Performance characteristics of the Merrow Infused ActiveSeam®: A comparative analysis of joining techniques for durability, comfort, and appearance in sportswear

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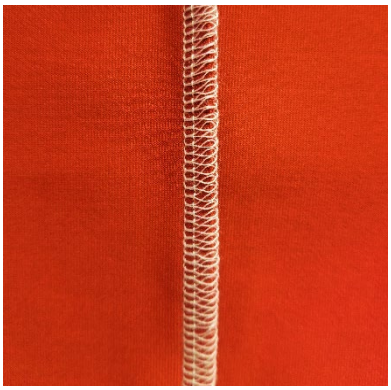
Background. The performance apparel market is one of the fastest-growing sectors of the global textile industry (Little, 2016). Sportswear aids athletes or active individuals by providing improved thermal regulation, comfort, and mobility (Motlogelwa, 2018). Manufacturing of sportswear use various fabrics and joining techniques (Hayes, 2018). Until recently, there were two stitch classes (overlock and flatlock) and two seam classes (superimposed and lapped-felled) typically used for joining knit fabrics (Hayes, 2018). The joining technique can impact seam durability, appearance, and comfort (Beaudette & Park, 2016; Liu et al., 2014). In 2017, Merrow's patented ActiveSeam® sewing machine introduced a new class of stitch designed specifically for constructing seams in performance apparel (Merrow, 2017). At present, there is limited literature on this new stitch class. Additionally, no research was found comparing the new ActiveSeam® to the existing superimposed and/or lapped-felled seams. Therefore, this study conducted seam testing to compare the Infused ActiveSeam®, lapped-felled seam, and superimposed seam for durability, comfort, and appearance after laundering. Knowledge gained from this study will allow designers and manufacturers to make the best decisions when specifying seams for sportswear.

Literature Review. Seam performance considers the overall safety, durability, and quality of joining materials and techniques (Motlogelwa, 2018). A common safety and durability complaint with sportswear is seam breakage (Ho & Au, 2016). Seam breakage is caused by the stretch/elongation of a seam thereby causing discomfort or improper fit (Fangueiro et al., 2010; Gurarda, 2009), both of which can directly impact the wearer's physical performance (Ho & Au, 2016). Laundering may also weaken seams, contributing to seam breakage, decreased thermal comfort, and changes in appearance/smoothness of seams (Easter & Ankenman, 2006). Finally, moisture management is of great interest with sportswear to mitigate discomfort from perspiration (Ho & Au, 2016). Important indices related to clothing comfort include drying time, seam thickness, and seam stiffness (Liu et al., 2014; Song & Mandal, 2016).

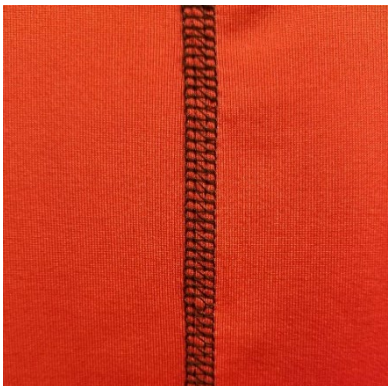
Materials & Methods. A substrate of super stretch compression tricot (70% Nylon, 30% Spandex, 285 g/m^2) with moisture management and MicroBlok anti-microbial finish was selected as representational of a typical textile used in sportswear (Power, 2018). The substrate seams were stitched with overlock (ISO 514 stitch), flatlock (ISO 607 stitch), and Infused ActiveSeam®, all using SabaFlex PTT Tex 70 (Polytrimethylene terephthalate) continuous filament thread. See Figure 1 for images of seams and stitch types. Color is the only distinguishing thread feature and served as an organizational tool for researchers. Textile performance testing was conducted in triplicate to compare durability (bursting strength of seams), comfort (seam stiffness, drying time), appearance after home laundering (smoothness of seams), and thickness. See Table 1 for standard test methods, evaluation procedures, and

associated indices. Specimens were randomized and tested in a laboratory environment maintained at 70 ±2°F and 40 ±2% relative humidity throughout the data collection process.

Figure 1. *Seams and stitch types*



a. Superimposed: ISO 514 stitch



b. Lapped-felled: ISO 607

c. Infused ActiveSeam®

Table 1. *Chart of standard methods and data*

Test Method or Evaluation Procedure	Index / Unit of measurement	Overlock	Lapped-felled	ActiveSeam®
ASTM D3787 Bursting Strength, CRT Test	Strength	217.3 lbf	183.0 lbf	220.8 lbf
ASTM D1388 Stiffness of Fabrics, Cantilever Test	Bending length	390 cm	202 cm	260 cm
AATCC 199 Drying Time, Moisture Analyzer Method	Drying time	15.90 min	62.38 min	60.86 min
AATCC 88B Seam Smoothness after Home Laundering	Visual Rating	4.5	3.83	5
ASTM D177 Thickness	Seam thickness	.061 in	.036 in	.055 in

Analysis & Results. Three replications were performed and averaged for each testing method (see Table 1), then ANOVA was conducted. Results with a statistical significance are featured in Table 2.

Table 2. *ANOVA results by test method*

Test method	Df	Sum Sq	Mean Sq	*F*-Value	*P*-Value
Bursting Strength	2	76180.22	38090.11	12243.25	<.001
Stiffness	2	22772.22	27886.11	57.37	<.001
Drying Time	2	4185.61	2092.81	147.49	<.001
Thickness	2	.001	.001	88.55	<.001

Conclusion: Infused ActiveSeam™ had the highest bursting strength and best smoothness rating. Lapped-felled was the thinnest of all three seams, showed lowest bending length, slowest drying rate, and lowest seam appearance rating. Overlock had the best drying rate but was the thickness of all three seams. Overall, the ActiveSeam™ showed better bursting strength and appearance but comparable drying time when tested against the lapped-felled and overlock seams. Designers and manufacturers of sportswear apparel should highly consider the use of ActiveSeam® as it has excellent appearance, durability, and comfort properties.

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