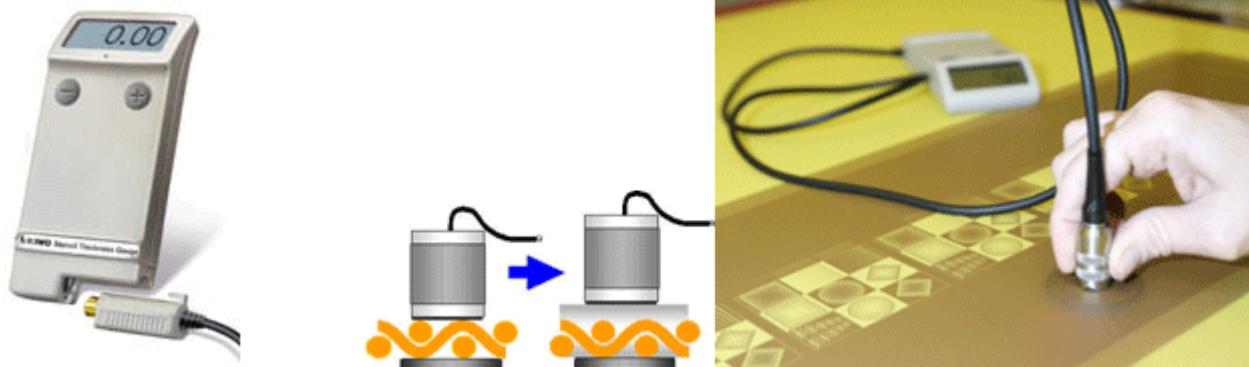
You need filtered dry air blowing across the surface to dry the film properly. If you simply rely on temperature without air movement in an enclosed cupboard you will produce a



sauna environment. And you know what saunas are like particularly if the flaxen haired optician is there, everything sweats. If the dryer is above 40°C a chemical reaction will take place and you will get fogging on the stencil. You need to know the temperature and humidity of the environment in the dryer and you need to exhaust it outside the dry side of stencil production. When you take the stencil out of the dryer expose it as quickly as possible. If you have to store it for more than an hour dry it again for five minutes. A dry stencil will absorb moisture from the air in minutes. The higher the humidity the worse it is. We know that more than 6% moisture content in the emulsion will stop a complete cure no matter how long it is exposed.

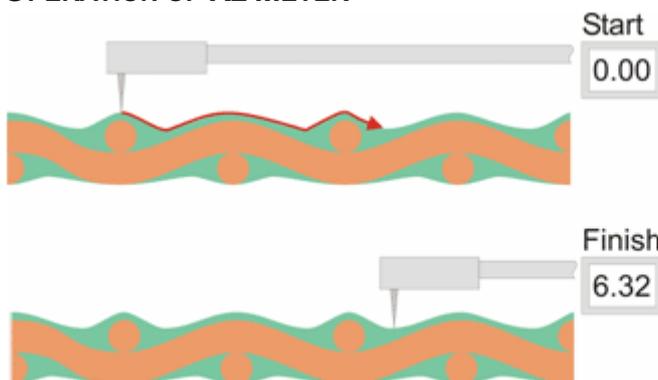
You check the stencil thickness before you expose just to ensure there was not a slip up in coating. There are several methods for measuring stencil thickness the most widely used being a capacitance probe.

STENCIL THICKNESS GAUGE KIWO



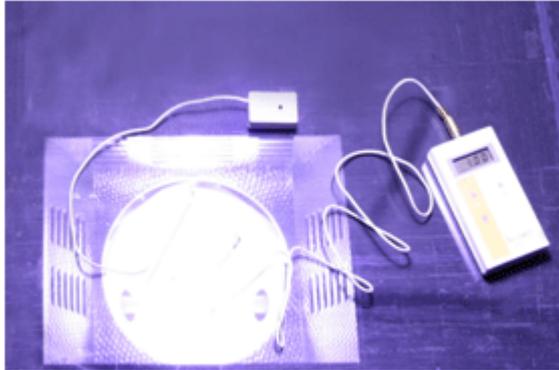
If the gasket effect of the stencil is important also measure the Rz. As mentioned before a rough stencil on the substrate side will give poor edge definition to the printed image. The Rz is measured using a device that pulls a stylus across the surface over a known distance the device measures the deflection of the stylus and produces a read out of roughness in microns.

OPERATION OF RZ METER



COURTESY OF KIWO

You would have done your exposure calculations to ensure the cure will be complete and you are resolving all the detail, wouldn't you? The exposure unit is fitted with an integrator that determines the level of UV energy is correct. You can check the performance of the UV exposure lamp with a measuring instrument.



COURTESY OF KMW0

If you don't know what I am talking about, worry. Photopositives used would have been stored in the dry area. A 100 cm photopositive will move 180 microns with a 10% change in humidity. Throw in the effect of temperature in the UK climate the change can be more than 500microns 0.5 mm. That is out of register. Uncontrolled exposure will throw in more dimensional variables.

Develop the exposed stencil in an automatic developer. There is a huge difference between automatic and hand developing, both from a cost and quality point of view. Dry the stencil again at near ambient temperatures and then inspect. This is where instrumentation will confirm that you have got it right through the process. Up until now you have measured tension in the mesh checked the mesh count, measured temperature and humidity in the dryer and the dry side of stencil production measured emulsion thickness and if possible the moisture content of the dried emulsion.

The final checks on the stencil should be much quicker if it has been processed correctly. Pinholes, one of the constant problems in stencil production is caused by dirt, dust and incorrectly dried emulsions. The recurrence of pinholes will be much reduced. Effective development will wash out the finest of details. The limitation being thread interference with the open area of the emulsion. With the correct exposure of a dry emulsion maximum mechanical and chemical strength should have been achieved. Having a dry emulsion means that it is unlikely that the image would be compromised by over exposure. Recent developments in instrumentation have made it possible to measure the step wedges on the stencil.

This equipment is based on litho plate measuring devices. In the case of screen stencils the instrument measures the tone values on the step wedge by sensing the difference in colour density between the mesh and the emulsion when they are illuminated from behind. These are very useful tools and provide the missing link in the chain of process control. We have been able to measure the tonal values on a photopositive with a transmission densitometer and the printed image with a reflection densitometer, it has



been the interim stage that has eluded us until now. Instruments are now available that can measure positive and negative dots on the photopositive and positive and negative dots on the stencil. This gives us a direct comparison that shows the efficiency of the exposure and development processes.



COURTESY OF TSS TECHNOLOGY

An electronic digital scale is a useful tool for measuring longer lengths, with careful use the tolerance of 10 microns on these devices is attainable. Checking a larger image by laying a photopositive on the stencil is fine as long as you know the ambient conditions and make allowances for any dimensional changes in the photopositive caused by the varying conditions.

At this stage you now know the quality of stencil you are giving to the print room. If you do not monitor these parameters on the stencil you are taking an unnecessary risk with every stencil. The tolerances on the measurements are dependant on the type of work you are doing, information is control ignorance is not bliss it is irresponsible. If the stencil is wrong you won't know until you have printed and then it is too late the profit has leaked

