MESH TENSION TIPS FOR REAL LIFE

Practical Ways of Reducing Mesh Failure in High Tension Mesh

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Without a doubt the single easiest thing that you can do to improve printing quality is to increase mesh tension. There have been numerous articles published in the trade press over the last three or four years about the value of increasing mesh tension. All of the major mesh manufacturers have released new fabrics that are “low elongation, high tension.” The quest for higher and higher tension continues with some progressive printers now operating in the 60 to 100 Newton/cm^2 range. While this is higher than the majority of shops can reasonably handle at this time, it is a demonstrated trend, and the printing results can be quite dramatic.

With the advance of high-tension printing techniques, I often hear from printers that they are confused by the claims, and often question the purpose for printing at such high levels. This month I would like to discuss some of the reasons why you would want to print with such high tension and some of the consequences. Also a few tips on the care and handling of these high-tension screens are important.

To begin, mesh tension is only one part of a complex series of “interface forces” that are involved in printing. In a simplified approach, there are seven primary interface force regions that must be overcome before we can achieve a print. They are related in that if we increase one area of force, we can take force away from another area. These seven major areas are:

A. Off contact.

B. Squeegee durometer.

C. Squeegee speed (shear rate)

D. Ink viscosity.

E. Mesh tension.

F. Mesh percent open area.

G. Squeegee pressure

Each one of these factors has an influence on how ink is transferred from the inside of the screen to the surface of a garment. There is a certain amount of energy necessary to overcome the adhesive characteristics of ink as it touches the inside of the screen, the squeegee, the mesh, and the garment itself. By controlling the amount of tension, we can control how the ink is transferred, and where printed ink will end up (i.e., it is more desirable to print the surface of a garment than to print through the garment onto the platen).

Of all of the outlined areas, the only one that we cannot control is viscosity of the ink. Since viscosity varies directly with increasing temperature, we are at a loss to accurately control it. The hotter the shop, the more heat from the flash units, and the more friction in the screen from the mesh and squeegee, the more difficult it is to control viscosity.

Since this is the case, we can reduce the applied forces in all other areas by increasing the mesh tension. Because we are overcoming six other primary forces by increasing the mesh tension, it is desirable to have as great a tension capacity as possible with the mesh count we have chosen to work with.

The percentage open area of the mesh is controlled by the manufacturer and is primarily related to the diameter of thread. The larger the percentage of open area, the thinner the thread. Thin threads (S threads) make it very difficult to obtain high mesh tensions as they do not have enough support area to bear a high-tension load. For this reason I normally do not recommend using an S thread for high-tension printing. Like everything else in this fast-developing technical area, recent advances in weaving methods and filament materials are changing the tension levels attainable with thinner thread diameters.

The higher the tension, the more accurate the press must be. This is a very real problem on automatic presses where there are multiple platens. All platens must be in the same plane and be level side to side and front to back. If they are not, extra pressure must be added to the squeegee to compensate for fluctuation in the platens. This results in prints where squeegee pressure is light in some areas and excessive in others. To control ink deposit, the pressure must be uniform over the platen and uniform from platen to platen. Excessive squeegee pressure is one of the things we are trying to eliminate. Without the press being properly set up we defeat this objective.

Besides the press being accurate, handling of the mesh becomes a very important consideration. Printers embarking on the high-tension route are often discouraged by screens that rip during stretching, fail on their own, or rip on the press, and screens that are destroyed during the reclaiming process. High-tension screens seem to be extremely fragile and have a mind of their own. The frustration is further compounded by the higher cost of fine meshes like 355 and 390.

Mesh failure falls into three major categories. The first is overstressing of the filaments and the second is abrasion or shock. The third factor is fatigue. If we are careful, the fatigue factor will be less important than the first two.

When stretching mesh, failure results from bringing the tension up too quickly. This is particularly true in the corners. Because you are elongating in two directions at the corners, the mesh is stretched twice as quickly. The result is often burst fabric as localized tension skyrockets in the corner. If the frame system that you are using requires the mesh to be held in a channel at the frame bar, overtensioning in the corners often results in a localized pressure point of the frame bar to mesh. This can cause the bar to pierce the mesh at the corner, resulting in failure of the screen. Regardless of the frame or stretching system that you use, overstress of the corners is a primary concern.

The second form of overstress is taking the initial mesh tension up too rapidly. If you have many mesh failures where the fabric tears down the middle of the screen, or rips 1 inch in from the frame bar, there is a very high chance that you are taking the tension up too high on the initial stretch. Reduce the initial tension 3-4 N/cm on the first go-round. Wait 15 minutes or so, and then increase in 2-3 N/cm steps until the desired final tension is achieved. Allow the mesh to rest and stabilize about 15 minutes between each increase. Each manufacturer will have its own recommendations for its mesh. Use these as guidelines while observing how your screens handle in production. If the screens are failing early, be more conservative in your stretching procedures.

One sure way of telling if you are overstressing your mesh is evidenced by what I call *spontaneous failure*. This is where the screen fails (rips) on its own with no one nearby. It often happens just after reclaiming or while the screen is drying in the rack before coating. Sometimes it will fail with emulsion on it, although this is less common.

Abrasion and shock are the next largest causes of high-tension failure. These are preventable with experience.With low-tension screens the mesh acts much like a trampoline when it is struck. The low tension allows for some “give” in the mesh. The higher the tension, the less capacity you have for bumps and bruises. Any type of bump will cause localized damage to the mesh filament that ultimately results in failure. This is particularly true with what I call “bar nicks.” These are small cuts and nicks that appear on the frame bar with normal handling. If they are small, they can be repaired with Super Glue. If they are large, there is great danger of failure. Most of these problems can be solved with mesh protectors or tape.

Another type of common abrasion failure is caused by nicks and surface roughness in the squeegee and floodbar. The floodbar is the most common culprit. Almost every shop that I have been in is guilty of damaged floodbars (including our own)! Sharp edges of the aluminum are extremely prone to damage. The best way to tell if you have nicks capable of tearing the screen is to run the fingernail of your index finger down the length of the blade. Your nail is capable of finding extremely small variations in the edge of the blade. Use 320-400 grit wet/dry sandpaper to remove any variation that you detect. This must be done *every time* the squeegee and floodbar are put into the screen.

Fatigue failure is the last area for discussion. Any material has a fatigue point at which it breaks. Remember when you were a kid and you would bend a paper clip back and forth until it broke? This is essentially what happens to your mesh after repeated printings. Our objective is to handle the mesh in such a way as to prolong this type of failure. It will happen at some point. The single biggest thing that we can do to increase its life is to reduce the off contact. The lower the off contact, the shorter the fatigue cycle. If your off contact is 1/8", the cycle is 1/4" (down and back up). By reducing the off contact to 1/32", the cycle is now only 1/16", a 4X reduction in the cycle. Likewise, if the off contact is lower, the squeegee pressure will also be lower, thus reducing the abrasion factor.

As the degree of sophistication continues to increase in this business, we have to readjust our thinking and processes to be successful. This is particularly true in the area of mesh tension and handling. The higher the tension, the less margin we have for error. Constant attention to the tasks at hand will result in successful effort. Because of the reduced margin for error at higher tensions, you will continue to experience failures until you can bring the areas that we have discussed under control. As a general rule, you should be able to expect a mesh life of 8 - 10X that of conventional stretch and glue with properly tensioned and prepared frames. If your experience is significantly less than this, focus on how you are handling the fabric.