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Impact of Different Stitch Types on Seam Strength and Seam Slippage

Md. Mazharul Islam[1*], Md. Nazmul Islam[1]

[1]*Department of Textile Engineering, Northern University Bangladesh*
**Corresponding Author's E-mail: mazh999@gmail.com*
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KEYWORDS

Seam strength
seam slippage
stitch type

ABSTRACT

The durability of seams significantly influences the overall performance of garments during their intended use. Seam strength is contingent upon multiple factors, encompassing seam type, stitch type, stitches per inch (SPI), sewing thread count, fabric strength, and fabric type. However, among these factors, the stitch type employed in seam creation holds paramount importance. This study aims to ascertain the impact of distinct stitch types on both seam strength and seam slippage. In pursuit of this objective, a fabric with the following construction (EPI: 186, PPI: 131, Warp Count: 32/1 Ne +40D, and Weft Count: 100D + 40D) has been procured. Subsequently, samples have been meticulously fashioned according to the EN ISO 13936-1 method. The seam strength of each sample has been meticulously assessed utilizing a seam strength tester. Throughout this study, diverse stitch types have been chosen, including lock stitch 301, chain stitch 401, double chain stitch 401x2, and overlock stitch 504. The findings encompassing seam strength have been extracted from the corresponding equipment. Comparative analysis of the findings yielded intriguing insights. This proactive approach ensures the production of high-quality apparel items that align with performance expectations and uphold the standard of excellence.

1. INTRODUCTION

The quality of garments is contingent not solely on fabric excellence, but also on the integrity of the seams [1]. The fundamental elements of the apparel industry are fabric and sewing thread, and the qualities of these materials profoundly influence the seam quality of the final garment [1]. Sewing, defined as the act of joining two or more pieces of fabric through the use of sewing machines, sewing threads, and assorted stitching techniques, is an essential process within the apparel industry [2]. Stitches and seams play a fundamental role in crafting quality garments, providing structure by uniting diverse components [3]. The overall performance of garments in practical use significantly hinges on the quality of the seams, with particular emphasis on seam strength [4]. Stitches bind materials and maintain garment cohesion, while seams contribute to contour, form, and intricate detail [5]. Efficacious seams are indispensable for the garment's durability, overall quality, and aesthetic appeal. The performance of a seam is influenced by factors such as the chosen seam type, appropriate sewing thread, sewing process parameters, and the fabric's sewability characteristics [6]. Optimal tensile properties of sewing threads enhance productivity in apparel manufacturing by minimizing breakage occurrences [7]. Seam quality encompasses attributes like strength, elasticity, durability, stability, and visual appearance [8]. During the creation and manufacturing of garments, the apparel manufacturer tends to focus on the secondary attributes of the fabric, with seam quality being

a paramount concern [5]. Performance attributes encompass both visual and functional requisites. Visual criteria encompass factors like color, pattern, design, trends, and accessories, while functional considerations pertain to the garment's stability during wear and maintenance [5]. The garment's quality is not solely contingent on its outward appearance; its technical attributes and seam strength also significantly contribute. To achieve a high-quality product, it becomes imperative to judiciously select the appropriate seam type, stitching approach, and sewing conditions [9]. Crucial attributes such as strength, tenacity, and efficiency play pivotal roles in evaluating the serviceability of apparel [10]. Extensive research has been conducted to ascertain seam strength based on diverse parameters [11–18]. Notably, seam slippage and grinning tendencies in sewn fabrics escalate with increased fabric extensibility, inversely correlating with weft yarn density [19]. Additional research has delved into seam slippage optimization, considering fabric design as a key factor [20]. The quality and performance of sewn garments are intrinsically linked to seam strength. Seam failure renders the garment unfit for its intended use, even if the fabric remains intact [21]. Such failures not only distort the garment's appearance but also diminish its operational lifespan [22]. Variations in seam and stitch types can impact seam strength by influencing the interlacing of sewing thread with fabric yarns [23]. Despite the material's inherent strength, a garment can become unsuitable due to inadequate seam performance. Consequently, relating sewing parameters to fabric properties is of utmost importance [5]. Even when material strength is commendable, poor seam performance can render the garment unsatisfactory. Thus, evaluating seam strength within the context of garment performance during use assumes paramount significance [24]. Such failures contribute to a shortened life cycle of the end product, primarily due to distortion of the sewing surface [25, 26]. So, the objective of this study is to find out the imapact of different stitch on seam strength and seam slippage.

2. MATERIALS & METHOD

In this study, a fabric with the following attributes (EPI: 186, PPI: 131, Warp Count: 32/1 Ne +40D, and Weft Count: 100D + 40D) and composition of (72% Polyester, 21% Viscose & 7% Elastane) was chosen for experimentation. The samples were meticulously prepared in accordance with the EN ISO 13936-1 methodology. Subsequently, the seam strength of each sample was quantified using the James Heal Titan universal strength tester. Distinct stitch types were utilized in this experiment, including lock stitch 301, chain stitch 401, double chain stitch 401x2, and overlock stitch 504. The final stage of analysis encompassed a comparison and in-depth examination of both seam strength and seam slippage reports.

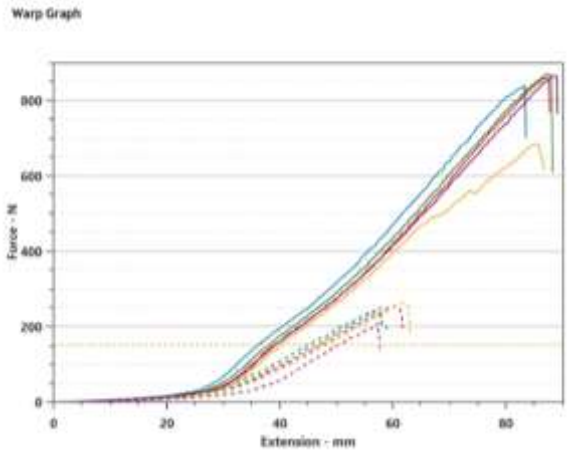

Figure 1: Warp-wise seam strength graphs of 301 single needle lock stitch

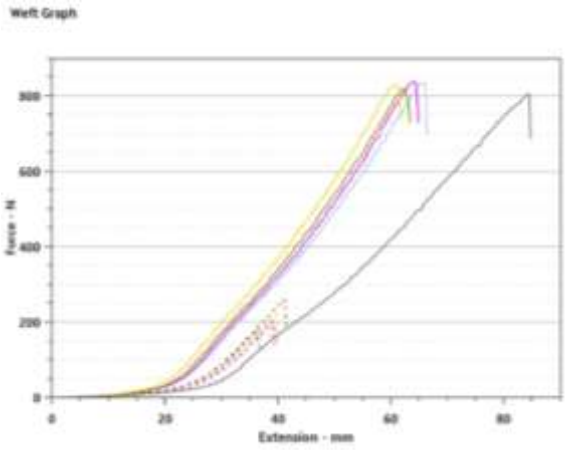

Figure 2: Weft-wise seam strength graphs of 301 single needle lock stitch

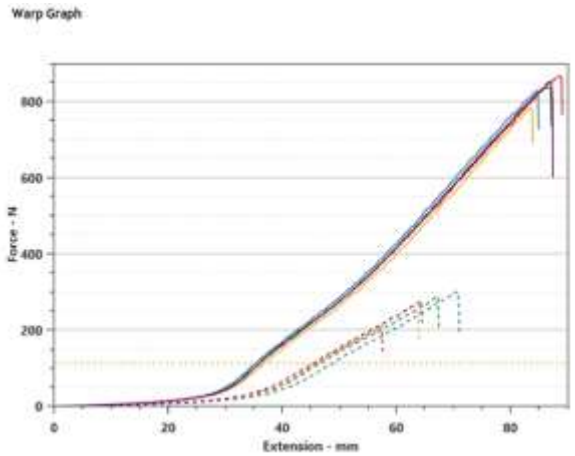

Figure 3: Warp-wise seam strength graphs of 401 single needle chain stitch

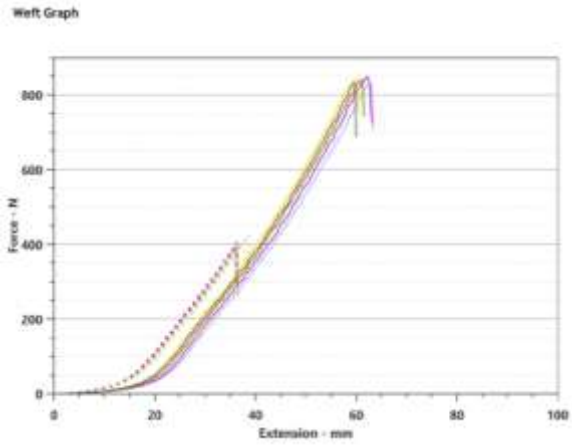

Figure 6: Weft-wise seam strength graphs of 401x2 double needle chain stitch

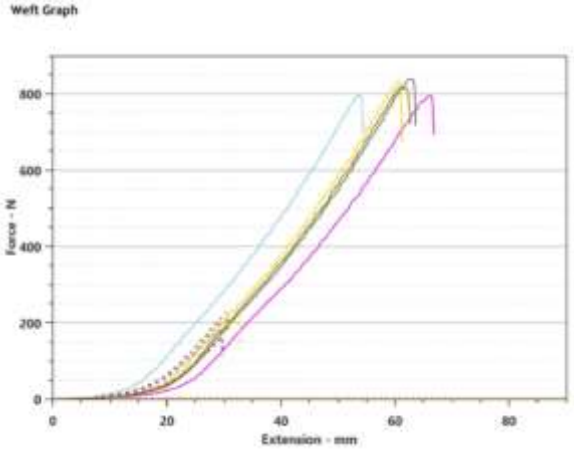

Figure 4: Weft-wise seam strength graphs of 401 single needle chain stitch

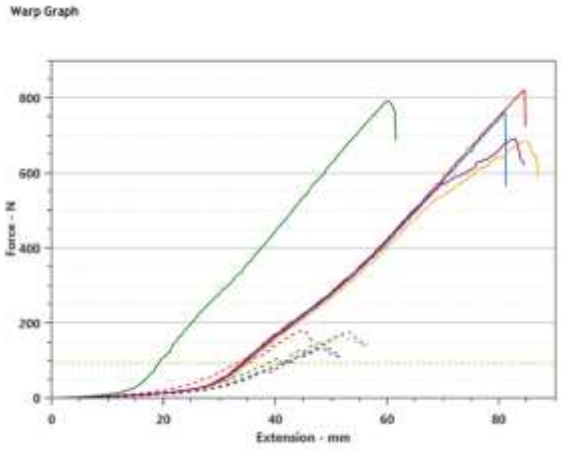

Figure 7: Warp-wise seam strength graphs of 504 three thread overlock stitch

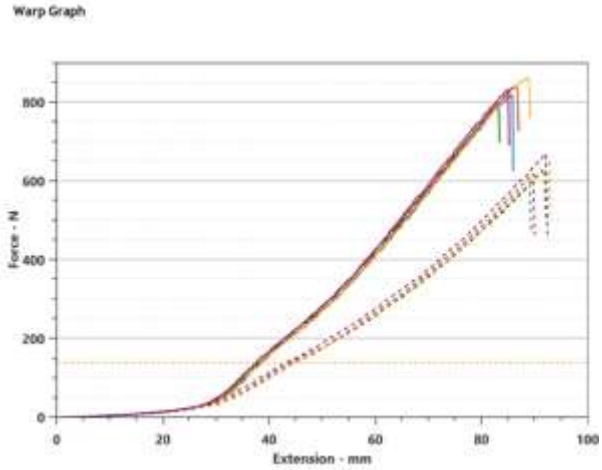

Figure 5: Warp-wise seam strength graphs of 401x2 double needle chain stitch

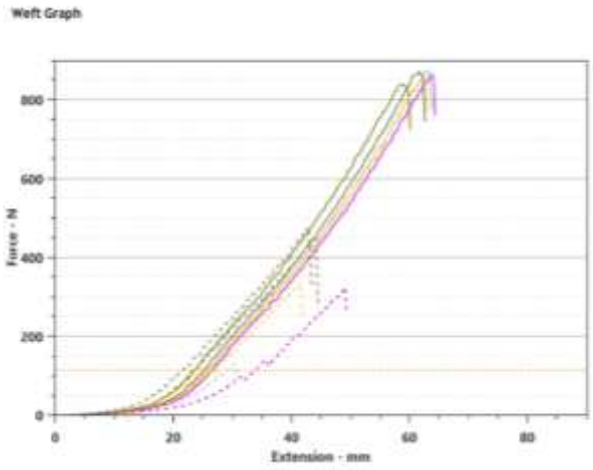

Figure 8: Weft-wise seam strength graphs of 504 three thread overlock stitch

3. RESULT & DISCUSSION

In this research work, seam strength & seam slippage of superimposed seam having different stitch type have been measured. The results are summarized below:

Table 1: Comparative study on seam strength & seam slippage based on stitch type

Stitch Code	Stitch Type	Average seam slippage (N)		Avg. seam strength (N)	
		Warp	Weft	Warp	Weft
301	SNLS	140.02	NA	242.57	214.02
401	SNCS	140.32	NA	268.02	202.30
401x2	DNCS	137.24	NA	631.68	403.56
504	3TOL	117.18	NA	160.25	343.74

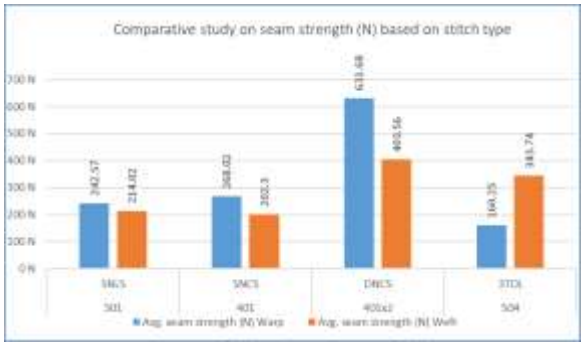

Figure 9 Comparative study on seam strength based on stitch type

Figure 10: Comparative study on seam slippage (warp) based on stitch type

Table 1 and figure 9, illustrates a comparative study on seam strength based on stitch type. Average seam strength value of warp in case of single needle lock stitch stood at 242.57N, which is then increased steadily in case of single needle chain stitch (268.02N). After that, it dramatically went up to hit the highest point of the graph 631.68N for double needle chain stitch. Finally, the value of seam strength in case of overlock seam plunged to a low of 160.25N.

However, in case of weft seam strength value of single needle lock stitch it stood at 214.02N, then it slightly went down to 202.3N in case of single needle chain stitch. After that, the value reached the highest point of the graph 403.56N for double needle chain stitch. Finally, the value of seam strength steadily fell down to 343.74N for overlock stitch.

Overall, it can be said that seam strength of double needle chain stitch (for both warp & weft seam) has the highest values as compared to the other stitches. Moreover, it can also be said that average seam strength of warp is always higher than weft for all types of stitch except overlock stitch. The result is altered in case of overlock stitch because rather than tearing the fabric seam, the force actually breaks the sewing thread in case of weft seam.

Table 1 and figure 10 illustrates a comparative study on seam slippage based on stitch type. Seam slippage value of warp in case of single needle lock stitch stood at 140.02N and then it almost remains constant (140.32N) for single needle chain stitch. After that, the value of seam slippage decreased steadily to 137.24N for double needle chain stitch. Finally, seam slippage value heats a low of 117.18N in case of overlock seam.

Overall, it can be said that seam slippage of overlock seam has the lowest value as compared to another seam. So, at lower amount of force, seam slippage happens in the fabric. Moreover, single needle (lock or chain) stitch has the lowest possibility of seam slippage rather than double needle stitch.

4. CONCLUSION

Apparel manufacturers often choose stitch and seam types according to fabric and sewing thread considerations, often neglecting the potential impact on the overall apparel performance. To ensure the quality of the apparel aligns with international standards, it becomes essential to evaluate seam strength and slippage, thereby offering consumers assurance regarding the product's quality within the global market. This process assures consumers of the garment's quality, instilling confidence in the product and its seam efficiency. The findings of this investigation underscore the significance of making deliberate

choices in stitch selection during apparel construction. It is therefore strongly advised that apparel manufacturers exercise heightened awareness when it comes to opting for appropriate stitch types. Such discerning choices are integral to guaranteeing the production of apparel products of the utmost quality.

CONFLICT OF INTEREST

The authors have confirmed that there is no conflict of interest with this work.

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