SOFTWARE AND THE MACHINE

EMBROIDERY IS AN ART OF DISTORTION IF IT LOOKS PERFECT ON THE SCREEN THE SEWING WILL BE DISTORTED

To make any machine run properly a good design is essential. The following are elements necessary for creating beautiful embroidery and having it run well.

Stitch Types

**Manual Stitch**—a manual stitch is entered one stitch at a time. It is used wherever the digitizer wants to control the stitch length, i.e. small lettering, fur, hair, fine detail.

Example: If one point is input at each end of a straight line, the manual stitch will be one long stitch.

![Manual Stitch Lettering](image)

**Running Stitch**—A running stitch or path is a line containing at least two punchpoints (a beginning and an end) that stitches will follow. Additional punchpoints between the beginning and ending points add detail and direction to a path. In most software programs, the digitizer can change the stitch length. A running stitch can also be called a walking stitch or a traveling stitch. A running stitch is also used for fine detail, multiple outline runs, i.e. 2 ply (twice around) 3 ply (three times around a shape).
A single run running stitch always sews to the shape’s exit point, so it is necessary to be careful where the start and end of the shape occur. It is important to make sure that there are equal passes on both sides of the shape when using multiple passes of running stitch.

Satin Stitches are formed by closely arranged zigzag stitches. They can be laid down at any angle and with varying stitch lengths and density. The satin stitch is input as a pair of points, the point and counterpoint determine the stitch width and stitch angle. The pair of points should be perpendicular across the satin column.
Correct Satin Stitch Angle

If the angle of the point and counterpoint are too great in either direction the stitching becomes sloppy. Satin stitches should flow around the shape that they are following.

Bad Satin Stitch Angle

If the first input point of the satin stitch is on the outside, then all of the points must be on the outside and the counterpoints on the inside. If the order of the points get reversed during input, the user will get what is know in the industry as a “Bowtie”

Bowtie

Satin Stitch Orchid
Good rules of thumb for satin stitches:

**Minimum Satin Stitch Length** - .05 inch – when a satin stitch length becomes less than .05 it looks like a sloppy running stitch although it still registers as a satin stitch.

**Maximum Satin Stitch Length** - .50 inch – This stitch length is fine if the work being done is for decoration and not going to be laundered or thrown around frequently. If one stitch gets caught and pulled out at this length, that portion of the design will unravel.

For example, letterman jackets- many customers like the look of the large satin stitch letters (2- 3” letters on jacket backs) however, depending on the font style and width of the columns the stitch length will be too long. A good analogy of satin stitches that are too long are loose guitar strings.

**Fill Stitch** – A fill is a series of closely placed running stitches that cover a large enclosed outline. Altering the angle, length and offset or repeat sequence of the stitching can create different fill patterns.

**Fill Stitch Length** - Depending on the software, fill stitch length can be increased to decrease stitch count. The following are one-inch squares with different stitch lengths (.15, .20 and .25 inches)

<table>
<thead>
<tr>
<th>Stitch Length</th>
<th>Stitches</th>
</tr>
</thead>
<tbody>
<tr>
<td>.15”</td>
<td>1,075</td>
</tr>
<tr>
<td>.20”</td>
<td>860</td>
</tr>
<tr>
<td>.25”</td>
<td>712</td>
</tr>
</tbody>
</table>

**Fill Stitch Angle** – Breaking a design into parts and changing the angle of the different parts, will add dimension and allow the user to make a simple design three dimensional.

Dancer 1
Technically there is nothing wrong with the Dancer 1 design; it was done in a fill stitch at 150-degree angle. The following design Dancer 2 was broken into pieces and the angles were changed for the different pieces, the arm and leg on the right side are at a 60 degree angle, while the left side is at 140 degree angle, and the body is a 7 degree angle making the design three-dimensional.

**Offset** – The offset of a fill stitch is how much the next row of stitches will be offset from the row of stitching before it. The industry standard is a 30-33 percent offset, and that means if the stitch length on the first line is a quarter of an inch long, the system will lay down quarter inch stitches. The second line of stitches will start one third off from the row of stitches before it. If it is a fifty percent offset, the pattern will look like corduroy.
Lock Stitches - A lock stitch is a series of four or five stitches that essentially tie down or knot the thread before and after a trim.

Lock stitches can be input either by using manual or running stitches. Lock stitches should be used or turned on at the beginning and end of each block of stitching to prevent stitches from pulling out at the start of stitching and to keep it from unraveling at the end of the stitching. Most software systems have automatic lockstitch settings that should always be on, except if the digitizer wants to input there own lock stitches.

Remember, it takes several revolutions of the bobbin to catch the topstitching so if there are no lock stitches several of the beginning stitches can pull out.

Density – Density is the space between the stitches. If you are working with a 40-weight thread, it means that each stitch should lay one next to another. Manual and running stitches have no density.

![Satin Stitch Density Examples](image)

<table>
<thead>
<tr>
<th>100%</th>
<th>80%</th>
<th>60%</th>
<th>40%</th>
</tr>
</thead>
</table>

![Fill Stitch Density Examples](image)

<table>
<thead>
<tr>
<th>100%</th>
<th>80%</th>
<th>60%</th>
<th>40%</th>
</tr>
</thead>
</table>

Underlay – Is one of the least talked about, yet most important details of embroidery. The purpose of underlay is two fold; it holds up the top stitching so it does not sink into the fabric and stabilizes the fabric so it does not pull or push too much in either direction. It also holds the fabric to the backing. Underlay reduces the need to add extra density to the topstitching in order to get good coverage, i.e. light on dark or dark on light. Using underlay stitching for better coverage eliminates bulletproof embroidery. Before foam was available, a digitizer would use layers of underlay stitches to give loft to the topstitching.
The following are some types of underlay stitching that are commonly used:

- **Edgewalk**
- **Zigzag**
- **Double Zigzag**

A crosshatch underlay is two layers of light density fill stitches, laid down in opposite directions. The underlay for a fill stitch should always run in the opposite direction of the topstitching.
**PULL COMPENSATION** – Widens the satin stitch width, it is based on a percentage of the column width, so when adding pull compensation to a narrow satin column, use a higher percentage (approx. 40-60 %)When adding pull compensation to a wider satin stitch use a lower percentage (approx. 5-10 %) On the software used for the following examples 0 per cent means that the stitches will fill in the shape of the outline, 25%, 40% and 60% means that the stitches will go outside the outline equally on both sides of the shape, i.e. 40%, 20% will go on the left side and 20% on the right side.

![Satin Stitch Pull Compensation](image)

*Fill Stitch Pull Compensation*

![Fill Stitch Pull Compensation](image)

Fill stitch pull compensation compensates in the direction that the fill is sewing. The first four examples are sewing horizontally while the last example is sewing vertically.

**Distortion Compensation** – When creating a fill area with a satin stitch border, put the input points on the outside edge of the satin stitch in the direction it is sewing, and put the input points on the inside edge of the satin stitch in the direction it's not sewing. This is done to account for the pull created when the design sews. Distorting it this way allows it to run on the widest variety of materials.
Text – Most keyboard lettering in embroidery software has what is called closest point connection. That means that when letters are input into the system the software always looks for the closest point between two letters to make the connection. All of the settings, underlay, pull compensation, stitch width, etc. that have been previously discussed also pertain to text.

If the user wanted to hand trim between the letters, instead of closest point connection where it would be difficult to trim, the connection could be made to the furthest point between the letters which gives extra thread and makes the trimming easier. Some software has this as a built in feature, however it can be built into the digitized design.

Distorted Text

Narrow Column Width – Placing too many letters that are too tall or are on too short of a baseline create distortion in the text. The satin column becomes too narrow and the stitches become sloppy.

Correct Column Width for the baseline – The baseline is calculated by the letter height.
The embroiderer must educate the customer base. The average person thinks that you can embroider whatever you can print. You cannot, remember that the needle must go into the fabric twice to form a stitch. If the satin stitch column is too narrow it becomes sloppy stitching.

**Threads**

Embroidery thread is available in various sizes or weights, however the most commonly used thread types in commercial embroidery are rayon and polyester. The most common weight of those threads is 40-weight. That means that at 100 percent density, each stitch should lie right next to each other. The settings vary depending on the software being used.

- **Rayon Thread** – Some traits of rayon thread are that it is smooth and easy running, has bright - lustrous sheen, excellent execution, excellent wash ability, and less equipment wear.

- **Polyester Thread** – Some traits of polyester thread are high tensile strength, great shine, and it is bleach resistant.

Large spools have approximately 5,500 yards. The mini spools have approximately 1,100 yards.

- **Cotton Thread** – Is the only 100 percent natural thread made for high-speed embroidery machines. Some traits of cotton thread are that it has a matt finish with a soft luster, and has a high tensile strength.

There are also other weights of embroidery thread, if you would like a heavier thread use a 30-weight thread. A 30-weight thread can be used for better coverage in larger fill areas, but should not be used for fine detail. For very fine detail and for small lettering the user should use a 50 or 60 weight thread. The larger the number, the thinner the thread will be.

**Thread Care**- Embroidery thread should be stored properly to stitch properly. The thread should be stored in an environment that is consistent. Temperature, humidity and direct sunlight can damage the thread. It is best to store embroidery thread in a place that is clean and dust free.

- **Metallic Thread** - Metallic thread is one of the most popular specialty threads used in embroidery. It can sometimes be difficult to work with because of its construction. The core of metallic thread is usually nylon with strips of metallic foil wrapped around it.

Many embroiderers experience a lot of thread breaks when running metallic thread. The following are some tips on how to avoid those thread breaks:

- Find out if your design was digitized/punched for metallic thread. If not, the holes may be punched too close together to use the metallic thread without having breaks. Since the metallic is not as supple as rayon, the metallic thread cannot make the little turns on small designs as easily as the rayon does. Thread will break in the same spot.
- Tension must be as loose as possible without making the tension control stop the machine. Keep the top and bottom tension in the right ratio but both must be very loose. The bobbin should just support itself when held by the thread.
- Bobbin thread should be the thinnest possible.
• The needle should be at least a size 75 or 80.
• The material should be as soft as possible. Hard or stiff material is abrasive to the metallic thread.
• The backing should also be soft and pliable. If the backing is stiff and hard, the thread has a difficult time getting through it.
• The machine itself needs to be in excellent working order. Any little flaw or rough area will break the metallic thread and make it fray.

Tips taken from Stitches magazine

**Stitch Formats**

Stitch files are what are used to run the machine; the user is limited as to what manipulation can be done to the design, i.e. changing densities, pull compensation and underlay settings. If a stitch file is 5 inches and 10,000 stitches and the user changes the size to 2.5 inches the stitch count will remain at approximately 10,000 stitches. The design then becomes what is know as “bulletproof” embroidery.

**Outline Formats**

Outline or condensed files are files that are created in specific software packages. Most software packages have proprietary outline formats. Usually the outline file cannot be read from one software package to another. An outline file means that if the user takes that same design that was 5 inches and 10,000, cuts the design size in half, the stitch count will change with the size change, so that the new count would be approximately 5,000 stitches. The properties of the design can also be changed, i.e. running and fill stitch length, densities, pull compensation, underlay settings and programmable patterns can be added.

**Stitch To Block Conversion**

Stitch to block conversion is a feature that allows the user to read in a stitch file and then convert it back to an outline file. Once this process is complete, in most cases the user will be able to manipulate the file as an outline file. This process works with most designs, of course it depends how the design was originally created. As with any design, if the changes are too drastic, i.e. changing the size too much in either direction, distortion will occur. This function also breaks the design into pieces, so make sure the changes are made to all of the necessary elements of the design.

**Format Types**

<table>
<thead>
<tr>
<th>Brother BES –100E Software</th>
<th>PE – Design</th>
<th>PR 600</th>
<th>Industrial</th>
</tr>
</thead>
</table>

Toby Diamond

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<table>
<thead>
<tr>
<th>Machine</th>
<th>DST - Input/output</th>
<th>PES</th>
<th>DST</th>
</tr>
</thead>
<tbody>
<tr>
<td>.DST – Tajima format</td>
<td>DST - Input/output</td>
<td>PES</td>
<td>DST</td>
</tr>
<tr>
<td>.EXP – Melco expanded</td>
<td>EXP - Input/output</td>
<td>DST</td>
<td>ESC</td>
</tr>
<tr>
<td>.HAS - Brother 412</td>
<td>PES - Input/output</td>
<td>PHC</td>
<td>ULT</td>
</tr>
<tr>
<td>.ECS – Brother multihead</td>
<td>PEC - In</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.PES - Home sewing machines</td>
<td>HUS - Input/output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.FDR – Barudan</td>
<td>PCS - Input/output</td>
<td></td>
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<td>.FMC – Barudan</td>
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<td>.ZSK – ZSK</td>
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<td></td>
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</tr>
<tr>
<td>Outline Files</td>
<td>.BDF – Brother Data Format</td>
<td></td>
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</tr>
<tr>
<td>.CND – Melco Dos Condensed</td>
<td>.KWK – PG1 Software</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stock Designs

Stock designs were originally created for a specific application and a specific fabric. As the digitizing companies increased the size of their design collections, they began selling the designs as individual stock designs or stock design collections. As these collections evolved the designs became more generic, meaning that they were digitized with no specific fabric or application in mind. Realizing this, please keep in mind that not all stock designs will work on all fabrics with no adjustments to the design. As the end user these designs must be adjusted to work properly for the specific job. Remember that major changes can cause distortion to the design.

Backing

Tearaway – Tearaway backing is a non-woven material that tears easily. Some tearaways are directional and will only tear in one direction; some are multi-directional and will tear in any direction. This makes removal after embroidery simple. Heavyweight backings add stability to fabrics and are best used with stable fabrics such as canvas, denim and terry cloth.

Cutaway - Cutaway backing is a woven or non-woven material that can be trimmed away after the embroidery is completed. They consist of several weights and range from very firm to very soft. With loose or fine knit fabrics, cutaway is required to keep the fabric stable while embroidering.

Specialty Topping – Water-soluble plastic topping is sometimes needed on knits, terry cloth or any fabric with a pile. It also can be used when sewing fine detail and small lettering.

Hooping

Using the correct hoop for a specific job is another element of creating beautiful embroidery. By not using the right hoop, i.e. size or type, a well-created design can move out of alignment and ruin the final result.
**Tubular frames** - This type of frame allows tubular fabric or pre-assembled garments to be placed around the hook assembly, thus allowing the front of a garment to be sewn without stitching through the back of the garment.

**Cap frames** - These are specialized hoops designs specifically designed for embroidering caps. The cap must be securely placed in the frame to allow the minimum amount of cap movement so the design will not shift in the sewing.

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**Appliqué**

The use of appliqué in embroidery can add dimension to the design and cut down on the stitch count thereby decreasing the cost of the final product.

The area for placement of the appliqué must be identified. Placing a markout line does this. Tracing around the desired appliqué shape with a running stitch creates a mark out line. This line will be stitched and then it is necessary for the machine to stop. Some software will let you place a jump stitch or machine movement so the pantograph can move out from under the hoop for easy placement of the fabric. If the software does not allow this movement, the machine must still stop for the fabric placement.

Position the appliqué within the mark out line. The appliqué fabric must have some type of adhesive, either spray adhesive, heat sensitive so the appliqué can be ironed on or a sticky backing can be fused on. If you opt for the sticky backing, make sure the needles don’t get gummed up.

Once the appliqué piece is placed it must be held down with either a running stitch or a light density (approximately 25%) satin stitch. If a satin stitch is used no underlay is necessary. Once the appliqué is tacked down, the final step would be to place the topstitching or final layer. The last layer would be a satin stitch at a 100 percent density, with no underlay, that is a little wider than the tack down stitch.

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**Appliqué Patterns**

If the user is going to create their own appliqué pieces, a pattern must first be created. To create the pattern, hoop a piece of tear away backing and adhere a piece of file folder to the backing using double sided tape or a spray adhesive. Take the thread out of the needle, turn off the thread sensor and stitch the
outline only on the file folder. The perforations from the needle will be the guideline for the pattern. Remove the folder from the backing and cut out the pattern. Trace the pattern onto the desired fabric and cut out the appliqué piece.

A sturdy cutaway can be substituted for the folder and tearaway. If this method is used do not take the thread out of the needle, stitch the outline only, and then cut along the stitching to create the pattern.

**Foam**

Foam is used to create loft under satin stitches in an embroidered design. The density of the lettering should be increased to 140-160 percent. Increasing the density allows the stitching to perforate the foam so it will pop off the design. The underlay stitching should be turned off for this process. This process is great for letters that are complete shapes, an O for example. For letters like T, L, P, H, J etc., an adjustment must be made to the letters where the normal satin stitches won’t perforate them. This process is called capping. To cap a letter, jagged edge satin stitches or a series of manual stitches, must be placed underneath the satin column so it will perforate the foam on one side and leave it in tact on the other side.

**Foam Capping**

The foam being used as well as the capping stitches should be the same color or close to the same color as the thread. For this example two colors were used, but that was because it is visually easier to see.
# Trouble Shooting Guide

## Stitches do not form

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty bobbin</td>
<td>Replace bobbin.</td>
</tr>
<tr>
<td>Incorrect timing</td>
<td>The bobbin hook is not catching the loop. Reset timing.</td>
</tr>
<tr>
<td>Machine retaining finger in the wrong position</td>
<td>The retaining finger under the needle plate holds the bobbin case in place. If this is not in the correct position, a loop will not form. Adjust according to your machine manual. Note: This part usually does not “wiggle” out of position on its own. Wrong positioning may occur after work has been done in the hook assembly/bobbin area. E.g. after timing the hook.</td>
</tr>
<tr>
<td>Incorrect needle position</td>
<td>Re-insert the needle. If needle is not pushed all the way into the needle bar shaft or not rotated properly, the effect is the same as if the timing were off.</td>
</tr>
<tr>
<td>Broken hook point</td>
<td>Replace rotary hook assembly.</td>
</tr>
</tbody>
</table>

## Skipped Stitches

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong needle size</td>
<td>Needles are too small or large in relation to the thread size and make it difficult for loops to form.</td>
</tr>
<tr>
<td>Too tight or too loose twist on thread</td>
<td>Improper twist results in irregular loop formation. Try a new cone or different color to test this possible cause.</td>
</tr>
<tr>
<td>Incorrect timing</td>
<td>The bobbin hook is not catching the loop. Reset timing.</td>
</tr>
</tbody>
</table>

## Design out of register

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose hooping</td>
<td>Re-hoop, being careful not to pull stretch fabrics out of shape in an attempt to hoop tightly.</td>
</tr>
<tr>
<td>Unstable fabric</td>
<td>Use more or heavier backing. For more stability use an adhesive spray to fix backing to garment.</td>
</tr>
<tr>
<td>Tape punched incorrectly</td>
<td>The design may need more pull compensation or underlay to accommodate stretchy or high-napped fabrics.</td>
</tr>
</tbody>
</table>

## Needle cuts or holes in garments

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dull needle</td>
<td>Replace needle. Dull needles have a difficult time getting through the garment causing some fabrics to tear.</td>
</tr>
<tr>
<td>Wrong needle point type</td>
<td>Sharp and round point needles can cut some delicate knits. Try a ballpoint needle.</td>
</tr>
<tr>
<td>Needle is too large</td>
<td>Large needles can stretch fibers excessively causing them to burst or become distorted. Use the smallest needle size that is acceptable for the thread size you are using.</td>
</tr>
<tr>
<td>Delicate fabric</td>
<td>The simple penetration of the needle will cut some delicate fabrics. Soften the impact by using a topping.</td>
</tr>
</tbody>
</table>
**Needle breaks**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper timing</td>
<td>If the needle point and hook point is not timed properly, damage to both could result. Also, stitching quality suffers. Replace damaged parts and re-time machine.</td>
</tr>
<tr>
<td>Needle inserted incorrectly</td>
<td>Follow your machine manual instructions for inserting the needle. Make sure that it is all the way up into the needle bar shaft that it is rotated properly and the needle screw is tight.</td>
</tr>
<tr>
<td>Bent needle</td>
<td>Always replace a needle if it hits, or even grazes, a hoop or other hard object.</td>
</tr>
<tr>
<td>Dull needle</td>
<td>Dull needles will bow in an effort to push through the fabric and eventually break.</td>
</tr>
<tr>
<td>Holding loose end of thread during start-up</td>
<td>Pulling the thread too tight and either wrapping it around the holding disk or holding it in your hand causes the needle to bend, and the needle and/or thread to break.</td>
</tr>
</tbody>
</table>

**Puckering**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight tensions</td>
<td>Adjust tensions for specific garment and thread. For example, polyester thread will stretch during sewing, especially if tensions are too tight. After the stitching is complete, the thread returns to its original strength, puckering the garment.</td>
</tr>
<tr>
<td>Improper hooping tension</td>
<td>Hoop sturdy, woven fabrics tightly: loose hooping will cause the fabric to bunch up under the stitching. Hoop soft knits tautly, using a stable backing: over-stretching the garment will cause it to look puckered when removed from the hoop.</td>
</tr>
<tr>
<td>Unstable fabric</td>
<td>Use a backing and be sure to hoop it with the garment. For added stability, use an adhesive spray designed for embroidery to affix backing to garment or use an iron-on tearaway backing</td>
</tr>
<tr>
<td>Column stitches are too long</td>
<td>Re-punch as fill stitching or multiple rows of column stitching.</td>
</tr>
<tr>
<td>Dull needles</td>
<td>Dull needles push fabric down instead of pushing between or piercing the weave. Replace needles.</td>
</tr>
<tr>
<td>Design densities are too heavy</td>
<td>Too many stitches in an area pull the fabric causing it to look puckered. Decrease density, increase the design slightly (5% to 10%) or use a thinner thread.</td>
</tr>
</tbody>
</table>
## Thread breaks

<table>
<thead>
<tr>
<th>Condition</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper threading</td>
<td>Re-thread machine, making sure thread goes through all the guides in the proper order.</td>
</tr>
<tr>
<td>Burrs in the needle’s eye, thread guides, throat plate or hook</td>
<td>Replace the needle. Use fine-grade emery cloth or emery cord to buff the thread guides and throat plate. Buffing the hook may alter the timing; a damaged hook should be replaced.</td>
</tr>
<tr>
<td>Lack of lubrication in hook assembly</td>
<td>The hook needs frequent lubrication because it dries out faster, using a hypodermic oiler, put one drop of oil in the hook assembly track every four to eight hours of machine running.</td>
</tr>
<tr>
<td>Needle size too small for thread</td>
<td>Change to a larger needle or a thinner thread.</td>
</tr>
<tr>
<td>Too much or incorrect adhesive spray</td>
<td>Use only spray adhesives designed for embroidery applications and sparingly! Excess adhesive build-up on needles causes them to drag and break threads. Replace the needle and examine your adhesive application technique.</td>
</tr>
<tr>
<td>Bent needle tip</td>
<td>Usually happens after the needle hits an impenetrable object (hoop, throat plate, and hook). Replace the needle. (Also check the hook for burrs and the timing after hitting a hard object).</td>
</tr>
<tr>
<td>Stitch length too short</td>
<td>Slowing the machine down helps sometimes. Best bet is to have the design re-punched with longer stitches.</td>
</tr>
<tr>
<td>Stitching over stitching</td>
<td>Reduce the density in the underlay. Try to avoid more than two layers of thread.</td>
</tr>
<tr>
<td>Incorrect needle depth</td>
<td>Commonly occurring after hitting the hoop or throat plate, these problem shows up when the thread splits and one ply continues to sew while the other ply peels back. The thread eventually breaks leaving previous stitching thinned out. Reset needle depth, and possibly timing according to machine instructions. Also check needle for damage.</td>
</tr>
<tr>
<td>Improper timing</td>
<td>This causes many problems such as broken needles, poor stitching (or no stitching) in addition to thread breaks.</td>
</tr>
<tr>
<td>Trimmer mechanism not working properly</td>
<td>Thread ends may not be cut cleanly or thread ends may be cut too short, activating your machine’s thread-break detectors. Adjust trimmers.</td>
</tr>
<tr>
<td>Needle too close to hole in throat plate</td>
<td>These causes thread to fray and eventually break. Adjust throat plate and/or needle position.</td>
</tr>
<tr>
<td>Old, dry thread</td>
<td>Replace thread. Thread becomes brittle with age and prolonged exposure to light, air and heat. Store new thread in a cool, dark place.</td>
</tr>
<tr>
<td>Too tight or inconsistent twist on the thread</td>
<td>Replace cone of thread.</td>
</tr>
<tr>
<td>Lint build-up in tensions discs, throat plate or bobbin case</td>
<td>Clean these areas with canned air or a brush.</td>
</tr>
</tbody>
</table>
### Thread breaks continued

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build-up of thread behind hook</td>
<td>Using a brush or tweezers, remove thread build-up on the hook shaft. In severe cases, the build-up may push the hook out of alignment and affect the timing. If this happens, remove the hook, clean the area and reset the timing.</td>
</tr>
<tr>
<td>Excessive friction</td>
<td>Increased friction between the needle and thick or abrasive fabrics or backings with excessive chemical coatings or treatments. Reduce machine speed, use a Teflon-coated needle, and apply silicone spray to thread or re-punch the design with longer stitch lengths.</td>
</tr>
<tr>
<td>Bruised cone</td>
<td>Bruising occurs when thread cones fall on the floor, causing the lower windings to loosen and catch as the thread spools off. Pull off the affected portion of the thread or replace the cone.</td>
</tr>
<tr>
<td>Using tape to tie off loose thread ends</td>
<td>Tape leaves a residue that causes friction and breaks. Pull off the affected portion and don’t use tape.</td>
</tr>
<tr>
<td>Too many stitches in a small area or densities are too heavy</td>
<td>Increase the design size by 5% to 10% to allow more room for stitches to lay down, decrease density or remove extra stitches using your machine functions, have the design re-punched or use a thinner thread to prevent thread build-up.</td>
</tr>
<tr>
<td>Improper tensions</td>
<td>Loose tensions cause thread to pile up and loop. Tight tensions cause pulling, puckering, and thread stress. Using machine manufacturer’s guidelines, adjust tensions to achieve a smooth, flat look.</td>
</tr>
<tr>
<td>Machine speed too high</td>
<td>Some designs and/or applications increase stress on the thread. Lower machine speed accordingly.</td>
</tr>
<tr>
<td>Knots or slugs in thread</td>
<td>Replace cone of thread. Consult your thread dealer if this frequently occurs.</td>
</tr>
<tr>
<td>Incorrect position of hook retaining finger</td>
<td>If the hook is set too close to the needle or the retaining finger is bent; the thread can’t pass through. Make adjustment in position or replace bent retaining finger.</td>
</tr>
<tr>
<td>Holding loose end of thread during start-up</td>
<td>Pulling the thread too tight and either wrapping it around the holding disc or holding it in your hand causes the needle to bend and the needle and/or thread to break.</td>
</tr>
<tr>
<td>Thread color</td>
<td>Some colors are more susceptible to thread breaks than others due to the amount of chemical processing involved. For example, some dark colors require more or stronger dye solutions, which place increased stress on the thread. Replace thread.</td>
</tr>
</tbody>
</table>

Tips taken from *Stitches* magazine
GLOSSARY OF EMBROIDERY MACHINE TERMS

Arm Machine- Multihead embroidery machine driven by a single main shaft. Each sewing head is attached to the shaft, usually by gears. Sewing heads resemble industrial sewing machines in the “arm” that the needle case is attached to.

Automatic Color Change - The ability of a multineedle commercial embroidery machine to follow a command to change to another specified needle.

Bobbin Case – Small, round metal device for holding the bobbin. Used to tension the bobbin thread. Inserted in the hook for sewing.

Bridge Machine – Embroidery machine with two shafts, one for the hook assembly and one for the needle assembly. Sewing heads are suspended from a beam allowing for larger sewing fields than an arm machine. Bridge machines are accessible from both the back and front of the machine through the “bridge”.

Cap Frames – Specialized embroidery frames (hoops) designed to hold finished caps for embroidering. Available in a variety of styles for various machines, with two basic styles being to sew the finished cap flattened out (for use on a flat machine) or sewing the finished cap (for use on a tubular machine) in its natural curve.

Check Spring – Assists in upper thread tensioning and is used to detect upper thread breaks in many embroidery machine models.

Cylinder Arm Machine – Refers to machines with “cylinder” beds. The hook assembly is housed in a cylinder-shaped arm, allowing goods to curve around the cylinder for embroidery.

Disk Reader – An external or internal device used to read machine movements from either a CD or 3.5 computer drive.

Flat Embroidery – Embroidery (usually on cut panels or patches) that is framed in hoops exclusively on the top of the embroidery machines hook assembly.

Framing Press – Machine to aid the framing process.

Frame Sash - Part of the pantograph to hold the frames. Also called a sash. Varieties of sash types include: border, frame, tubular, cap and sock.

Hook assembly – Rotary device designed to pass the needle at a given point in the needle bar rise. The hook point passed into a thread loop formed by the rising needle bar and pulls the thread around the bobbin case to form a lock stitch.

Hooping board – Board designed to hold the outer portion on the hoop while the goods to be embroidered are placed over the board to be hooped. Once the goods are aligned and placed correctly over the outer hoop, the operator inserts the inner portion of the hoop.
**Jumbo Rotary Hook** – Rotary hook which holds a bobbin case with a much larger thread capacity than a standard hook.

**Jump Stitch** – Movement of the frame without stitching but with take-up lever and hook movement.

**Lock Stitch Machine** – Machine which forms a stitch using a hook and needle. Includes home sewing, as well as computerized embroidery machines.

**Memory** – The amount of stitches that the machine can store internally.

**Needle Bar** – Holds the needle in the machine: moves in an up and down motion.

**Needle Plate** – The metal plate located above the hook assembly of an embroidery machine. This plate has a hole in the center through which the needle travels to reach the hook and form a stitch. Also known as a throat plate.

**Origin** – The starting point of the design.

**Pantograph** – A bar, rack or holder that frames or holding fixtures are attached to. The pantograph moves in X and Y directions to form the embroidery design, controlled electronically or mechanically depending on the machine.

**Paper Tape** – One punching format. Continuous reel of paper or Mylar® tape containing x-y coordinate information in Binary, Fortran or other numeric code to control pantograph movement. Becoming less favored and replaced by computer disks.

**Presser Foot** – Metal device that touches the goods being embroidered while the needle is in the goods. The main function of the presser foot is to hold the material being embroidered until the hook point catches the thread loop formed by the needle rise.

**Pre-Tensioner** – Thread tension assemblies that are before the main tension assembly in the thread path. The function of the pre-tensioner is to apply a light amount of tension in order to make the main tensioner work. *See Tensioner.*

**Repeat** – Layout used for making emblems or designs on a fabric span that are repeated at regular intervals.

**Take Up Spring** – *See Check spring.*

**Tape Reader** – A device attached to an embroidery machine that enables the machine to read embroidery designs from 8-channel paper computer tapes.

**Tensioner** – Device used to adjust the tautness of thread when forming stitches.

**Thread Clippers** – Small cutting utensil with a spring action that is operated by the thumb in a whole on the top blade and the fingers cupped around the bottom blade. Useful for quick thread cutting, but unsuitable for detailed trimming or removal of backing.
Trimmers – Built into an embroidery machine to automatically trim or cut remaining thread when the design jumps from one area to another or performs a color change.

Tubular Embroidery – Embroidery produced on an embroidery machine, which allows tubular fabric or pre-assembled garments to be placed around the hook assembly. Allows sewing of the front of a garment without sewing thorough the front and back of it.

Glossary of Embroidery Terms

Appliqué -
1) Decoration of trimming cut from one piece of fabric and stitched to another to add dimension and texture. Designs with appliqué and embroidery can be more economical than embroidery alone. If appliqué occupies a significant amount of the design the stitch count is lower.
2) In Schiffli embroidery, an embroidered motif is hand-cut or aetzed away from the base fabric.

Backing - Woven or non-woven material used underneath the garment or fabric being embroidered to provide support and stability. Can be hooped with the item or placed between the machine throat plate and the hooped garment. Available in two basic types: cutaway and tearaway, both in various weights.

Bean stitch - Three stitches placed back and forth between two points. Often used for outlining because it eliminates the need for digitizing a single ply running stitch outline three times.

Birdnesting – Collection of thread between goods and needle plate, resembling a bird’s nest. Formation of a birdnest prevents the free movement of goods and may be caused by: inadequate tensioning of the top thread, the top thread not going through the takeup lever, the top thread not following the thread path correctly, or flagging goods.

Blatt stitch - Schiffli term meaning, “to feed the yarn” therefore producing a long zigzag stitch with threads lying close together. Adapted for multi-head use; see satin stitch.

Bobbin - Spool or reel that holds the bobbin thread, which helps to form stitches on the underside of the fabric

Bonnaz - Chain stitch machine developed in the 1800’s. Named for it’s French inventor Emilie Bonnaz, and first manufactured by the Cornely Co. of France.

Boring - Openwork incorporated into embroidered designs. A sharp pointed instrument punctures, or bores the fabric, and stitches are made around the opening to enclose the raw edges.

Buckram - Coarse woven fabric stiffened with glue and used to stabilize fabric for stitching. Commonly used in caps to hold the front panel erect.

Cartoon - Finished artwork of an embroidery design to be digitized. Usually six times larger than the finished design size, based on the art –to stitching ratio historically used in the schiffli industry.

Ceeding stitch - See fill stitch
Chain stitch-Stitch that looks like a chain link formed with one thread fed from the bottom side of the fabric done on a manual or computerized machine with a hook that functions like a needle.

Chenille –Form of embroidery in which a loop stitch is formed on the top side of the fabric. Uses heavy yarns of wool, cotton, or acrylic. Created by a chain stitch machine that has been adjusted to form this stitch type. Also known as loop piling.

Column Stitch- Formed by a closely placed zigzag stitches and often used to form borders. Also known as steil stitch. See satin stitch.

Complex fill- Refers to the digitizing capability that allows areas to be designated as voids at the same time the design’s edges or perimeter points, are defined. The design can thus be digitized as one fill area instead of being broken down into multiple sections.

Condensed format- Method of digitizing in which a proportionate number of stitches are placed between defined points after a scale has been designated. With a machine that can read condensed format, the scale, density and stitch lengths in a design may be changed. See expanded format.

Design library /catalog- A collection of digitized designs kept by embroidery shops. The library or catalog allows an embroiderer to access the design by subject, stitch count, number of colors or other criteria for customers looking for a specific type of design.

Digitize - Modern term for punching the computerized method of converting artwork into a series of commands to be read by an embroidery machine’s computer. See punching

Digitizing tablet- A computer aided design device used by digitizers to plot needle penetrations for embroidery designs. Typically a pencil drawing of the designs is enlarged six times and then taped to this tablet. The digitizer then uses a device known as a puck to indicate stitch types, curved areas, underlay and actual needle penetrations.

Editing – Changing aspects of a design via a computerized editing program. Most programs allow the user to scale designs up or down, edit stitch by stitch or block by block, merge lettering with the design, move aspects of the design around, combine designs and insert or edit machine commands.

Emblem- Embroidered design with a finished edge, commonly an insignia of identification, usually worn on outer clothing. Historically an emblem carried a motto or verse or suggested a moral lesson. Also known as a crest or patch.

Embroidery–Decorative stitching on fabric. Generally involves non-lettering designs but also can include lettering and /or monograms. Evidence of embroidery exists during the reign of Egyptian Pharaoh’s in the writings of Homer and the crusaders of the 12th century. Evolved from the handwork to manual sewing machines and from handlooms and Schiffli machines with hundreds of needles to high speed computerized multi head machines.

Expanded format- A design program in which individual stitches in a design have been specifically digitized for a certain size. Designs punched in this format cannot generally be enlarged or reduced more than 10 percent or 20 percent without distortion because the stitch count remains constant.
Facing – Material hooped or placed on top of fabrics that have definable nap or surface texture, such as corduroy and terry cloth, prior to embroidery. The facing compacts the wale, or nap, and holds the stitches above it. Includes a variety of substances such as plastic wrap, water-soluble plastic, water-soluble plastic “foil” and open-weave fabric that has been chemically treated to disintegrate with the application of heat. Also known as topping.

Fill stitch - Series of closely placed running stitches commonly used to cover large areas. Different fill patterns can be created by altering the angle, length and repeat sequence of the stitches. Also known as a geflect stitch.

Finishing – Processes done after embroidery is complete. Includes trimming loose threads, cutting or tearing away excess backing, removing facing or topping, cleaning any stains, pressing or steaming to remove wrinkles or hoop marks and packaging for sale or shipment.

Flagging – Up and down motion of goods under the action of the needle, so named because of its resemblance to a waving flag. Often caused by improper hooping. Flagging may result in poor registration, unsatisfactory stitch formation and birdnesting.

Frame- Holding device for inserting of good under an embroidery head for the application of embroidery. May employ a number of means for maintaining stability during the embroidery process, including clamps, vacuum devices, magnets or strings.

Geflect stitch – See fill stitch

Hook- Holds the bobbin case in the machine and plays a vital role in stitch formation. Making two complete rotations for each stitch, its point meets a loop of top thread at a precisely timed moment and distance gap to form a stitch.

Hoop- Device made from wood, plastic or steel with which fabric is gripped tightly between an inner ring and an outer ring and attached to the machine’s pantograph. Machine hoops are designed to push the fabric to the bottom of the inner ring and hold it against the machine bed for embroidering.

Hooping device- Device that aids in hooping garments or items for embroidery. Especially helpful for hooping multicolored items and for uniformly hooping multiple items.

Lettering – Embroidery using letters or words. Lettering, commonly called “keyboard lettering” may be created from circuit boards that allow variance of letter styles, sizes, height, density and other characteristics.

Lock Stitch-
1) Commonly referred to as a lock-down or tack-down stitch, a lock stitch is formed by three or four consecutive stitches. It should be used at the end of all column fills and any element where jump stitches will follow, such as color changes or the end of a design. May be stitched in a triangle or in a straight line.

2) Lock stitch is also the name of the type formed by the hook and needle of home sewing machines as well as computerized embroidery machines.
**Logo** - Name, symbol or trademark of a company or organization. Short for logotype.

**Looping** - Loops on the surface of embroidery generally caused by poor top tension or tension problems. Typically occurs where polyester top thread has been improperly tensioned.

**Machine language** - The codes and formats used by different machine manufacturers within the embroidery industry. Common formats include Barudan, Brother, Happy, Marco, Meistergram, Melco, Pfaff, Stellar, Tajima, Toyota, Ultramatic and ZSK. Most digitizing systems can save designs in these languages so the embroidery machine can read the computer disk.

**Marking** - Marking of goods to serve as an aid in positioning the frame and referencing the needle start points.

**Modular** - Machine system where many separate stitching heads or configurations of heads are controlled by a central computer.

**Monogram** - Embroidered design composed of one or more letters usually the initials in a name.

**Moss stitch** - *See chain stitch*

**Needle** - Small, slender piece of steel with a hole for thread and a point for stitching. A machine needle differs from a handiwork needle in that the machine needle’s eye is found at its pointed end. Machine embroidery needles come with sharp points for piercing heavy, tightly woven fabrics; ballpoints, which glide between the fiber of knits; and a variety of specialty points, such as wedge points, which are used for leather.

**Network** - To link embroidery machines via a central computer and disk drive system. 2) A group of machines linked via a central computer.

**Nippers** - *See thread nippers*

**Paper tape** - A punching format that uses a continuous reel of paper or Mylar tape containing x-y coordinate information in binary Fortran or other numeric code to control pantograph movement. Becoming less favored and frequently replaced by computer disks.

**Pencil rub** - A low cost way of producing a “sample” of an embroidery design. Consists literally of a piece of tracing paper placed over a sew-out and rubbed lightly with a pencil to produce an impression of the embroidery.

**Puckering** - Result of the fabric being gathered by the stitches. Many possible causes include loose hooping, lack of backing, incorrect tension, or a dull needle.

**Pull compensation** - A degree of distortion built into a design by the digitizer to compensate for pull on the fabric caused by the embroidery stitches.

**Punching** - Conversion of artwork into a series of commands to be read by an embroidery machine’s computer. Derived from an early method of machine embroidery in which part of the machine called an
automat read paper tapes or Jacquards punched with hole representing stitches, pantograph movements and other commands. While still capable of producing paper tape, many computerized digitizing systems now store this information on disk.

**Registration** - Correct registration is achieved when all stitches and design elements line up correctly.

**Running stitch** - Consists of one line of stitching between two points. Used for outlining and fine detail. Also known as a walk stitch.

**SPM** - Stitches per minute. A system for measuring the running speed of an embroidery machine.

**Satin stitch** - Formed by closely arranged zigzag stitches. Can be laid down at any angle and with varying stitch lengths and density. Adapted from the blat stitch used in schiffli embroidery. *See blat stitch.*

**Scaling** - Ability within a design program to enlarge or reduce a design. In expanded or stitch format, most scaling is limited to 10 percent to 20 percent because the stitch count remains constant despite the final design size.
In condensed formats on the other hand, scale changes may be more dramatic because stitch count and density may vary.

**Scanning** - Scanners will convert design artwork into a computer format. Scanning allows the digitizer to use even the most primitive of artwork without recreating the design. A few digitizing systems even allow the digitizer to transfer the design directly into the digitizing program without using an intermediary software.

**Scissors** - Cutting utensil with identically sized finger holes, or bows, and an overall length of usually less than six inches.

**Short stitch** - A digitizing technique that places shorter stitches in curves and corners to avoid unnecessary bulky buildup of stitches.

**Specialty fill** - Born of recent technology, a fill stitch capability that produces a fill with a “relief” or motif design within a fill stitch area.

**Steil stitch** - *See column stitch*

**Stitch editing** - Digitizing feature that allows one or more stitches in a pattern to be deleted or altered.

**Stitch processing** - The calculation of stitch information by means of specialized software, allowing scaling of expanded (stitch) format designs with density compensation and stitch count.

**Stock designs** - Digitized generic embroidery designs that are readily available at a cost below that of custom digitized designs.

**Swiss Embroidery** - Satin stitch embroidery. Recalls the origins of an automated embroidery machine that was developed in the 1800’s by Isaak Groebli. Embroidery remains a government-supported industry in Switzerland today.
Tackle twill- Letters or numbers cut from polyester or rayon twill fabric, that are commonly used for athletic teams and organizations. Tackle twill appliqués attached to a garment have an adhesive backing that tacks it down in place, and the edges of the appliqués are then zigzag-stitched.

Tension- Tautness of thread when forming stitches. Top thread tension as well as bobbin thread tension need to be set. Proper thread tension is achieved when about one third of the thread showing on the underside of the column stitch is bobbin thread.

Thread — Fine cord of natural or synthetic material made from two or more filaments twisted together and used for stitching. Machine embroidery threads come in rayon, which has a high sheen; cotton, which has a duller finish than rayon but is available in very fine deniers, polyester; which is strong and colorfast; metallics, which have a high luster and are composed of a synthetic core wrapped in metal foil; and acrylic, which is purported to have rayon’s sheen.

Thread clippers-Small cutting utensil with a spring action that is operated by the thumb in a hole on the top blade and the fingers cupped around the bottom blade. Useful for quick thread cutting but unsuitable for detailed trimming or the removal of backing.

Topping- See facing

Trimming – Operation in the finishing process that involves trimming the reverse and top sides of the embroidery, including jump stitches and backing.

Underlay stitch- Stitches laid down before other design elements to help stabilize stretchy fabrics and to tack down high wale or naps on fabrics so the design’s details don’t get lost. Also may be used to create such effects as crowned or raised areas in the embroidery, depending on how they are laid down.

Variable sizing- Ability to scale a design to different sizes

Verify Sample -Sew out of a new embroidery design to make sure the pattern is correct

Walk stitch- See running stitch.

The Press- Special Issue