

**Request Number: 1353/271008**

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<b>Date:</b>	13 <sup>th</sup> November 2008
<b>Requested by:</b>	Terry Davey
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**REQUEST DESCRIPTION**

Customer provided six sets of prepared seam swatches with a request to test the seam strengths.

Each set comprised four swatches of a particular fabric with sewn and bonded seams. Two swatches in each set consisted of a sewn seam, the remaining two swatches consisted of bonded seams.

**INVESTIGATION OVERVIEW**

The submitted seam mock-ups were tested to determine seam strength and mode of failure.

**EXPERIMENTAL****Materials**

Six sets of seam swatches prepared by the customer. Each set comprised four swatches of a particular fabric with sewn and bonded seams. Two swatches in each set contained sewn seams, one sewn in the fabric warp direction and one in the weft direction, the remaining two swatches consisted of 10 mm wide bonded seams, one in the warp direction and one in the weft direction.

- Fabric #1 Navy blue, fleece. Overlocked edge seam samples, warp and weft, and 10 mm bonded seam samples, warp and weft.
- Fabric #2 Black, woven. Straight seams and edges overlocked together, warp and weft, and 10 mm bonded seam samples, warp and weft.
- Fabric #3 Black, knit. Overlocked edge seam samples, warp and weft, and 10 mm bonded seam samples, warp and weft.
- Fabric #4 Black, knit. Overlocked edge seam samples, warp and weft, and 10 mm bonded seam samples, warp and weft.
- Fabric #5 Black, twill. Straight seams and edges overlocked together, warp and weft, and 10 mm bonded seam samples, warp and weft.
- Fabric #6 Charcoal, woven. Straight seams and edges overlocked together, warp and weft, and 10 mm bonded seam samples, warp and weft.

## Test Procedure Summary

Samples were left in a temperature-controlled room (20°C ±2°C) at 42% humidity for 24 hours before testing.

## Testing

Test pieces, each 50 mm wide, were cut from each seam sample. Five test pieces were obtained from the warp samples, four test pieces from the narrower weft samples. Each test piece was pulled on a Hounsfield H10KS tensile testing machine at the following settings:

Load range                    500 N  
 Cross head speed            300 mm/min  
 Approach speed              300 mm/min  
 Preload                        0.01 N  
 Mechanical grips set with distance between jaws at 100 mm.  
 Grip area dimensions       25.4 mm x 25.4 mm (1 inch x 1 inch).  
 Clamps                         Front clamps 25.4 mm x 25.4 mm  
                                       Rear clamps 50 mm wide, 25.4 mm height.  
                                       Rubber faced.

Results were reported as the maximum force (in newtons) achieved before failure, and the mode of failure, e.g. fabric rupture, sewing thread rupture, bond failure.

## RESULTS

Results of seam strength tests are given in the following tables. Note that the sewn swatches of fabrics #2, #5 and #6 were constructed with a straight seam and the raw edges were overlapped together. The force at straight seam failure and then the subsequent force at overlock stitch failure are both reported. Sewn swatches #1 and #4 were constructed with overlapped seam only.

Fabric #1	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	104.9	106.5	104.5	111.1	101.4	Fabric	9.73	8.72	9.47	15.38	24.78	Bond
WEFT	318.8	311.2	315.6	283.6		Stitching	14.55	33.32	15.70	49.90		Bond

Fabric #2	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	49.5	35.8	26.1	30.7	37.3	Straight seam stitch	283.2	266.0	264.0	266.0	252.0	Fabric
	182.6	174.4	163.8	171.4	177.0							
WEFT	89.8	72.2	60.8	147.9		Straight seam stitch	413.0	418.5	426.0	441.0		Fabric
	267.2	272.8	282.0	356.0								

Fabric #3	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	181.8	186.4	188.2	189.2	161.2	Stitching	399.0	411.5	404.0	416.5	369.2	Fabric
WEFT	167.8	207.0	252.0	244.5		Stitching	>500	>500	>500	>500		*None

Fabric #4	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	208.3	226.8	221.8	211.0	181.2	Fabric	226.0	214.3	230.5	215.5	215.3	Fabric
WEFT	182.8	215.8	135.8	215.0		Stitching	246.0	246.0	232.3	257.6		Fabric

Fabric #5	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	109.9	77.6	56.3	75.6	64.1	Straight seam stitch	>500	>500	>500	>500	>500	*None
	250.8	216.5	174.2	237.0	215.8	Overlock stitching						
WEFT	29.4	55.5	33.9	51.7		Straight seam stitch	>500	>500	>500	>500		*None
	230.8	192.8	183.6	171.0		Overlock stitching						

Fabric #6	SEWN SEAM						BONDED SEAM					
	Seam strength measurements (N)					Failure	Seam strength measurements (N)					Failure
WARP	48.5	30.1	46.0	37.7	41.45	Straight seam stitch	369.6	384.8	378.0	379.6	373.6	Fabric
	212.3	213.8	209.3	205.8	249.3	Overlock stitching						
WEFT	68.2	45.3	44.1	70.1		Straight seam stitch	>500	>500	492.5	>500		One fabric failure (at 492.5 N). Remaining samples did not fail (>500 N)
	245.8	236.5	252.8	252.0		Overlock stitching						

\* There were no failures up to the limit of the load cell on the test machine. The seam strength of these samples exceeds 500N.

## Summary

<b>FABRIC</b>	<b>Sewn seams</b>	<b>Bonded seams</b>
#1	Strong. The warp sample seams were stronger than the tensile strength of the fabric since the fabric ruptured. The weft direction had a higher tensile strength and seam failure occurred when the stitch threads ruptured.	Weak. All seams failed due to inadequate bond. After test, the adhesive had a very clear appearance and a very stiff feel. The adhesive had not been bonded very well to the fabric possibly due to incorrect processing but just as likely, the adhesive is not an ideal match for this fabric.
#2	The straight seams failed at low forces. The overlock stitching threads ruptured at much higher forces.	Strong – stronger than the sewn seams. All failures due to fabric rupture.
#3	Strong. Both warp and weft samples failed due to stitch thread breakages.	Strong – stronger than the sewn seams. The warp sample failed when the fabric ruptured; the bonded seam remained intact. The weft bonded seam sample did not fail. The strength of the fabric and the bonded seam exceeded 500 N which was the limit of the load cell in the testing machine.
#4	Strong. The sewn warp samples failed due to fabric rupture. The weft seam failed due to stitch thread breakage.	Strong. The sewn and bonded warp samples, and the bonded weft samples all performed the same; failures were due to rupture of the fabric.
#5	The straight seams failed at low forces. The overlock stitching threads ruptured at much higher forces.	Strong. No failures with either warp or weft sample. The strength of the fabric and the bonded seam exceeded 500 N which was the limit of the load cell in the testing machine.
#6	The straight seams failed at low forces. The overlock stitching threads ruptured at much higher forces.	Strong. All warp sample failures and one weft sample failure were due to fabric rupture. Three out of four weft test pieces did not fail because the strength of the fabric and the bonded seam exceeded 500 N which was the limit of the load cell in the testing machine.

## COMMENTS

For fabrics #2, #3, #4, #5 and #6, the bonded seams performed better than the sewn seams with bond strengths as good as or better than the tensile strengths of the fabrics.

With fabric #1 the sewn seams were much stronger than the bonded seams. Very low forces were required to rupture the bonded seams. The majority of the adhesive surface appeared not to have bonded at all to the fabric.

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*end of report*