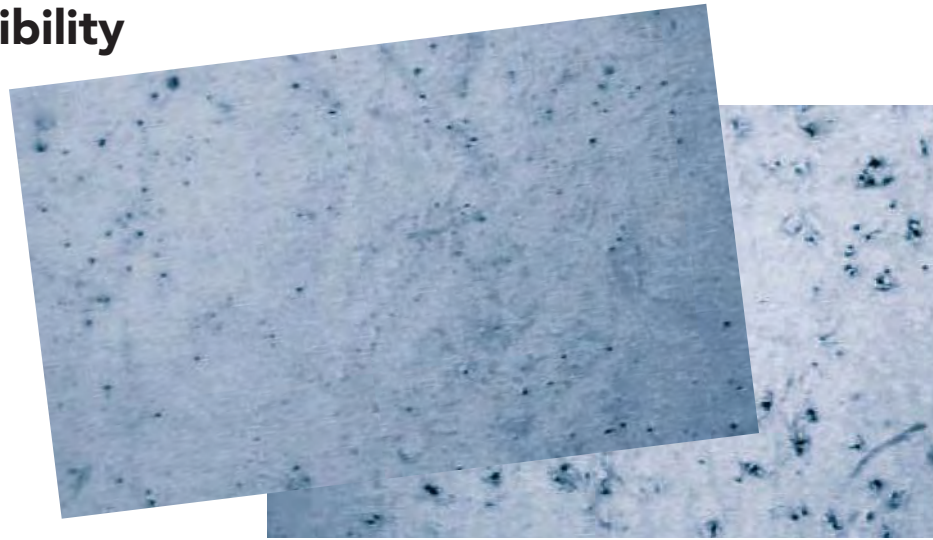


Screen Manufacture: Base for Printing Quality and Reproducibility



One of the key factors in the quality and reproducibility of screen printing is the manufacture of the screens. A screen consists of the screen printing frame and the mesh that is stretched and glued onto it. At first glance, screen production appears to be a routine job that poses no problems, however, it is in the detail that the difficulties lie, as we all know. The elements listed in Table 1 (page 40) and the way they interrelate are highly important when it comes to achieving an optimal printing result

Use Modern, High-Quality Mesh

The type of mesh depends on the screen-printing job. You should take note of recommendations from dealers, manufacturers and SGIA. It is worthwhile using high-quality screen-printing meshes. For example, innovative users are achieving better all-round results from newer mesh technologies that have a special surface treatment, enabling it to offer repeatable stretching values, excellent leeway for exposure, specifications within tight tolerances and a long stencil lifetime. Users enjoy a range of additional benefits depending on the application. Benefits include no degreasing, improved wetting properties and adhesion of the emulsion/capillary film on the mesh, excellent ink flow and easier re-

claiming - and there are also fewer ghost images, depending on the ink system. These benefits mean increased process reliability as well as better cost-effectiveness. (See Figures 1 & 2, page 40)

Don't Underestimate the Influence of the Screen-Printing Frame

Mechanical distortion of the screen-printing frame after the mesh has been stretched and glued, or during the printing process, can have fatal effects on registration accuracy. To make sure that the frame has the required stability, the profile must be adapted to the mesh tension and the frame format.

The choice of frame size depends on the size of the printed image and the type of printing. A zone outside of the printed image — known as the “ink margin” — always has to be factored in. Practical tests should be carried out to determine the ink margins that are required for each type of machine, at the sides and especially the top and bottom where space for the squeegee and floodbar are required. Table 2 provides minimum guidance values for this purpose, according to the size of the frame. If the ink margins are too small, it can lead to registration difficulties and unclear printing. The only way to ensure what print

Spending the **necessary time** and **resources** to construct a **quality** screen will have **huge returns** later in the workflow.

By **Monika Spirig**, Technical Area Sales Manager (Scandinavia, The Netherlands and The Baltic States), Sefar AG



Uneven gluing areas can lead to **contact problems** with the **mesh** during gluing.

Table 1

screen-printing mesh:

use modern, high-quality meshes

screen-printing frame:

only use high-quality flat frames with adequate strength

stretching system:

clean, well-maintained stretching systems (with frame pretensioning if possible) pay off

tension measuring device:

it is worthwhile purchasing a modern electronic instrument with a digital display and a calibration mechanism

glue:

the newest types of glue save time

formats a machine can actually handle is to carry out your own tests.

Pre-Treating the Screen-Printing Frame

Sharp edges and corners on the frame will quickly lead to injuries and breaks, especially in fine mesh grades. The most common method of removing residues of glue and roughening the area to be glued is to use a right-angle grinder with a rubber plate and a grit or fiber disc. The grain size for the discs should be number 24 or 36. Some drawbacks of using this method include:

- Frame material is often removed, leading to weakening and wear on the frame. It is difficult to judge when the wall thickness starts to be inadequate, meaning that a frame can no longer be used.
- Uneven gluing areas can lead to contact problems with the mesh during gluing. Tears in the mesh and inexplicably high-tension losses are the consequences.
- The job generates dust and noise, making it unpopular with employees.

Today there are a number of tried-and-tested cleaning methods which are more modern and involve no wear, such as those used for printing PCBs, CDs and DVDs. Examples include automatic frame grinding machines, high-pressure water, chemical

and sandblasting processes. The benefits: no wear means long frame lifetimes, the gluing surfaces are always polished and even, and there are no sharp ground-down edges.

Professional Mesh Stretching

Mechanical and pneumatic stretching devices are available on the market as well as combinations of both systems. Mechanical stretching systems have advantages when large frame formats are used and when it is necessary to adapt quickly to every frame size or to stretch several frames (of the same or different sizes) at the same time. On the other hand, pneumatic stretching devices have these strengths:

- During the stretching process, pneumatic clamps will push against the frame, pre-bowing it according to the tension value. This helps to maintain tension after the frame is removed from the clamps.
- The clamping force and the mesh tension are optimally matched. The mesh cannot slip out, even with the highest tension values.
- With modern pneumatic stretching clamps, the mesh is raised above the frame during the stretching process. This prevents undesirable friction between the frame and the mesh, and the screen tension is more uniform.
- It is easier to avoid the risk of over-stretching at the corners, which could lead to tears in the mesh.
- The air hoses are fitted with fast closures and the frame supports are

Table 2: Frame profiles and ink margin Recommendations for aluminum frame profiles (Hurtz profiles)

Frame length	Tension value	L x W x D (mm)	L x W x D (mm)	L x W x D (mm)	Ink rest side/up-down
65 cm – 70 cm	20	35 x 35 x 2.5	38.1 x 24.5 x 2.5	40/30 x 30 x 3.0/1.8	15/15
	25		40.0 x 30.0 x 2.5		
75 cm - 90 cm	20	40 x 40 x 2.8/2.0			16/16
	25			40/35 x 40 x 3.1/1.8	
100 cm - 110 cm	20			40/35 x 40 x 3.1/1.8	16/16
	25	40 x 40 x 4.5/2.0			
120 cm - 130 cm	20		50 x 30 x 4.5/2.0		18/18
	25		50 x 40 x 4.5/2.0		
140 cm - 150 cm	20			55/45 x 40 x 3.2/2.0	18/18
	25		60 x 40 x 3.0/2.0		
160 cm - 200 cm	20		60 x 40 x 6.0/3.0	65/55 x 40 x 4.5/2.5	20/20
	25			75/65 x 50 x 5.0/2.8	
220 cm - 250 cm	20		80 x 40 x 6.3/3.0	85/75 x 50 x 5.0/2.8	25/25
	25			90/80 x 40 x 6.0/3.0	
Material: aluminum. Width: up to approx. 70% of the frame length					

easy and quick to adjust. A stretching system of this sort can be ideally adapted to any desired size of frame.

Use care when inserting the mesh.

It is important to insert the mesh threads precisely parallel to the stretching clamps, so that they cross at an angle of 90°. There must be no space between the individual clamps. Depending on the application, size of the frame and stretching system, corner-softening should be performed at the corners to relieve potential tension that could overstretch and tear the mesh.

Clamp the mesh on pneumatic stretching systems.

A single-circuit system is adequate for frames with sides up to 150 cm (59 in.) long. All the clamps are closed immediately. The clamps at the corners must be flush with the inner edge of the frame. (see Figure 3)

Frames with sides longer than 150 cm (59 in.) require a dual-circuit system. The mesh should be inserted and stretched in three stages:

1. Insert the mesh on the two shorter sides and close the clamps. Position



Figure 1: Applying ink with SEFAR®PET 1500

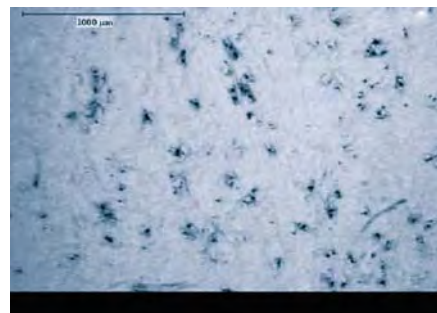


Figure 2: Applying ink on high-modulus mesh without a special surface treatment.

the corner clamps so that the ends of the clamps protrude from the frame by one profile width on both sides of the short frame side. Pre-stretch the mesh length to half of the desired tension level.

2. Insert the pre-stretched mesh on the lengthwise sides, parallel with the clamps, and close them. Use corner softening if necessary. Pre-stretch the mesh width, also to half of the final tension value.
3. Increase the tension in the mesh sides simultaneously, preferably in 2-3 stages until the final tension value is reached. (see Figure 4)

Clamp the mesh on mechanical stretching systems.

With mechanical stretching systems, the clamps protrude over the stretching frame(s) rather than touching them, but the procedure for them is similar to the one indicated for pneumatic systems. Corner softening is highly recommended to relieve the tension at the corners of the mesh and here again, the three stages for inserting and stretching should be followed for frames longer than 150 cm (59 in.).

Checking the Mesh Tension

Increasing quality requirements together with the need for high printing reproducibility make it essential to check the mesh tension carefully. Modern digital monitoring instruments guarantee accurate measurements so tension values can always be reproduced. Maximum process reliability can only be guaranteed, however, if the measurement accuracy is checked on a regular basis. This is why a calibrating device for tension-measuring instruments is more than just a useful accessory. (see Figure 5)

For multicolor printing, the tension values for the various screens should not differ from each other by more than ± 1 to 1.5

Maximum process **reliability** can only be guaranteed, however, if the measurement **accuracy** is checked on a **regular** basis.

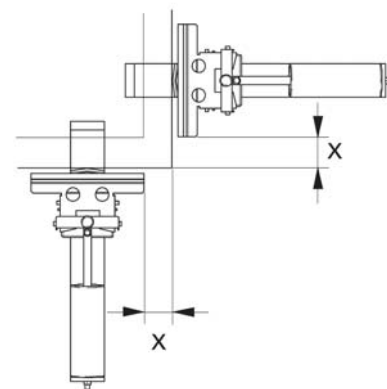


Figure 3: Positioning of corner clamps on frames up to 150 cm long

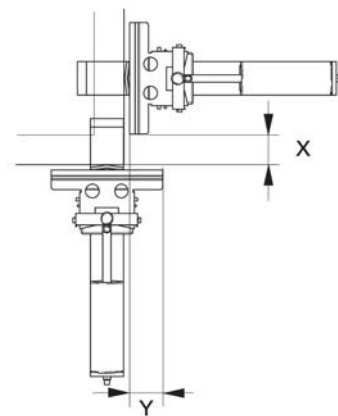


Figure 4: Positioning of corner clamps on frames with sides longer than 150 cm

N/cm. This requirement can only be met with first-class frames and meshes.

Gluing the Meshes Correctly

Dual component glues are used in most cases. These products, consisting of glue and hardener, are known as “reaction adhesives” and usually offer good resistance to solvents. The glue and the hardener must be carefully mixed together in the proportions indicated prior to use. The mixing ratio must be followed precisely, otherwise problems can occur in the hardening process and therefore in the bonding behavior.

Fast adhesives (cyanoacrylate adhesives) are also used in certain cases. They bond within less than a minute and they offer excellent adhesion characteristics and resistance



Figure 5: A modern digital tension measuring instrument: the SEFAR Tensocheck 100 with its calibration plate (Illustration to be adapted)

The **tension loss** must be **reproducible**, and must be kept as **low** as possible.



Figure 6: the SEFAR 51 programmable control unit

to solvents. However, only chemical methods are suitable for the cleaning the frame.

The higher price of fast adhesives is balanced out by the time they save. It is important to ensure continuous contact throughout the entire area when applying adhesive between the frame and the mesh, otherwise the bond will not resist the tension forces. You will soon see whether the glued surfaces are flat, or whether they were roughened by polishing during the cleaning process! The edges of the frame in particular have to be perfectly glued, otherwise solvents can penetrate and start to dissolve the adhesive.

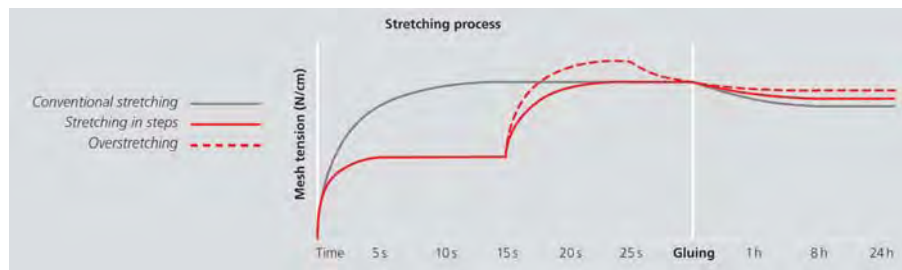


Figure 7: Programmed tension increase in stages

Loss of Screen Tension

Depending on the mesh quality, every screen displays a certain loss of tension after the mesh has been glued. This is due to the flow behavior of synthetic mesh materials and to mechanical yielding of frames that are too weak or have not been pre-bowed. The tension loss proceeds digressively, i.e. the loss is highest in the first half hour after the adhesive has bonded and the stretching clamps have been released. It then reduces gradually until it comes to a virtual standstill after about 24 hours, provided there are no changes in the ambient conditions (temperature). In practice, this means that: *the tension loss must be reproducible, and must be kept as low as possible.*

These factors have to be taken into account to achieve optimal reproducibility of the tension loss, even over lengthy periods:

- High-quality screen-printing meshes: use high-quality screen-printing meshes with low elongation and tension loss.
- Uniform stretching process: a clearly defined stretching procedure. The speed at which the tension is increased, the individual stretching stages and waiting times, and the time between reaching the final tension and gluing should be specified and always kept the same.
- Modern electronic controls for stretching systems can be programmed: Individual stretching programs for various types of mesh, applications and customers can be saved and called up as they are needed. These features mean that a specific customer order will always be stretched in an identical, reproducible manner. (see Figure 6 & 7)
- Rest period for screens: after stretching and gluing, the finished screens should be set aside for at least 24 hours. The tension loss reduces digressively over this time and it can virtually be neglected after this amount of time has elapsed.

The Payoff is a Quality Screen

The screen-printing process has many variables to contend with to produce quality prints. The screen is our foundation. The steps in its manufacture are critical and should not be overlooked. Spending the necessary time and resources to construct a quality screen will have huge returns later in the workflow. The process is one that should not be approached from a low-cost perspective. Doing so may cost you even more down the road.