2002
JULY

ENGINEERS USE MICROMETERS, SCREEN PRINTERS USE GUESSWORK

If you are in the fortunate position of having made it, stashed it away and are not tied with guarantees to the company overdraft then you probably need not bother to read any more. If you want to survive and prosper then read on.

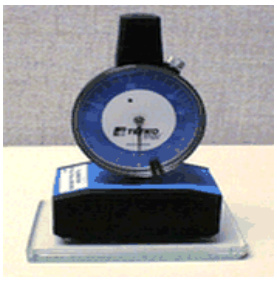
Probably the most surprising aspect of the screen printing industry is that many of its practitioners don't measure any aspect of the process. How some companies have remained in business is amazing.

Why do screen printers think that they can "make it work", "keep it going" and "get it out on time" and still make a profit when the process is not controlled. But we have always done it that way. "Not any more sunshine". The hot breath of competition and alternative technologies will see to that. For screen printing to continue as an important aspect of printing technology it has to cast off the mantle of "Black art" and stand along side other engineering processes. An increasing number of printers are recognising the need to control the process for without controlling the process they lose control of their profitability.

In the May and June issues I spoke about stretched screens and squeegees respectively. In both cases quality control was paramount.

THE STENCIL

Every text book, article and item of technical advice talks about mesh tension. This is the crucial hidden energy of the process. Again most screen printers do not measure mesh tension on a regular basis and some never. Of all the instruments available to the screen printer the one I would say is essential is a tension measuring device (Tensiometer).



COURTESY OF G BOPP LIMITED

These come in two form, mechanical and electronic. Both display the deflection caused to the mesh by a controlled force. The mechanical version costs between £250 and £300 and the electronic £1200 to £1500. Placed on the mesh at prescribed positions they will tell you how the mesh is likely to perform its job of lifting away from the wet ink film. Target tensions will vary depending on the particular application. Ranging from 15 Newtons to 25 Newtons for Polyester Low Elongation Meshes and higher for some steel meshes. The target tension is important but consistency over the screen and from screen to screen is more so. Variations in tension on a multicolour print can push registration out by millimetres. Too low a tension will pluck wet ink up from the ink film and give that orange peel effect with consequent uneven colour.

Additionally the stencil will degrade more quickly. It is not only the mechanics of printing that are effected by low mesh and uneven tensions. Coating the stencil will also be less reliable when this occurs. There are many other negative effects experienced throughout the process because of unreliable mesh tensions.

Aim for your target tension +/- 2 Newtons. A multi-colour set must all be within +/- 1.0 Newtons.

The combination of a correctly stretched screen and a robust frame provide the firm foundation that is essential to consistently high quality screen printing.

Temperature is a key issue when it comes to tension. During recent stencil production run a temperature change of 13 degrees centigrade caused a 4 Newton variation in tension. Not only is measurement of tension critical but you must also be aware of ambient temperatures.

As well as checking tension it is also recommended to be sure that the mesh count of stretched mesh is within tolerance. Experience tells me that variations of more than two threads per centimetre from the stated mesh count on mesh from a reputable supplier is unusual even when the tolerance is 3%.

COURTESY OF G BOPP LIMITED

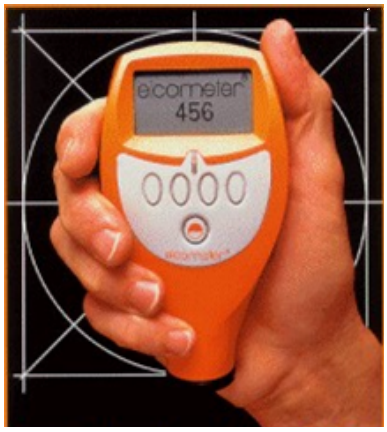
A mesh counter is the tool to use. Its magnification of 50X is also an excellent tool for checking stencil edge definition. Again it is consistency that is important.

There are also indicator films that can be placed on the mesh and rotated to indicate the mesh count. These are simple and quick method of checking.

MESH AND STENCIL THICKNESS

Mesh thickness is an important parameter this can be checked with a stencil thickness gauge available from most emulsion and capillary film suppliers. Stencil thickness is determined by measuring the mesh thickness and subtracting it from the overall mesh plus emulsion thickness.

For four colour process work using water based inks a maximum of 4 microns is acceptable. For conventional UV inks 2 microns is the target. The stencil thickness effects ink build and excessive ink builds will result in excessive ink build, collapsing dots or skipping as your over print colours.

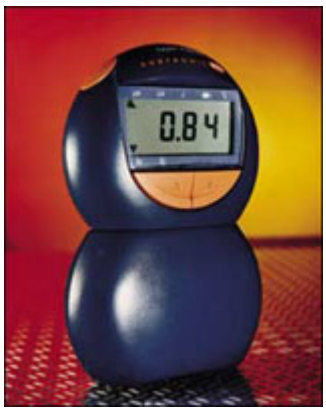


COURTESY OF ELCOMETER LIMITED

Stencil build also effects flatness of the print side of the stencil. If the stencil is not flat enough you will see the infamous “Star Dot” where the dots appear to have legs, where the ink has found its way out of the dot and along the valleys between the threads. Also the edge of lines will have a saw-tooth effect. Make sure this is not a poor quality photopositve where the pixillation of the output device is showing up. The aim is to have a gasket effect where the ink is contained within the image area.

RZ VALUE (FLATNESS)

Controlling the flatness of the stencil with the correct coating techniques or capillary film selection and application is key. The flatness is measured using an Rz Meter. This is a device that pulls a stylus over the surface and measures the vertical movement of the stylus in microns. The ideal is to have the Rz value less than the stencil build. For high quality printing on flat non absorbent surfaces 3-7 microns is normally the range.



COURTESY OF TAYLOR HOBSON LIMITED

The precise value is dependent on your application. The stencil can be too flat, if so the stencil will stick to a flat substrate and generate excessive static electricity resulting in splattering of ink also known as cob-webbing.

HUMIDITY AND MOISTURE CONTENT

Emulsions must by dried sufficiently before exposure for them to fully cure. The moisture content should not exceed 4%. If it above 6% they will not cure completely. Efficient driers are crucial, that means plenty of air movement and with the air having a relative humidity of 30%-40% or lower. A Hygrometer measures relative humidity and there are a whole range of electronic and non electronic instruments. As far as measuring the moisture content of the emulsion, this is one of the key measurements that is not easily taken. Equipment can be very expensive. To date I am unaware of a reasonably priced unit although there is work being carried out on such equipment.

EXPOSURE ENERGY LEVELS

When producing stencils carrying out exposure calculations when required is essential. It is also good practice to measure the effective spectral out put of the lamp. This is done with a Digital Radiometer.

A user can accurately measure and control the intensity, direction, and consistency of ultraviolet energy which reaches the emulsion when the bulb is new and during its useful life.

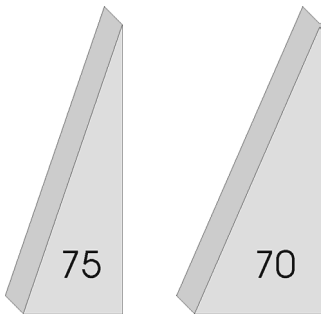
SQUEEGEE PARAMETERS

Printers know that the hardness of the squeegee has an effect on the lay down of the ink. Squeegees are provided in a range of hardness's quoted by the manufacturers. Do you know if the hardness is as stated? Often units of hardness are not specified just the colour, red, green, blue etc. Unfortunately there is no standard range of colours between the manufacturers. It is likely that 90% of users do not know because they never measure it. The instrument to measure the hardness is a Durometer Gauge. Good quality squeegees will maintain their hardness level for many months if stored correctly. Others will vary on receipt and get harder during storage.

ENGINEERS USE MICROMETERS, SCREEN PRINTERS USE GUESSWORK

I know it is not part of measuring the parameters of the process but it never ceases to amaze me how a printer will buy carefully prepared squeegee and then proceed to wreck it. Good squeegee manufacturers will produce an edge on the squeegee that is as smooth and as straight as possible. The printer will then put it in the squeegee holder and lacerate the edge on a squeegee dresser that appears to have spent time on a building site for sharpening pick axes. This is then mounted on the machine and produces an ink film with the profile of a ploughed field. When questioned about this act of vandalism the printer states he can't get it in the squeegee holder properly because it is clogged with dried ink or it is distorted. Well there you go! This way to the dole queue.

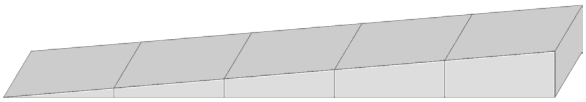
Other simple tools that help with consistency of setting are angle blocks. These are used to set the angle of a squeegee. Many machines have graduations on the squeegee holder that indicate the angle of the squeegee but they are often damaged or obscured. Simple blocks that can be placed on the machine bed to which the squeegee angle is adjusted are simple to use. These blocks can have the angle stamped on them as you may use different angles for different jobs.



SETTING SNAP DISTANCE

Most printers will set snap distance by pressing down on the mesh until it touches the bed. Similar to their method for measuring mesh tension. You might as well hold your finger over a tyre valve to measure tyre pressure. Another simple device is a calibrated wedge. This has a shallow angle with lines scribed across the top where the thickness of

the wedge is at 1 mm, 2 mm, 3 mm, 4 mm, 5 mm etc. If you are controlling snap distance to 0.5 mm.



Some more forward thinking suppliers can supply these free. Slipping the wedge gently under frame with its horizontal face on the machine bed will show you the height of the frame above the bed. Take this measurement at the front and rear of the frame to ensure it is level. Subtract the substrate thickness and you have the snap distance.

There are hand held electronic instruments available for measuring snap distance provided by major mesh suppliers.

CONTROLLING FOUR COLOUR PROCESS

A densitometer is essential for those serious about four colour process printing. Dot gain and dot loss and the density of the process colours are critical measurements. Guess work means process drift. There are a fistful of instruments available. Cheap does not mean value for money.

WHAT DO YOU BUY

The simple answer is all of them. For those on a limited budget the mechanical tensiometer and the gauges (you can make the gauges yourself) would be the start. If you were to have all the equipment the total cost would be between five and eight thousand pounds dependent on the choice of equipment. There is a supplier of the complete range of test equipment out there but it is no use me giving you their name because their sole UK agent did not have a clue what I was talking about when asked for prices. Then that is what we come to expect when we try to control the screen printing process. You don't need to measure it, it's a black art you know.