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by

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PERFORMANCE OF MOHAIR/WOOL WORSTED SUITING FABRICS DURING MAKING-UP

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ABSTRACT

The making-up of five commercial mohair worsted suiting fabrics was investigated in terms of dimensional stability, bond peel strength, seam slippage, seam pucker, sewability and fraying. The results obtained showed that fusing, dry-cleaning and steaming caused some changes in fabric dimension and bond peel strength. All fabrics had low resistance to seam slippage. The use of pulley-feed mechanism eliminated seam pucker caused by the feed mechanism. Use of the chain stitch, or tissue paper in the case of the lock stitch, prevented the seams from puckering due to sewing thread contraction. Application of a lubricant to the needle thread reduced the fabric resistance to needle piercing, but it increased the degree of pucker caused by sewing thread contraction.

1. INTRODUCTION

Garments made of mohair/wool worsted fabrics are generally aimed at the upper end of the market where fashion and style have an important influence. In this market, the fabric physical properties generally play a less important rôle, whereas the aesthetics of the garment and its finish are of the utmost importance.

The physical properties of worsted mohair suiting fabrics may cause some appearance problems in the made-up garment, such as seam slippage, seam pucker and fraying. There appears to be limited information on the dimensional stability, sewability, seam slippage and seam pucker of mohair fabrics. A study was therefore undertaken to determine the extent of these problems using five commercial mohair suiting fabrics.

2. EXPERIMENTAL

2.1 MATERIALS

Five commercial mohair/wool worsted suiting fabrics were used in this investigation (Table 1) together with a warp-knitted (weft inlay) polyester/rayon fusible interlining (104 g/m^2, glue line temperature 121-127°C). Three commercial sewing threads (ticket Nos. 120 spun polyester, 120 core-spun and 60 mercerised cotton), slim set and medium ball point needles of diameters 0,80 and 0,90 mm (chromium finish) and ®Berbro thread lubricant were used.

TABLE I

FABRIC SPECIFICATION

Fabric Code	Fabric Mass (g/m²)	Fabric Sett (per 10 cm)		Resultant Yarn Linear Density (Rtex)		Weave	Mohair Content (%)	
		Ends	Picks	Warp	Weft		Warp	Weft
1	152	243	253	26	27	Plain	0	72
2	158	190	200	31	44	Plain	0	85
3	186	190	200	44	48	Plain	0	50
4	189	210	200	36	45	Plain	0	75
5	220	170	170	53	70	Plain	0	22

2.2 METHODS AND APPARATUS

Sewability tests were conducted on an industrial single needle lock-stitch sewing machine on which the fabric resistance to needle piercing (FRNP) was measured[1]. The sewing conditions were: sewing speed — 1760 rev/min., stitch length — 2,5 mm and needle thread peak tension — 100 cN. Seam pucker was evaluated using the SAWTRI Puckermeter, and seam slippage tests were conducted in accordance with the BS3320:1970 method. The bond peel strength was determined applying the AATCC Test Method 136-1972. Fabric dimensional changes and the bond peel strength were evaluated in terms of the following operations:

— passing through fusing press (referred to as fusing)

— steaming

— commercial dry-cleaning

Fusing was carried out on a Reliant continuous fusing press. Steaming was conducted on a Presto steaming press at a steam temperature of 102° C and commercial dry-cleaning in a Donini dry-cleaning machine. The cleaning time was 45 minutes and the temperature inside the cleaning chamber was 40° C. The cleaning agent was a mixture of perchloroethylene and ®Finess soap in the proportion of 7,5 ml of soap to 1000 ml of perchloroethylene.

3. **RESULTS AND DISCUSSION**

3.1 DIMENSIONAL STABILITY

Preliminary investigations showed that shrinkage in the weft direction was very small and conditioning had a negligible effect on shrinkage recovery, therefore, only the warp shrinkages are given here and the effect of conditioning has been omitted.

3.1.1 **Effect of Fusing Conditions**

Previous investigations[2,6] showed that the fusing press temperature setting and fusing time were the major factors affecting fabric shrinkage due to the fusing operation, therefore, in this study shrinkage under different fusing temperatures and times was investigated.

3.1.1.1 *Effect of temperatures*

The result obtained (Table 2) showed that an increase in press temperature setting produced little, if any, changes in the shrinkage of the outer fabrics alone. In the case of the laminates (Table 3) an increase in fusing temperature (indicated by the glue line temperature) also did not produce significant changes in the amount of shrinkage of either the outer fabric or the interlining.

TABLE II

EFFECT OF FUSING CONDITIONS ON SHRINKAGE (%) OF MOHAIR FABRICS (ALONE)

Fabric Code	Press Temp. Setting (°C) (15s, 300 KPa)				Time (s) (160°C, 300 KPa)		
	130	145	160	172	10	15	20
1	0,8	1,2	1,2	—	1,2	1,2	1,2
2	—	1,2	1,6	1,6	1,6	1,6	1,6
3	—	1,6	1,6	1,6	1,6	1,6	2,0
4	—	2,0	2,4	2,4	2,4	2,4	2,8
5	—	2,0	2,0	2,0	2,0	2,0	2,4

3.1.1.2 *Effect of fusing time*

The results obtained for the outer fabrics alone (Table 2) showed that a change in fusing time did not affect the magnitude of fabric shrinkage. The laminates, however, showed (Table 3) some slight increase in shrinkage of both the outer fabric and the interlining with an increase in fusing time.

3.1.2 **Effect of Steaming**

3.1.2.1 *Outer fabrics alone*

Steaming of the outer fabrics and the interlining not subjected to fusing conditions, or when subjected to dry-cleaning only, had no significant effect on

TABLE V

EFFECT OF STEAMING ON SHRINKAGE (%) OF LAMINATES

Fabric Code	Due to Fusing		Due to Steaming [steaming time (s)]					
			5		15		20	
	OF	I	OF	I	OF	I	OF	I
1	1,3	1,3	-0,1	-0,1	-0,5	-0,5	-0,3	-0,3
2	1,6	1,5	-0,8	-0,7	-0,8	-0,7	-0,4	-0,4
3	2,0,0	2,0	-0,8	-0,8	-1,2	-1,2	-0,8	-0,8
4	2,0	2,0	-0,8	-0,8	-0,8	-0,9	-1,2	-1,2
5	1,9	1,9	0,0	0,0	-0,3	-0,3	-0,3	-0,3

TABLE VI

EFFECT OF DRY-CLEANING ON SHRINKAGE (%) OF OUTER FABRICS ALONE

Fabric Code	Fabrics not Subjected to Fusing Conditions			Fabrics Subjected to Fusing Conditions			
	Number of dry-cleaning cycles			Number of dry-cleaning cycles			
	1	5	10	0	1	5	10
1	0,4	0,8	0,8	0,8	-0,4	0,0	0,4
2	0,8	0,4	1,6	1,6	-1,2	-0,8	0,0
3	0,4	0,4	1,6	1,6	-0,4	-0,8	0,9
4	0,4	1,2	1,6	2,5	-1,3	-2,0	0,0
5	0,4	0,4	0,4	2,2	-0,2	-0,2	0,2

3.1.3.2 *Laminates*

When the laminates were subjected to one dry-cleaning cycle, four of the outer fabrics (1-4) showed (Table 7) some dimensional recovery. An increase in the number of dry-cleaning cycles reduced the amount of recovery, and some fabrics (2, 4, 5) showed some increase in fabric shrinkage (Table 7). After 10 dry-cleaning cycles all five laminates showed a significant increase in shrinkage. Steaming after dry-cleaning had an insignificant effect on fabric dimensions.

TABLE VII

EFFECT OF DRY-CLEANING ON SHRINKAGE (%) OF LAMINATES

Fabric Code	Due to Fusing		Due to Dry-Cleaning (Number of dry-cleaning cycles)					
			1		5		10	
	OF	I	OF	I	OF	I	OF	I
1	1,2	1,2	-0,4	-0,4	0,0	0,0	0,8	0,8
2	1,6	1,5	-0,4	-0,3	0,4	0,1	0,8	0,9
3	1,8	1,6	-0,6	-0,4	-0,2	-0,2	0,6	0,6
4	2,1	2,0	-0,4	-0,4	0,4	0,3	0,5	0,6
5	2,1	1,9	0,3	0,4	0,3	0,4	1,1	1,3

3.2 BOND PEEL STRENGTH

3.2.1 Effect of Fusing Conditions

3.2.1.1 *Effect of actual glue line temperature*

The results obtained (Table 8) showed that an increase in the actual glue line temperature led to an increase in the bond peel strength. On average, in the investigated range 120-140°C, an increase in glue line temperature of °C produced an increase in the bond peel strength of 0,1 N.

TABLE VIII

EFFECT OF GLUE LINE TEMPERATURE AND FUSING TIME ON BOND PEEL STRENGTH (N)

Fabric Code	Glue Line Temperature (°C) (25s, 300 KPa)			TIME (s) (125 ± 2°C, 300 KPa)		
	120	130	140	10	15	20
1	6,4	7,3	8,0	5,4	7,1	7,6
2	5,9	6,4	7,5	4,4	6,3	6,4
3	6,4	6,7	7,9	7,1	7,7	9,0
4	5,8	7,4	8,3	6,0	7,7	9,1
5	9,2	10,8	10,9	8,9	10,8	12,4

3.2.1.2 *Effect of fusing time*

The results obtained (Table 8) showed that an increase in fusing time always led to an increase in the bond peel strength. On average an increase in fusing time of 1 s gave an increase in the bond peel strength of 0,15 N.

3.2.2 Effect of Steaming

The results obtained (Table 9) showed that the introduction of steaming resulted in a significant improvement in the bond peel strength. The degree of the improvement was not consistent, and depended on the outer fabric and the steaming time. Application of steam to the interlining side or outer fabric side had the same effect on bond peel strength.

3.2.3 Effect of Dry-cleaning

The dry-cleaning process had a deteriorating effect on the bond peel strength (Tables 9 and 10) for all investigated fabrics. The degree of

TABLE IX

EFFECT OF STEAMING ON BOND PEEL STRENGTH (N)
(Steam applied to interlining side)

Fabric Code	Before Steaming or Dry Cleaning	After Steaming (steaming time) (s)			Steaming After Dry-Cleaning			
					After Dry-Cleaning	Steaming time (s)		
		5	15	30		5	15	30
1	7,6	8,2	9,3	8,8	5,6	7,6	7,2	7,2
2	5,5	5,7	5,7	6,9	4,7	6,1	5,2	5,9
3	7,0	7,3	8,2	8,6	5,0	6,5	7,3	7,9
4	7,0	7,7	7,7	9,6	5,7	6,4	7,2	7,5
5	9,9	11,6	10,6	12,9	7,1	10,1	10,9	10,9

deterioration increased with an increase in the number of dry-cleaning cycles. Steaming after dry-cleaning (Table 9) improved the bond peel strength, and in some cases recovery to the original level was observed.

The formation of the trends of the magnitudes of the bond peel strength in terms of fusing conditions, steaming and dry-cleaning obtained here agrees with previous investigations concerned with all-wool, polyester/wool and polyester/viscose outer fabrics[3-9].

TABLE X
EFFECT OF DRY-CLEANING ON BOND PEEL STRENGTH (N)

Fabric Code	Before Dry-Cleaning	After Dry-Cleaning (Dry-cleaning cycles)		
		1	5	10
1	7,6	5,5	4,9	4,4
2	5,5	4,8	2,9	2,3
3	7,0	5,9	4,7	4,5
4	7,0	5,4	4,8	3,7
5	9,9	6,9	5,7	4,5

3.3 SEAM SLIPPAGE

Seam slippage tests were carried out on the mohair suiting fabrics as received and after fusing, steaming, and 10 dry-cleaning cycles, respectively. The effect of application of sewing thread lubricant on seam slippage was also investigated. The results obtained (Table 11) showed that on average the investigated fabrics had a low resistance to seam slippage in both warp and weft directions. This trend was not affected by the subsequent operations. However, the fabrics showed one positive feature, namely some reduction in the amount of seam slippage occurred when the applied load was reduced from 118 N to 2,5 N. On average, a recovery of 2,5 mm and 2,0 mm for warp and weft directions, respectively, was obtained (Table 11).

The introduction of a lubricant to the needle thread reduced, on average, the seam slippage from 7,0 to 6,0 mm and from 6,4 to 5,6 mm for warp and weft directions, respectively. At the same time the average seam slippage recovery was reduced from 2,5 to 1,5 and from 2,0 to 1,2 mm for warp and weft directions, respectively.

3.4 SEAM PUCKER

Seam pucker was investigated in terms of type of feed mechanism, stitch type, sewing threads and sewing thread lubricant using a single row of stitches.

Of the three feed mechanisms employed, i.e. drop, pulley and unison (Table 12), the drop-feed mechanism produced the highest degree of seam pucker. The unison-feed gave a significant improvement, and the best results were obtained with the pulley-feed mechanism where only fabric No. 4 showed excessive seam pucker.

A comparison of the magnitudes of pucker indices produced by the lock stitch with those produced by the chain stitch (Table 13) showed that the chain

TABLE XI

SEAM SLIPPAGE (mm) OF MOHAIR SUITING FABRICS

Fabric Code	Load (N)	SEAM SLIPPAGE (mm)									
		Original fabric		After fusing		After steaming (30s)		After 10 DC*		Original fabric with lubrication of sewing thread	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	118,0	9,0	6,0	8,2	6,4	7,7	6,7	7,6	5,7	7,0	5,3
	2,5	5,5	3,5	4,5	3,9	5,8	3,9	5,0	3,5	5,7	4,0
2	118,0	9,2	8,2	9,2	8,2	10,0	7,8	10,0	9,0	8,3	7,0
	2,5	7,0	6,5	7,0	5,8	7,0	5,5	7,8	6,7	6,3	6,3
3	118,0	7,0	6,0	6,0	5,8	7,0	6,0	7,0	5,8	5,7	5,3
	2,5	4,0	4,0	5,0	3,7	5,0	3,9	4,7	3,7	4,7	4,0
4	118,0	4,7	7,0	4,5	6,2	5,0	6,2	4,8	6,3	5,3	6,7
	2,5	2,3	5,5	2,0	4,0	2,0	3,8	2,2	4,0	3,3	5,0
5	118,0	5,0	5,0	5,0	4,8	5,2	4,7	5,2	4,8	3,7	3,7
	2,5	3,0	2,7	3,0	2,8	3,0	2,8	3,0	3,0	2,3	2,7

DC* — Dry-cleaning cycles

Warp, weft — direction of slippage

TABLE XII

EFFECT OF TYPE OF FEED MECHANISM ON SEAM PUCKER CAUSED BY FEED MECHANISM

(Seam pucker is indicated by pucker index P* (%), Lock stitch)

Fabric Code	FEED MECHANISM		
	Drop	Pulley	Unison
1	1,13	0,36	0,71
2	1,27	0,74	0,80
3	1,20	0,68	0,81
4	1,31	0,85	1,04
5	1,11	0,55	0,77

$$p^* = \frac{\text{Fabric length} - \text{Seam length}}{\text{Seam length}} \times 100$$

TABLE XIII

EFFECT OF STITCH AND SEWING THREAD TYPE ON SEAM PUCKER, [P (%)], CAUSED BY SEWING THREAD

Fabric Code	LOCK STITCH (drop-feed)			CHAIN STITCH		
	S.P.*	C.S.**	M.C.***	S.P.	C.S.	M.C.
1	1,14	1,46	0,76	0,28	0,21	0,21
2	0,71	1,28	0,51	0,26	0,14	0,11
3	1,09	1,45	0,68	0,22	0,11	0,09
4	0,45	0,92	0,64	0,18	0,21	0,18
5	0,60	1,16	0,64	0,21	0,24	0,19

S.P.* — Spun polyester
C.S.** — Core-spun
M.C.*** — Mercerised cotton

stitch always produced acceptable seams for all three sewing threads used. The mercerised cotton sewing thread, however, produced the smallest degree of pucker following by spun polyester and core-spun thread.

Application of a lubricant to the needle thread produced a significant increase in seam pucker (Table 14) caused by sewing thread contraction for all investigated threads and fabrics.

TABLE XIV

EFFECT OF THREAD LUBRICANT, TISSUE PAPER AND SEWING THREAD ON SEAM PUCKER [P (%)] CAUSED BY SEWING THREAD CONTRACTION

(Lock stitch, drop feed)

Fabric Code	Sewing Thread	Without Thread Lubricant		With Thread Lubricant	
		Without tissue paper	With tissue paper	Without tissue paper	With tissue paper
1	S.P.	1,14	0,65	2,47	0,82
	C.S.	1,46	0,55	2,68	0,39
	M.C.	0,76	0,45	2,43	0,55
2	S.P.	0,71	0,38	2,14	1,15
	C.S.	1,28	0,62	2,43	0,62
	M.C.	0,51	0,25	1,98	0,74
3	S.P.	1,09	0,45	1,83	1,17
	C.S.	1,45	0,55	2,69	0,72
	M.C.	0,68	0,34	1,90	0,68
4	S.P.	0,45	0,26	1,07	0,40
	C.S.	0,92	0,35	1,26	0,18
	M.C.	0,64	0,23	1,40	0,45
5	S.P.	0,60	0,44	1,36	0,54
	C.S.	1,16	0,48	1,30	0,45
	M.C.	0,64	0,47	1,51	0,45

In order to prevent seam pucker produced by the sewing thread contraction a tissue paper was placed between the top and bottom fabrics. After sewing the tissue paper was removed. The results obtained (Table 14) showed a significant improvement in seam appearance.

3.5 SEWABILITY

The term sewability, as used in this report, refers to the fabric resistance to needle piercing (FRNP). The higher the FRNP, the more difficult the sewing operation. The results obtained (Table 15) showed that the medium ball point needles produced smaller values of FRNP than the slim set point needles. On average the difference was about 10%. Application of a lubricant to the needle thread reduced the values of FRNP, on average, by about 30%. However, one should be aware of the negative effect of lubrication on seam pucker as mentioned previously. The trends obtained here agree with previous findings[10].

TABLE XV

EFFECT OF NEEDLE DIAMETER, POINT TYPE, SEWING THREAD AND NEEDLE THREAD LUBRICATION ON FRNP (cN)

Fabric Code	Type of Needle Point	NEEDLE DIAMETER 0,80 mm						NEEDLE DIAMETER 0,90 mm							
		60 Cotton		120 Core-spun		120 Spun Polyester		60 Cotton		120 Core-spun		120 Spun Polyester		Average	
		L*	NL**	L	NL	L	NL	L	NL	L	NL	L	NL	L	NL
1	B†	220	387	220	295	240	331	232	418	268	309	276	344	243	347
	S‡	259	404	249	351	295	372	309	425	290	370	303	389	284	385
2	B	198	430	211	300	235	358	213	401	257	303	246	361	227	359
	S	220	452	252	326	259	379	244	470	272	341	300	384	258	392
3	B	216	418	247	307	271	356	235	436	252	307	276	360	264	364
	S	256	467	273	339	300	396	312	491	288	339	310	401	290	406
4	B	247	346	210	298	266	353	264	390	248	314	271	365	251	344
	S	280	426	259	346	297	382	315	455	310	372	298	402	293	397
5	B	222	392	246	329	263	373	230	452	271	350	275	397	253	382
	S	273	443	261	373	334	414	314	467	324	387	337	414	307	416
Average	B	221	395	227	306	255	354	235	419	261	327	269	365	248	359
	S	258	438	259	347	297	389	299	462	297	362	310	398	286	399

B† — Medium ball point; S‡ — Slim set point

L* — Sewing with lubrication of needle thread; NL** — Sewing without needle thread lubrication

3.6 FRAYING

The propensity of a fabric to fray may cause some problems during making-up and may also lead to a seam failure at a later stage. Observation made during fusing, steaming and dry-cleaning showed that the mohair fabrics were very susceptible to fraying. Overlocking the fabric edges reduced fraying to an acceptable level irrespective of type of overlock stitch used (503, 504 and 514[11]).

4. SUMMARY AND CONCLUSIONS

Five commercial mohair/wool worsted suiting fabrics were investigated in terms of their dimensional stability, bond peel strength, seam slippage, seam pucker, sewability and fraying. The results obtained showed that:

— steaming of samples not subjected to either fusing or dry-cleaning had a negligible effect on fabric shrinkage. Steaming after fusing produced some dimensional recovery of both outer fabrics (alone) and laminates,

— dry-cleaning of fabrics not subjected to fusing conditions produced some fabric shrinkage, whereas dry-cleaning of samples subjected to fusing conditions produced some dimensional recovery. In the case of laminates, the trend was inconsistent showing both a decrease and an increase in shrinkage depending on the fabric and number of dry-cleaning cycles applied,

— an increase in the actual glue line temperature or fusing time led to an increase in the bond peel strength,

— steaming of the laminates improved the bond peel strength,

— the fabrics had a low resistance to seam slippage, which was not affected by fusing conditions, steaming or dry-cleaning,

— use of the pulley-feed mechanism produced seams free from feed pucker,

— use of the chain stitch produced seams free from seam pucker caused by sewing thread contraction,

— medium ball point needles produced smaller values of fabric resistance to needle piercing (FRNP) than slim set point needles, particularly when sewing with a synthetic thread and for all threads when the lubricant was applied to the needle thread,

— lubrication of the needle thread reduced the magnitude of FRNP, but at the same time increased the degree of seam pucker.

It was concluded that for a commercial operation one should select the following conditions:

— fusing, glue line temperature — as recommended by the manufacturer of fusible interlining, time — 15s, pressure — 300 KPa,

— sewing, fine thread, chain stitch or lock stitch with mercerised cotton and tissue paper, pulley- or unison-feed using ball point needles,

— fabric edges should be overlocked.

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THE USE OF PROPRIETARY NAMES

The names of proprietary products where they appear in this report are mentioned for information only. This does not imply that SAWTRI recommends them to the exclusion of other similar products.

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