Minimizing Thread Breakage and Skipped Stitches

Introduction

Thread breakage and skipped stitches are common aggravations on any sewing floor because it interrupts production, affects quality, and reduces the earnings and efficiency of production operators. Thread breakage and skipped stitches can be caused by many factors including:

- Wrong thread for the application.
- Quality defects in the thread.
- Improper needle / thread size relationship.
- Worn or defective thread guides or eyelets.
- Improper threading.
- Excessive machine thread tension.
- Defective needle or improper positioning of the needle.
- Needle heat.
- Worn or defective machine parts (burrs or sharp surfaces on thread handling or stitch forming devices).
- Machines out of adjustment.
- Improper feeding.
- Improper operator handling.
- Flagging.

As you can see then there are many variables that impact thread breakage and skipped stitches. Initially, we will focus on the characteristics in thread that impact thread breakage, but later we will also discuss a logical approach used for trouble-shooting thread breakage.

Characteristics in Thread That Affect Breakage & Skipped Stitches

The key product characteristics in thread that have the greatest impact on thread breakage and skipped stitches include:

- Proper loop formation.
- Absence of yarn imperfections.
- Proper lubrication.
- Ply security or ply adhesion.

Proper Loop Formation

Every sewing machine uses a needle to pass thread through the seam to form a stitch. Most sewing machines begin their stitch forming cycle when the needle starts to rise from the bottom of its stroke: (1) The upward motion of the needle, (2) the clamping action of the thread between the needle blade and the fabric, and (3) the holding of the seam in a stationary position all play an important role in proper loop formation.

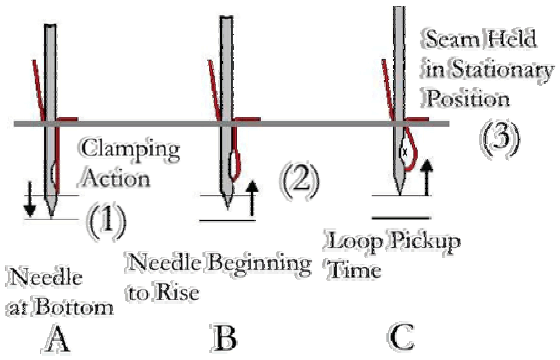

Figure 1. Proper Loop Formation

Loop Formation refers to the forming of a loop for the stitch-forming device (e.g., hook, looper, spreader) to enter. When the needle thread loop is formed, three things can happen and two of them are bad. Ideally, the stitch forming device will enter the loop and continue to form the stitch; however, if an improper thread loop is formed, the stitch forming device can strike the thread causing the thread to break or miss the loop causing a skipped stitch.

The thread characteristics that impact loop formation include:

- Elongation or stretchiness of the thread.
- Initial modulus or initial resistance to stretching.
- Twist direction & twist level.
- Liveliness of the thread.
- Frictional characteristics needed to set a balanced stitch.

If the needle size - thread size relationship is improper, the thread will not be properly clamped on the scarf side of the needle and poor loop formation will occur. If the seam is not held in a stationary position when the needle is rising, the seam will rise with the needle and not form a proper needle loop. This condition, called flagging, is one of the most common causes of skipped stitches and thread breakage.

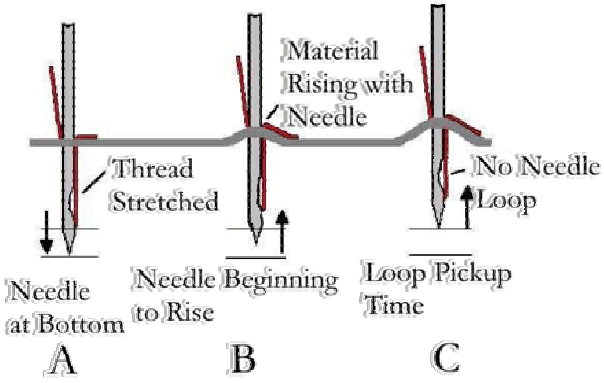

Figure 2. Flagging

Many times a skipped stitch or thread break will occur when crossing another seam. This problem could occur due to the additional thickness that the needle has to penetrate. This could apply additional tension to the thread or cause the needle to deflect away from the stitch-forming device. However, many time the skip or break occurs right after the thickness has been crossed and usually the result of flagging. This happens when the back portion of the presser foot is still on the seam and the front portion of the foot is no longer clamping the fabric securely. Therefore, as the needle begins to rise, the fabric moves up with the needle and a poor needle loop is formed.

Thread Elongation and Initial Modulus

The inherent stretchiness or elongation of the thread is generally determined by the fiber type. For example, both nylon and polyester threads have a much higher elongation than 100% cotton threads. On the following graph, you can see the relationship between tension and elongation. The cotton thread stretches approximately 3 to 4% before it breaks. Polyester thread, on the other hand, stretches approximately 17 to 20% before it breaks. The polyester thread has a higher elongation at break that contributes to greater seam elasticity and seam strength.

A key product characteristic developed in our synthetic threads to enhance loop formation is a high initial modulus or initial resistance to stretching. A thread with a higher initial modulus will minimize the amount that the thread stretches as the needle approaches the bottom of its travel. Therefore, when the needle begins to rise, the thread will be relaxed so a proper needle loop will be formed.

When the thread is stretched as the needle reaches the bottom of its travel in the stitch formation cycle, the thread will recover to its original un-stretched length as the needle begins to rise. The more the thread is stretched, the later a needle loop will be formed and the smaller the target the stitch forming device has to enter to form a proper stitch. The end result may be a skipped stitch or thread breakage.

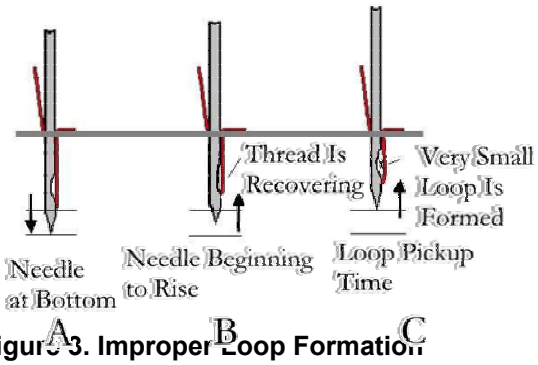

Figure 3. Improper Loop Formation

The physical properties in thread that impact how much the thread is stretched during the sewing process include:

- Elongation properties of the fiber being used.
- Initial modulus - the thread's initial resistance to stretching.
- Frictional characteristics of the thread needed to set a balanced stitch.

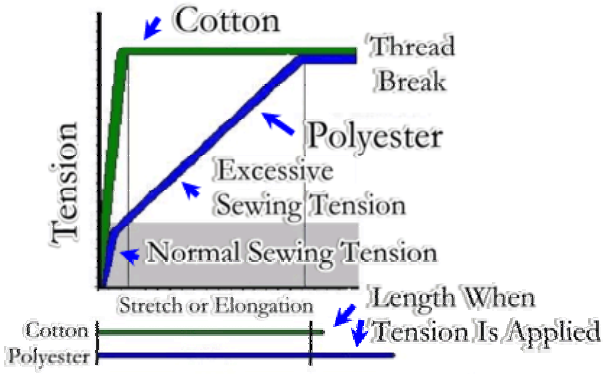

Figure 4. Stretch or Elongation When Tension Is Applied

Note: Regardless of the type of thread being used, as more and more tension is applied to the thread, the thread will stretch more, affecting loop formation. Improper loop formation will result in a higher frequency of sewing interruptions. This is why it is recommended to always adjust the sewing machines thread handling system to sew with minimum thread tension.

Below is a recommended procedure for balancing the stitch on a any sewing machine:

1. Set the bottom tension (bobbin or looper) to a minimum that still forms a consistent stitch.
2. Reduce the needle thread tension until the stitch appears to be loose on the bottom side of the seam then tighten the top tension until a balanced stitch is achieved.

Thread Lubricant

The thread lubricant is another important variable in the loop formation equation. Ideally, the thread lubricant will give the thread a consistent dynamic tension as it passes through the sewing machine's thread guides and tension devices and also allow the thread to form a balanced stitch with minimum thread tension. This will minimize the amount that the thread stretches allowing a proper needle loop to form. Later in this bulletin, we will look at some of the variables that impact the frictional characteristics of sewing thread.

Many thread lubricants include an antistat to minimize the static electrical attraction of the thread to metal surfaces. This attraction can cause the thread to leave its proper thread path impacting loop formation and thread breakage. Synthetic threads made from polyester and nylon are more susceptible to static than threads made from cotton or rayon.

Uniformity - Consistency of Physical Properties

Many factors affect the uniformity of the thread. By uniformity, we are referring to the consistency in physical properties regarding:

- Yarn Construction.
- Yarn Diameter (absence of yarn imperfections like knots and slubs, etc.).
- Strength.
- Elongation and modulus.
- Lubrication.
- Cone build or wind.

These are the primary thread properties that have an impact on sewability. Other factors that affect seam integrity and seam appearance include:

- Color.
- Color Fastness.
- Resistance to seam degradation (chemicals, abrasion, UV, etc.).
- Loop strength.

For the sake of this technical bulletin, we will focus on the factors that affect thread breakage.

Yarn Construction

Continuous filament thread constructions are more consistent in physical properties and diameter and generally have a higher tenacity or strength per size than spun constructions made with staple fibers. Below is a ranking of thread constructions regarding consistency of construction:

- Monofilament.
- Monocord.
- Twisted Multifilament.
- Textured Air Entangled.
- Corespun.
- Spun.

The reason why spun constructions are not as consistent as continuous filament thread constructions is that spun threads are made from staple fibers that are spun into a yarn. Thousands of staple fibers have to be aligned and twisted together to make the thread. Spun threads are also generally weaker than continuous filament threads of equal size and therefore may break during the spinning and twisting processes requiring knots or air splices.

However, spun threads have the following advantages:

- Fibrous or fuzzy surface has a softer "hand".
- Fibrous or fuzzy surface refracts light so it blends in better with spun fabrics.
- Fibrous surface contributes to superior frictional characteristics.
- Generally, spun threads are less expensive than continuous thread constructions like Corespun and Twisted multifilament thread constructions.

Uniformity - Absence of Yarn Imperfections

Yarn imperfections like knots and slubs will generally cause thread breakage; that is why A&E has reengineered many of its processes to eliminate major imperfections. This includes the use of Air Splices where knots used to be used. We believe that "no knot is a good knot".

Payoff the Cone Due to the Build or the Wind

To minimize thread breakage, it is imperative that the thread feed off the cone with the least amount of resistance. This is why it is important that the thread-stand eyelet is located directly over the center of the cone.

Proper Frictional Characteristics

The frictional characteristics of a sewing thread can be affected by:

- Fiber Type (e.g., Cotton, Polyester).
- Thread Construction (e.g., Spun, Textured, Air Entangled).
- Dye Types and Cycle times (e.g., Disperse, Acid) ·
- Thread Finish (Soft, Bond, Glace).
- Thread Lubricant (e.g., Silicone, Wax based).
- Cone type and wind.

A&E is working hard to reduce the variation in all these characteristics to allow our threads to be sewn with minimum machine tension adjustments.

Thread Lubricant

One purpose of a thread lubricant applied to the surface of the thread is to allow the thread to pass through the sewing machine's thread guides and tension devices with uniform tension and to also allow the stitch to be set with minimum thread tension. The other primary purpose of a thread lubricant on synthetic threads is to protect the thread against needle heat. Needle heat is generated by the friction between the fabric and the needle blade. Ideally, the thread lubricant comes off on the needle blade surface allowing it to penetrate the fabric with less friction. A number of factors impact the amount of heat generated by the sewing process. They include:

- Seam density and thickness.
- Machine speed.
- Needle type and size.
- Amount and type of lubricant used on the thread.

Generally, larger thread sizes have more thread lubricant than finer thread sizes because larger thread sizes are sewn into the heavier fabrics.

Good Ply Security or Ply Adhesion

If you look at the end of the thread that has broken, it usually is not a clean break but an unraveled group of fibers. These unraveled thread breaks are caused by a breakdown in the ply adhesion of the fibers in the thread. If there was a clean cut or break it could be caused by a weak spot in the thread or a sharp surface in the machine that cuts the thread. However, most breaks appear to have been unraveled.

A number of factors affect the ply security of the thread. They include:

- Thread construction (e.g., spun, core, textured).
- Uniformity of construction.
- Twist level (tpi).
- Fiber cohesion characteristics.
- Thread finish (e.g., soft, bonded, glaced).
- Frictional characteristics of the thread.

Most manufacturers have learned by experience that core spun threads give better sewing performance on automated multi-directional sewing machines than spun constructed threads.

Thread Selection Summary

As you can see from the preceding remarks, there are many causes of thread breakage and skipped stitches so it is important to observe and evaluate the problem to determine what might be the primary cause. Usually, more than one of the factors listed contributes to excessive thread breakage.

If you need technical assistance in evaluating your thread breakage problem, you can contact A&E's Technical Service Department for assistance. We look forward to serving you.

Other Causes of Thread Breakage and Skipped Stitches

In the following comments, we will outline a trouble-shooting guide from three perspectives:

- Is the thread breakage or skipping occurring on all operations and on most types of machines?
- Is the thread breakage or skipping occurring primarily on one operation or type of machine?
- Is the thread breakage or skipping occurring on one or two machines only?

The reason for this analysis is to help you differentiate between thread related problems and machine related problems. Common sense should tell you that if a sewing problem is occurring on only one or two machines, the problem is most likely NOT a thread related problem unless a noticeable defect is visible. On the other hand, if the problem is occurring on one color and on all sewing operations, the thread should be investigated first.

Is Thread Breakage Occurring on All Operations and on Most Types of Machines?

Check the following:

a) Has there been a thread change:

- From one type to another?
- From one size to another?
- From one supplier to another?

b) Check the quality of the thread for obvious defects:

- Knots, slubs, neps, improper twist, etc.
- Does the thread feel weak?
- Does the thread feel dry or pull through the sewing machine with a rough drag?

c) Check the quality of the piece goods being sewn:

- Has there been a change from one supplier to another?
- From one type to another?
- In the weight or stiffness of the fabric?

d) Is thread breakage occurring on all colors and patterns, or on one color or style?

Recommendations:

- Try sewing with thread from a different case or shipment.
- Make sure the correct thread type and size is being used.
- Send cones that are breaking to your thread supplier for evaluation. Ask for technical assistance if available.
- If the fabric appears to be different, see if fabric from a different shipment causes the same problem.
- Ask your piece goods supplier to check the fabric for proper finishing, etc.
- Check for signs of needle heat.

Is Thread Breakage or Skipping Occurring Primarily on One Operation or Type of Machine?

a) Has there been a thread change:

- From one type to another?
- From one size to another?
- From one supplier to another?

b) Is the correct type and size needle being used?

c) Is the proper machine and attachment being used for the operation?

d) Are the machines adjusted correctly for the operation?

e) Have the sewing operators made any changes in their method of operation?

Recommendations:

- Observe the operation to see if the thread is breaking at the same location most of the time. Depending on the fabric and operation, a special thread might be required.
- Make sure the correct needle and thread sizes are being used for the operation.
- The machines should be set up correctly for the operation with the correct presser foot, feed, needle plate and attachments.
- Check to make sure the mechanics are familiar with the particular type of machines being used on this operation. If not, try to find a training program on the equipment. Check with your machine supplier.
- Check for signs of needle heat. Try reducing the size of the needle or use a special coated needle. Use needle coolers on the machines if needed.
- Make sure the sewing operators are properly trained on the operation and are using the correct material handling techniques.