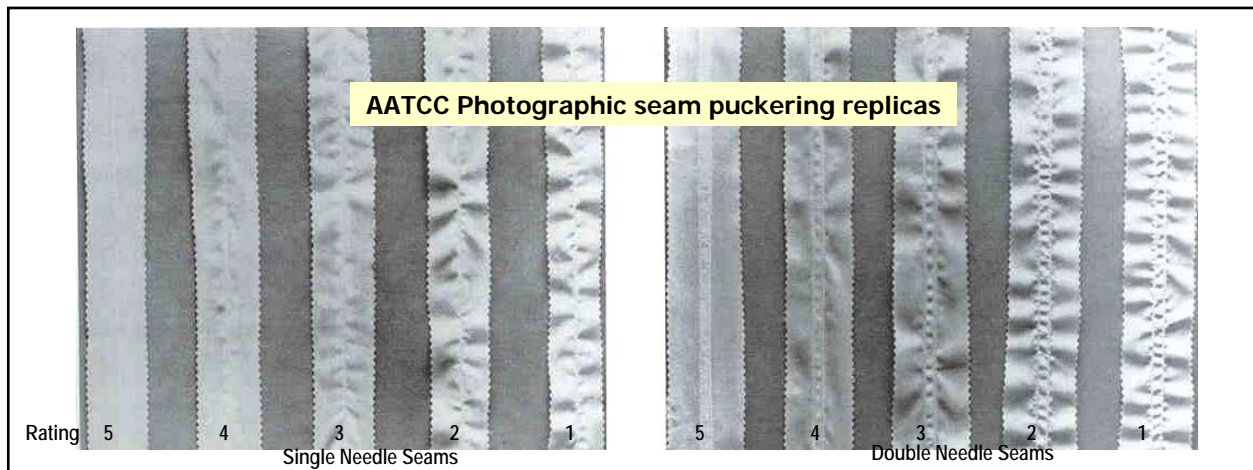


Minimizing Seam Puckering

Seam puckering refers to the gathering of a seam during sewing, after sewing, or after laundering, causing an unacceptable seam appearance. Seam puckering is more common on woven fabrics than knits; and it is prominent on tightly woven fabrics. Puckering is usually caused by one or more of the following conditions:

- Yarn Displacement (structural jamming of fabric yarns).
- Tension Puckering (excessive thread tension and recovery).
- Machine Puckering (uneven ply feeding).
- Shrinkage (where seam components have differential shrinkage).

Below is a rating system for seam puckering from 1 to 5 with 5 being pucker-free. This AATCC seam smoothness analysis is used by many major manufacturers to rate their seam performance.

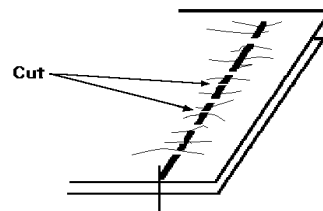


Yarn Displacement or Structural Damage

Seam puckering is more prevalent on very tightly woven fabrics because the yarns are oriented in very tight layers that cannot shift easily to compensate for the thread as it is inserted into the seam. This causes these tight yarns in the fabric to draw up giving a rippled appearance along the seam line. This is usually more of a problem when seams are sewn in the warp direction than in the weft (filling) or bias directions.

Identification

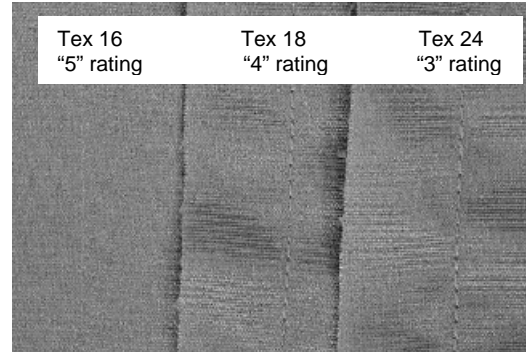
If possible, carefully clip the thread between adjacent needle penetrations along the seam and observe if the puckering remains in the fabric or goes away. If the puckering is still in the seam after the threads are clipped, then yarn displacement is the probable cause.



Solutions to Puckering Caused by Yarn Displacement

- To minimize seam puckering caused by yarn displacement or the structural jamming of the yarn in the fabric being sewn, the following corrective action should be used:

Use the smallest thread size available that will maintain adequate seam strength and sewing performance. Threads specifically designed for minimizing seam puckering on light weight no-iron shirts and blouses include our T-16, T-18 & T-24 Perma Core® Ultimate. These threads are very strong for their size and have excellent frictional characteristics allowing them to be sewn with minimum machine thread tension.



Use smallest needle size possible that will not cause excessive sewing problems. We also recommend using a needle with a longer needle point, if available which will have less resistance as it penetrates the seam.

Use a needle plate with a small needle hole; and a presser foot with a small needle hole.

Reduce the number of stitches per inch so there are fewer yarns displaced in the stitch line to cause seam puckering.

When possible, cut the garment pieces so they can be sewn on the bias or in a direction that allows the different yarns in the construction of the fabric to be displaced.

Thread Tension Puckering

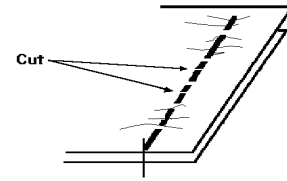
If a thread is sewn into the seam with excessive machine thread tension, the thread will try to recover or return to its original length. This will cause the seam to pucker immediately as the seam comes out from under the presser-foot. However, sometimes the sizing or resins in the fabric will initially maintain a flat seam but later in the day, the seam will appear puckered. This phenomenon also occurs after the garment is laundered and the sizing materials are removed causing the seam to pucker and the inspector to think that there was too much shrinkage in the thread. Excessive thread tension during sewing will not only cause puckered seams but also cause other sewing problems including thread breakage and skipped stitches. Our Perma Core® Ultimate threads are designed to be sewn with minimum thread tension. They also have a very high initial modulus or resistance to stretching under normal sewing tensions. This will help minimize or eliminate 'tension' puckering.



Excessive Needle Tension

Identification

Carefully clip the thread between adjacent needle penetrations along the seam and observe if the puckering is reduced in the fabric. If it is, then excessive thread tension is the probable cause of the seam puckering.



Solutions to Tension Puckering

Use a thread with a low elongation or high initial modulus to minimize stretching during sewing. Use a thread with good lubricity characteristics that will allow it to be sewn with minimum machine thread tension. *Perma Core® Ultimate* is specifically designed to have these physical characteristics.

Use very light machine thread tensions. Begin by setting the bottom thread tension (bobbin or looper) as light as possible but still maintain the proper thread control. Next adjust the needle thread tension to a minimum level necessary to maintain a closed seam and a balanced stitch. This not only reduces the elongation of the thread in the seam, but also improves loop formation and sewability.

Reducing the thread size will not only help to minimize structural jamming but can usually be sewn with lighter machine thread tension because a smaller thread requires less tension to pull it up into the seam and set the stitch. We recommend using T-16 or T-18 on 'wrinkle-resistant' or 'no-iron' shirts and blouses. T-24 *Perma Core® Ultimate* is ideal for tailored suits and trousers.

If structural jamming does not appear to be a problem, increase the needle size or use a needle with a ball eye to open up a larger hole in the fabric so the stitch can be set with the lightest tension possible.

Properly set the take-up spring so that the stitch can be set with minimum thread tension. Polish or replace all eyelets and thread guides that may be grooved to make sure they do not affect the frictional properties of the thread. On some machines a rotary tension system is available that meters the thread more uniformly than conventional tension disc systems.

On some machines the thread control guides and eyelets can be adjusted to control the thread more efficiently so less tension is required. This is advisable when possible.

Solutions for lockstitch machines:

Make sure the positioning finger is correctly set to allow the thread to pass through the hook with minimum resistance. If the machine has a mechanical opener, set the opener to shift the bobbin case holder so it will allow the thread to pass by the positioning finger with as little resistance as possible.

It is sometimes necessary to refine the gib or rail on the bobbin case holder so the thread can be released by the hook sooner in the stitch cycle. This sometimes allows the thread to be set with lighter tension.

On most sewing machines, four elements help in setting the stitch in the seam. They are the take-up system, the feed system, the needle thread tension, and the bottom thread tension. Proper feed timing in reference to the take-up system is critical to sewing with light tensions.

In extreme cases, it may be necessary to use an oil free hook that uses a Teflon coated rail. It has been found that machine oil migrates on other surfaces of the hook and can increase the surface friction as the thread passes around the hook.

Solutions for chainstitch machines:

On 401 Chainstitch machines, adjust the stitch balance so the needle loops on the bottom side of the seam lay over at least half way to the next needle penetration when the looper thread is unraveled out of the seam. The looper thread must also be as loose as possible.

- Adjust the thread controls to allow the stitch to be set with minimum thread tension. On many chainstitch machines, it is best to draw most of the needle thread through the tension discs when the needle is rising and a small amount when the needle is descending (75% on upstroke & 25% on the down stroke). Advancing the looper thread take-up timing will sometimes allow the needle thread to be released sooner so that it can set with lighter machine thread tension.

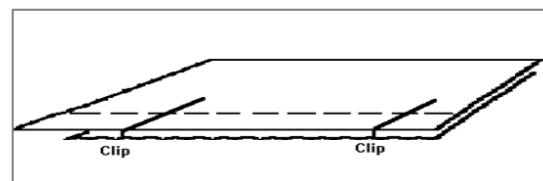
Feed Puckering (Uneven Ply Feeding)

Feed puckering occurs when one of the fabric plies is fed into the seam at a different rate than the other ply or plies. This causes a gathering effect in the over-fed ply. Ply mismatching as shown to the right (a) usually occurs when the presser foot holds back on the upper ply as the bottom ply is being fed into the seam at a higher rate by the feed dog. (b) Usually occurs when the operator holds back on the bottom ply and pushes the top ply into the machine so the fabric edges will come out evenly. Many seams observed display both of these conditions, with the first usually contributing to the latter because the sewing operator will attempt to correct for the uneven feeding of the sewing machine.



Identification

Make two perpendicular cuts across a sewn seam where the puckered condition is the greatest. Remove the thread in the seam and see if the two plies are of equal length. If one is longer than the other then the puckering is being caused by uneven ply feeding.



Solutions to Feed Puckering

To minimize seam puckering caused by uneven ply feeding, the following corrective action should be used:

- Use the minimum presser foot pressure that will maintain uniform feeding. Make sure the presser foot is clamping the fabric properly both in front and back of the needle. When the feed is up and moving the fabric, the seam should be clamped by the entire bottom surface of the presser foot. This can be checked by inserting a piece of paper under the foot from different angles and observing if the foot is clamping the fabric properly.
- Set the feed dogs at their proper height and check for back-feeding. The feed dog should have the optimum teeth per inch and number of rows of teeth for the operation and fabric being sewn.

Puckering can sometimes occur if the material is not held down flat as it is being fed through the machine creating a rippled appearance as the plies conform to the feed dog teeth. Usually lightweight wrinkle resistant fabrics should be sewn with feed dogs with 20 - 24 teeth per inch. Medium weight fabrics like men's trousers should be sewn with feed dogs with 14 - 18 teeth per inch. Heavy weight fabrics are usually sewn with feed dogs with 8 - 12 teeth per inch.

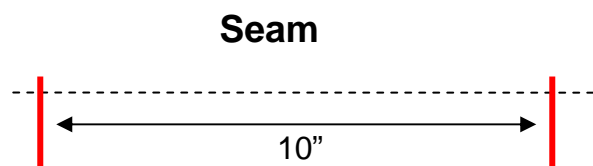
- Use the correct presser foot and needle plate for the material and operation being sewn. The needle plate and presser foot should have relatively small needle holes in relation to the needle size being used. As a general rule, the needle hole should be approximately twice the size of the needle. Check to make sure that the needle plate is not bent down at the needle hole.
- Use a low friction presser foot: Teflon coated roller bearing, "feeding foot", etc. Use an "anti-puckering" needle plate with a retaining spring that holds back on the bottom ply to match the top ply.
- Use machines equipped with a needle feed or compound feed mechanism where the needle moves with the feed as the fabric is being sewn. This "pinning" of the plies as they are being fed helps reduce feed puckering.
- Whenever possible, use machines equipped with auxiliary top feeding mechanisms such as: walking foot, puller, top driven roller feed, upper belt feed, etc..
- On machines equipped with differential feed systems, set the differential action to slightly stretch the bottom ply to match the top ply so they are fed evenly into the seam.
- Use automatic machines equipped with material clamping systems that prevent the fabric from moving as it is being sewn.
- Make sure you are using the correct capacity of folders and guides for the fabric being sewn.
- Observe operator handling for proper fabric movement to and through the machine.
- Make sure the pieces are cut properly in the cutting room and the proper seam tolerances have been maintained so the pieces are of equal length before seaming.
- If the plies have different stretch characteristics, position the ply with the greatest amount of stretch against the feed if possible.

SHRINKAGE PUCKERING

Shrinkage puckering can be caused when one of the components sewn into a seam shrinks at a different rate than the other components. Typical components include the shell fabric, interlining, zipper tapes, stay tapes and the thread. All these components should have minimum shrinkage to produce the flattest pucker-free seam.

Identification

Using an indelible ink pen, make two perpendicular lines exactly 10 inches apart across a seam that usually exhibits excessive seam puckering after laundering. Connect the marks with a line running parallel to the seam connecting the two perpendicular lines previously made. Now, subject the garment to finishing and pressing cycles and then check the length of the seam again. If there is seam shrinkage, the distance between the two marks will be less than 10 inches. The difference in length divided by 10 will give you the percent shrinkage.



Solutions To Shrinkage Puckering

A&E's *Perma Core® Ultimate* has been designed with minimum shrinkage. In fact, when this new thread was subjected to standard shrinkage testing at 180° C for 15 minutes, our *Perma Core® Ultimate* had zero shrinkage.

Summary

As you can see, there are many causes of seam puckering and on severe cases all the causes mentioned above can contribute to the problem at the same time. Our recommendation is to follow the solutions listed above to obtain the best results on your sewn products and make sure you are using the right thread.

If you need additional assistance, please contact your local A&E Sales Representative or Technical Solutions team member.