

SELECTING THE RIGHT SPI (STITCHES PER INCH)

Introduction

When writing garment specifications, you should always specify the proper number of stitches per inch (SPI) that should be used in your sewn products. Why? Because the number of stitches per inch can have a direct influence on the following: 1) the seam strength; 2) the stitch appearance; and, 3) the seam elasticity on stretch fabrics.

Seam Strength

An estimated seam strength formula was developed years ago for woven seams where one piece of fabric is placed on top of another with a specific seam margin and stitched with either a 301 lockstitch or 401 chainstitch.

Obviously, the seam strength is dependent on a number of factors including:

- Type & Weight of the Fabric
- Stitch & Seam Construction
- Stitches per Inch
- Thread Type and Size
- Stitch Balance (Thread Tensioning)

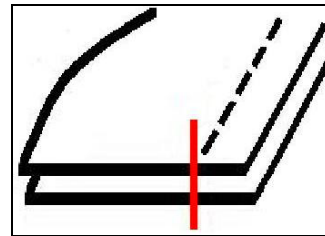


Figure 1. Superimposed Seam

Formulas for Estimating Seam Strength

301 Lockstitch - Estimated Seam Strength	401 Chainstitch – Estimated Seam Strength
$= \text{SPI} \times \text{Thread Strength (lbs.)} \times 1.5^*$ <p><i>* 1.5 is a factor based on the average loop strength ratio of most sewing threads.</i></p> $= 10 \text{ SPI} \times 4.0 \text{ lbs.} \times 1.5 = 60 \text{ lb. strength}$	$= \text{SPI} \times \text{Thread Strength (lbs.)} \times 1.7^*$ <p><i>* This factor is higher than a lockstitch because almost twice as much thread is consumed per inch of seam using a chainstitch.</i></p> $= 10 \text{ SPI} \times 4.0 \text{ lbs.} \times 1.7 = 68 \text{ lb. strength}$

From the above formulas, you can see the impact that stitches per inch, thread strength, and stitch selection have on the strength of the seam. Generally, the more stitches per inch, the greater the seam strength. There are rare cases where adding stitches per inch can actually damage the fabric so that the seam is weakened, however, this only happens on specific fabrics that can be easily damaged by excessive needle penetrations.

Given:

- 301 Lockstitch Superimposed Seam
- Thread Used Top & Bottom = T-24 Perma Core – Strength: 2.8 lbs.

SPI	6	8	10	12
Estimated Seam Strength	25 lbs.	34 lbs.	42 lbs.	50 lbs.

As you can see from the chart above, the stitches per inch has a tremendous impact on the strength of the seam, as long as the fabric doesn't rupture before the thread. If the same seams were sewn with a lower tenacity spun polyester thread, this also will effect the resulting seam strength.

Given:

- 301 Lockstitch Superimposed Seam
- Thread Used Top & Bottom = T-27 Spun Poly – Strength: 2.2 lbs.

SPI	6	8	10	12
Estimated Seam Strength	20 lbs.	26 lbs.	33 lbs.	40 lbs.

Some manufacturers substitute a smaller bobbin thread when sewing lockstitch seams to minimize the number of times a sewing operator has to change the bobbin. Remember, however, that the resulting seam strength will be much less and will be determined by the strength of the bobbin thread and not the needle thread.

How to Measure the Stitch Length or Stitches Per Inch

The stitch length is measured by measuring the number of lengths of thread found within one inch. Stitch counters are available from A&E that make this measurement easier. However, you can place a ruler next to the seam and perform the same task.

SPI is measured by counting the number of lengths of thread found within one inch. As you can see here, there are approximately 9 SPI sewn in this seam.

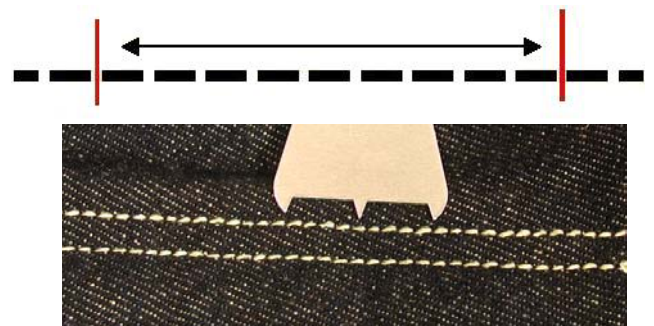


Figure 2. Stitch Counter Measuring SPI

Typical Stitch Lengths Recommended for Wovens & Knits

Below is a list of garments and the recommended typical number of stitches per inch.

WOVEN GARMENTS

Garments	SPI	Comments
Blindstitch Operations on Slacks, Dresses, Skirts, etc.	3 – 5	A long stitch length is desirable to minimize the dimple or appearance of the needle penetration on the outside of the garment.
Buttonhole (1/2" purl or whip stitch)	85 - 90	Generally, sewn vertically – approx. 85-90 stitches with a lockstitch buttonhole machine.
Buttonsew (4 hole button)	16	Buttonsew machines are cycle machines with a predetermined number of stitches per cycle.
Casual Shirts, Blouses, Tops	10 - 14	
Childrenswear	8 - 10	
Denim Jeans, Jackets, Skirts	7 – 8	Fewer stitches per inch generally will give a more contrast stitch appearance.
Dress Shirt or Blouse	14 – 20	Using more SPI allows the use of smaller diameter threads that will minimize seam puckering.
Dresses, Skirts	10 - 12	
Twill Pants or Shorts	8 – 10	More stitches per inch will help minimize seam grinning.
Trousers, Dress Pants, Slacks	10 - 12	On some operations like serge panels, it may be desirable to use a longer stitch length.

KNIT GARMENTS

Garments	SPI	Garments	SPI
Dresses, Skirts	10 - 12	Jersey T-Shirts, Tops, Polos	10 - 12
Fleece	10 – 12	Sweaters (Medium to Heavy)	8 - 10
Hosiery, Socks	35 – 50	Stretch Knits (Lycra®, Spandex®, etc.)	14 - 18
Infantwear	10 - 12	Swimwear	12 - 16
Intimates	12 – 16	Underwear	12 – 14

Factors to Consider

When setting standards for stitches per inch, you should always keep in mind that the more stitches per inch used in a seam requires longer sewing cycles to complete the seam. Longer sewing cycles translate into higher labor costs and lower production levels. A sewing machine running at 5,000 SPM (stitches per minute) at 8 SPI will sew 17.4 yards of seam per minute. A sewing machine running at 5,000 SPM at 14 SPI will sew 9.9 yards of seam per minute.

More stitches per inch will also consume more thread for every inch of sewn seam. This will contribute to higher seam strength and more elastic seams, but will also increase the consumption of thread required to sew the garment.

Therefore, the prior recommendations are common stitch levels that provide adequate seam strength but also take into consideration the already mentioned production and cost factors.

When sewing knit fabrics, you should always check for excessive seam grinning; and also check for stitch cracking. Seam grinning occurs when the thread stitch balance is too loose allowing the seam to open up too much when stress is applied to it. Stitch Cracking is checked by applying pressure on the seam in the stitching direction. If the thread tensions are too tight or unbalanced, or if you are not using enough stitches per inch, the threads will rupture as stress is applied on the seam.

Summary

From the comments and information listed above, you can see how important it is to add stitches per inch to your garment specification instructions. Using the correct number of stitches per inch can greatly enhance the strength, appearance, and performance of the seam for a given fabric type and application. If you need assistance in determining what the appropriate stitch level for your sewn products would be, please contact A&E's Technical Service team for assistance.