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Understanding Push and Pull Compensation

The **Push and Pull Concept** is a hard one to grasp especially if you are new to embroidery. It is easier to understand if you know something about fabrics in the first place and understand how fabric is created but for most embroiderers, this has never been part of their training. If you are a home sewer, then you know what a knit fabric is and what a woven fabric is. Many embroiderers do not even know the difference between a knit fabric and a woven fabric.

Three Main Types Of Fabrics

The 3 main types of fabrics that we are going to talk about are the Woven fabrics, Knit fabrics and Terry cloth.

Woven Fabrics

Denim shirts, pants, jackets, a piece of canvass such as a tote bag or a Carhart jacket, a thin nylon windbreaker or heavy denier tote bag, loosely woven waffle weave fabric such as a bath robe and Linen fabrics such as table cloths, napkins and guest towels are all woven fabrics. Most caps are also woven fabrics. These fabrics are usually very stable in nature and do not stretch very much.

Knit fabrics

A t-shirt, a golf or polo shirt, a sweater, a sweatshirt and a Lycra garment are all knit fabrics. These fabrics have various amounts of stretch and must be compensated according to the weight and stretchiness of each fabric. A fabric that is an open knit or a loose knit will require more compensation than the fabrics that are more stable. Terry cloth is another type of fabric that must be dealt with in a different manner. We will talk about that later on in the program.

What is Push and Pull Compensation?

When the needle goes down or penetrates into the fabric this is called the penetration point of your stitch. As the top thread in the needle penetrates the fabric it connects with the bobbin thread and as the two threads connect it creates a pulling effect. This pulling effect is magnified if you have a long

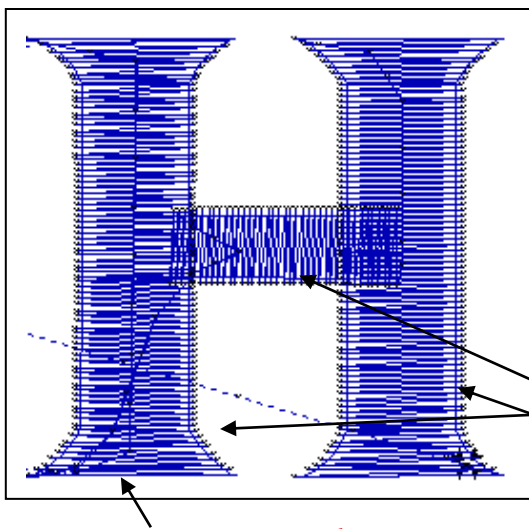
stitch or a stretchy fabric. The longer the stitch is, the more it will pull in. This is also true if your fabric is soft and stretchy.

When this happens you have to make your stitch even longer to compensate for this action. This is called **Pull Compensation**. When you create a design to sew out on a denim shirt and on a knit golf shirt, you want the finished design to look the same. It will not unless you add stitch length to compensate for the amount of give or stretchiness in the fabric.

This is very evident when you are working with shapes; such as a circle or a square. How often have you created a circle, sewn it out and discovered that no matter what you do, it does not look like a circle. Many times when you are working with a square, oblong or a large filled segment you will experience some pushing out or bunching in the corner. This totally throws off your shape and it no longer will be squared off in the corners.

Most fabrics require that **Pull compensation** be added in order to compensate for the push and pull effect brought about when you stitch a design into the fabric. All types of stitches create the push-pull effect, but it is most prominent when you are using Satin path or Complex fill stitches.

It is also very prominent when you are sewing a large area. The larger the area, the more push and pull you will have. The longer the stitch length is, the more you will have stitches pulling in from the edges. Knit fabrics are known for their pulling in. The softer the fabric the more you will have this push-pull effect.



The **Push or Expansion** area is the open end of the segment or column. This is on the opposite side of the penetration points. You must bring in those areas or cut them short. This is called **Push Compensation**. It does not matter if you are working with a letter or a shape. It also holds true with the angles of your shape.

Pull Points of the letter

Expansion or Push points of a letter-Open End

What Are The Determining Factors Of How Much Pull Comp To Use?

The amount of stitch length or pull comp that you add depends on how stretchy the fabric is, what type of underlay or how much underlay you are using or how wide the column of your segment is.

If your column or satin stitch is 2 millimeters wide you will only need to add about .15 millimeters to your width but if your column or satin stitch is 5 or 6 millimeters wide you may need to add .25 or .3 millimeters to the width of your stitch depending on how stretchy your fabric is. On a fabric that has a lot of stretch and texture such as a pique, you may need to add as much as .40 millimeters for your Pull Comp.

If you find that you have a design that you are currently using that does not stay in registration, you might want to try adding to the stitch length on the pull in areas.

The push or expansion portion of the area or segment would need to be brought in using approximately the same measurement as you have added for the Pull compensation. By that I mean, if you are adding .40 millimeters pull comp to the pull in portion of the design, cut back the push portion of the design by about the same amount.

As I have stated before, if you are creating a design for a knit fabric, you will have to add more to the finished width of the stitch than you will if you are creating a design for a woven fabric such as a denim shirt. The stitches will not pull in as much on a woven fabric as they do on a knit fabric because the fabric does not have as much stretch. This **extra stitch width** that you are adding to compensate for this pulling in, is the actual **Pull comp** that you are adding.

Always Save Your Designs In Your Native Software File

If you have a design that you are going to sew on a woven fabric such as a denim shirt and a golf shirt that is a knit, you want the finished embroidery to look the same on both products. They will not unless you have added the right amount of pull comp and underlay to accomplish this job.

Always save your outline file so that you can make adjustments to your designs when you have a different fabric that you are going to use. Some of you may not know what an outline file is. It is the native file for your software. The native pulse software file is the POF or PXF depending on your

version. In the Wilcom software it is the EMB file. In the Design Shop it is the OFM file. Each software has its own particular type that you can save your original file in so that you can go back and make any adjustments that are necessary. Your DST file is the design file that goes to the machine, but you do not make your adjustments to this file.

Working With Terry Cloth

Terry cloth is basically an animal all its own. Terry can be a knit or a woven fabric. There are many types of terry. There is light weight terry, medium weight terry and heavy weight terry. The underlay and pull comp that you add depends on the weight of the fabric and the size of the embroidery design or monogram.

For a light or medium weight terry, I would use 2 to 4 lines of Perpendicular underlay, Zig Zag underlay and Contour underlay at .40 millimeters as the inset distance. I would create a pull comp of .40 millimeters. This can vary depending on software packages. You want to make sure that you have enough underlay to mash down and hold the terry loops.

For the heavy weight terry, I would use 4 lines of Perpendicular underlay, Zig Zag underlay at a 45 degree angle and the Contour underlay. I usually increase the density of my Zig Zag underlay and maybe even the density of the top stitching. It all depends on the fabric. I would create a pull comp of .60 millimeters because it has a tendency to pull in the fibers more than the lighter weight terry. You will have to experiment on a sample before you can come up with your final settings. Once you have that you will want to save these settings and use them all of the time for your terry fabrics.

Adjustments Needed For Different Embroidery Machines

All software packages are different, and all embroidery machines are different so there will always be adjustments. I have a customer that has older machines that seem to sew thinner than her newer machines. This really poses a problem when are digitizing their designs. She has to have designs with different settings to compensate for the issues of these machines. This is the same situation for some specific brands. They do not all sew the same, so you have to make adjustments to compensate for this. It could be underlay stitching, it could just be the pull compensation.

Some software packages give you choices of percentage or absolute or column width. These are not the same thing. Some packages will offer you two for a choice, some only have one specific way that they calculate it. You need to

find out how your system works and learn how to make adjustments to get the specific values that you need. Sometimes this means that you have to digitize the actual pull comp into your design if you are not getting the results that you need or that will work with your machine.

If you are creating your own underlay, you must know how much pull comp you are applying before you even create your underlay. When creating your own underlay, it does not move out closer to the edge of the outline as you apply pull comp. When you use the auto underlay, it moves out in relation to the pull comp. If you are placing a .40 millimeters inset distance for your underlay it will be .40 millimeters from the penetration point of the needle when you do use the auto underlay settings in your software.

I hope that I have helped you to understand pull comps a little bit better. I know that this subject is huge and tough to grasp but if you do a lot of experimenting and keep track of your settings, you will soon gain a whole lot more knowledge of this huge subject and will be able to create better looking embroidery designs.

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