SAWTRI BULLETIN

SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
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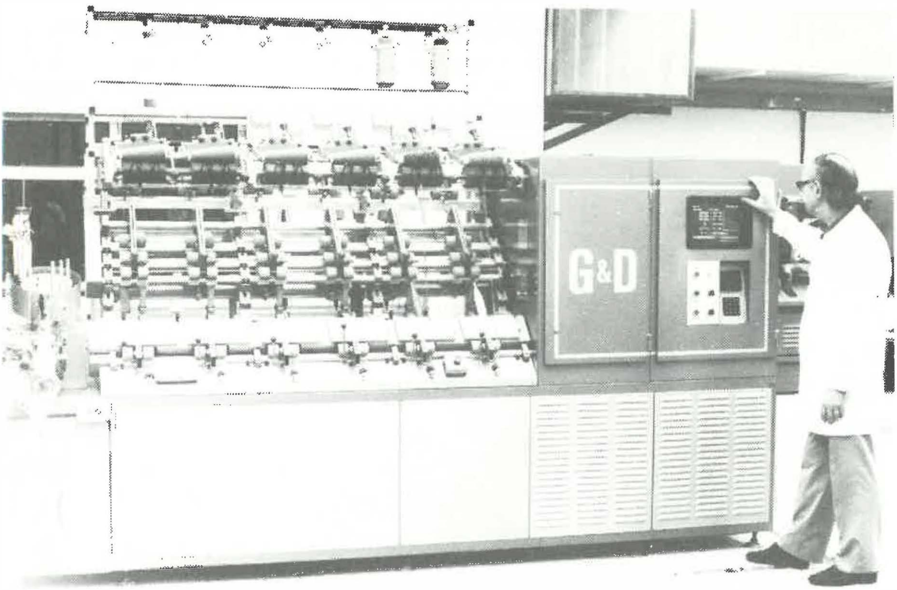
INSTITUTE NEWS

Chief Director attends IWTO meeting, Paris

SAWTRI's Chief Director, Dr D W F Turpie, attended the January meeting of the International Wool Textile Organisation (IWTO) which was held in Paris, France. The main purpose of this visit was to present a paper and slide/video programme to the Technical Committee introducing the SAWTRI Length/Strength Tester for raw wool staples which has been developed by the Institute for the South African Wool Board.

New fancy yarn spinner installed at SAWTRI

SAWTRI's range of long staple spinning equipment has recently been extended with the installation of a GDM Mk3 fancy yarn spinner which is the first to be installed at a textile research institute outside the U.K. This machine incorporates the latest in hollow spindle technology whereby wrap-spun plain or fancy yarns can be produced utilising an extensive range of feedstock material. The unit is controlled by a microprocessor via a keyboard and visual display unit which allows the operator to programme the machine to produce a large variety of fancy yarns, or plain yarns as required. No gear changes are required which facilitates rapid changes in the construction of yarns and which will be of considerable value for experimental purposes. It is intended to use



SAWTRI's new fancy yarn spinning machine

the machine in both the fancy as the plain mode of operation to assist in SAWTRI's fabric development programme of wool and mohair fabrics, but also to provide basic or plain yarns for more fundamental studies.

SAWTRI introduces a new model Yarn Friction Meter

This compact and portable instrument has been developed at SAWTRI and is a much improved version of a previous generation of friction testers produced at SAWTRI for measuring yarn to metal friction, a property which is of paramount importance in hosiery yarns destined for machine knitting. The basic principle of operation has not been altered, but many detail changes have been incorporated to increase the versatility and ease of operation. Notable amongst the changes is the incorporation of an input tensioner and an associated tension transducer which will facilitate the measurement of yarn to yarn friction and the friction associated with yarns passing over or through small radii. The latter is of particular interest to users of knitting yarns. Instrument control has been simplified by pre-setting the calibration of the instrument during the production phase as well as pre-setting the duration of the test at either 5 or 10 seconds. Operator control is further simplied by a digital display on the front panel which supplies continuous readings of friction during the duration of the test and which locks onto the last reading as the test ends.

Visitors to SAWTRI

Mr K Yoneda, Deputy General Manager, Textile Department, Marubeni Corporation and Mr M Amano, Manager, Sales Division, Toyoshima Spin-

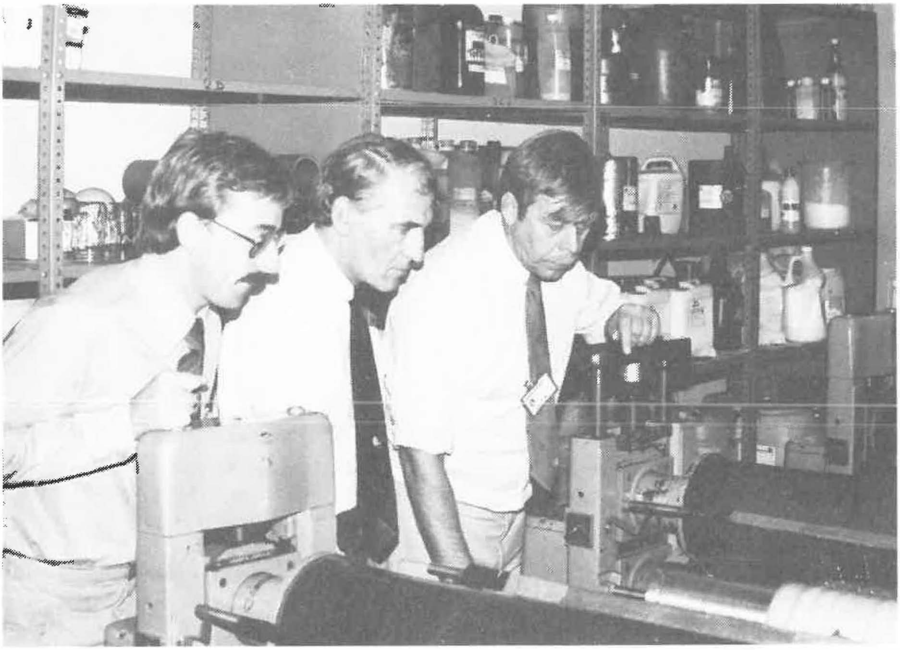
SAWTRI's Yarn Friction Meter

Mr David Alcock from the Weaving Department demonstrating the operation of one of the weaving machines to a group of students from the University of the Orange Free State.

ning Company, both of Nagoya, Japan, and important importers of South African wool, visited the Institute during January while on a study tour of the South African wool industry.

Early in February 60 final year agricultural students from the University of the Orange Free State visited the Institute with the view to see the conver-

Mr R V Stroud, Chairman of Wira, in discussion with Mr G A Robinson, Group Leader: Fabric and Garment Manufacture, at SAWTRI.



Mr Gary Edwards from the South African Wool Board, Dr Dai Morgan and Mr Peter Smith, both from IWS, looking at SAWTRI's shrink-resist process during a recent demonstration.

sion of raw fibre into finished fabric.

Mr R V Stroud, Chairman of Wira, UK, and Managing Director of Stroud Riley Ltd., visited SAWTRI during February for discussions on subjects of mutual interest to Wira and SAWTRI. SAWTRI's Group Leaders and Heads of Departments were then given an opportunity to see a video show introducing and depicting Wira's wide range of functions.

Mr R Crompton, Managing Director, Shirley Developments, UK, visited the Institute on February 5th for discussions on new developments in textile instruments.

Dr Dai Morgan and Mr Peter Smith of IWS, paid a courtesy visit to SAWTRI at the end of February for discussions on the research progress in specific areas of mutual interest. They also attended a demonstration organised by the South African Inventions Development Corporation in collaboration with the South African Wool Board of the patented SAWTRI gaseous chlorination process. This process has already been licensed to two textile manufacturers in South Africa and one in Europe.

Staff News

Mr N G Trollip of the Department of Textile Chemistry, was recently awarded a M.Sc. degree by the University of Port Elizabeth for his thesis: "The photo-oxidation of polypropylene: Sensitization by polycyclic aromatic hydrocarbons".

Mrs Wendy Galuszynski, who left SAWTRI at the end of 1983 to enroll as a fulltime student at the University of Port Elizabeth, has completed a honours degree in Chemistry and was re-appointed in January as researcher in the Chemistry Department.

SAWTRI PUBLICATIONS

Since the previous edition of the Bulletin, the following papers were published by SAWTRI:

Technical Reports

No. 558 Bird, S.L., A Comparison of the Abrasion Results Obtained Using Three Different Instruments on Some Woven Fabrics. (December 1984).

No. 559 Garner, E. and Barkhuysen, F.A., Radio Frequency Bleaching of Cotton Fabrics, Part I: An Introductory Study. (December 1984).

No. 560 Smuts, S., Hunter, L. and Gee, E., The Effect of Medullation and Coefficient of Variation of Diameter on the Air-Flow Measured Diameter of Mohair. (February 1985).

Papers by SAWTRI Authors appearing in other Journals

Smuts, S. and Hunter, L., Certain Physical Properties of Some Commercial Sewing Threads. *Journal of Dietetics and Home Economics,* **12**(3), 70 (1984).

Barella, A., Manich, A.M., Castro, L. and Hunter, L., Diameter and Hairiness of Ring and Rotor Polyester-Cotton Blended Spun Yarns. *Textile Research Journal,* **54**, 12 (December 1984).

Weideman, E. and Hunter, L., The S.E.M.: A Useful Tool in Textile Fault Analysis. *Proceedings of the Twenty-third Annual Conference of the Electron Microscopy Society of Southern Africa,* University of Stellenbosch, **14**, 25 (December 1984).

Maasdorp, A.P.B. and van Rensburg, N.J.J., A S.E.M. Study of Prickliness in Wool and Mohair Fabrics. *Proceedings of the Twenty-third Annual Conference of the Electron Microscopy Society of Southern Africa,* University of Stellenbosch, **14**, 165 (December 1984).

Barella, A., Manich, A.M. and Hunter, L., The Hairiness of Mohair and Wool Worsted-spun Yarns: Correlation Between the Results Obtained with the Shirley Hairiness Meter and those Obtained with the Digital ITQT Apparatus. *J. Text. Inst.,* **75**, 363 (1984).

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Gee, E., Comments on "Distribution of Fiber Diameter in Wool Tops". *Textile Research Journal,* **54**, (10), 689 (1984).

SELF-TWIST WOOL YARNS CONTAINING TEXTURED MULTI-FILAMENT YARNS IN DOUBLE JERSEY FABRICS

by C M Shorthouse and G A Robinson

ABSTRACT

Repco wrapped core-spun (RWCS) and Repco wrapped spun (RWS) wool yarns, having textured nylon or polyester as the filament component, were spun to limiting counts and then knitted into medium and fine gauge double jersey fabrics (Punto-di-Roma and Interlock) after which they were dyed and finished.

The yarns were knitted satisfactorily, direct from the spinner's package, in self-twist (ST) uncleared and unwaxed form (i.e. not uptwisted) and the fabrics had acceptable handle and appearance.

INTRODUCTION

The production of RWCS wool yarns and their use in knitwear have been reported previously[1—5]. In these studies, either *flat* filament nylon or polyester yarns were used as core and wrapper and the yarns were subsequently uptwisted (STT). Although the physical properties of the fabrics were acceptable, there was some criticism that the fabrics were lean and harsh and that the uptwisting operation was expensive. In a subsequent study[6], men's half-hose were knitted from 50 tex and 40 tex RWCS wool yarns having either 78 dtex f20 textured nylon or 85 dtex f15 textured polyester as core and wrapper. The socks were knitted from unwaxed and uncleared yarns, direct from the spinner's package, in self-twist (ST) form. It was found that socks could be knitted, using wrapped spun (RWS) yarns. These socks had a higher wool content and a bulkier and softer handle than those knitted previously from RWCS wool yarns spun with 44 dtex f13 *flat* filament nylon as core and wrapper and subsequently uptwisted (STT)[7].

With fine *textured* filament yarns now available (20 dtex f7 nylon and also 33 dtex f15 and 55 dtex f24 polyester), it was decided to combine these with wool tops (19,2 and 20,8 μm) in RWCS and RWS form and to determine the *finest* yarns which could be spun in self-twist form (ST). Furthermore, these yarns would be knitted directly from the spinner's package on medium (18gg) and fine (28gg) double jersey machines and the knitting performance and fabric physical properties evaluated.

EXPERIMENTAL

Raw Material

Two lots of shrink-resist treated tops (19,2 μm, 64 mm and 20,8 μm, 62 mm) respectively, were selected for this study.

Spinning

Eight different yarns were spun on a modified Repco Mk1 spinning machine using either the RWCS[1] or RWS[6] technique at normal roller loading and a front roller delivery speed of 220 m/min. Each yarn was wound directly on the Repco spinner on to a cheese type package. Three types of textured yarns were used as the filament yarn components, these having linear densities of 20 dtex f7 (nylon), 33 dtex f15 and 55 dtex f24 (polyester) respectively. Details of the wool roving linear density, spinning draft and composition of each yarn are given in Table I.

The minimum yarn linear density at which each of the staple fibre/filament combinations could be spun satisfactorily was determined by a preliminary experiment (see Table I). Approximately 15 kgs of each lot was subsequently spun.

Knitting

Four yarns (3, 6, 7 and 8) were knitted into a Punto-di-Roma structure on an 18gg Wildt Mellor Bromley 8RD double jersey knitting machine and four yarns (1, 2, 4 and 5) into an interlock structure on a 28gg Jumberca (4TJ) double jersey knitting machine. The fabrics were knitted using trip-tape positive feed and a machine tightness factor (MTF) of 13,9. The dial height of both machines was set at 1,4 mm .

TABLE I

SPINNING AND YARN DETAILS

Lot No.	Yarn Linear Density (tex)	Yarn Type (ST)	Composition (%)					Roving Linear Density (tex)	Spinning Draft
			Wool		Nylon 20 dtex f7	Polyester			
			19,2 μm	20,8 μm		33 dtex f15	55 dtex f24		
1	11,3	RWCS	64		36			240	29,2
2	15,0	RWCS	56			44		240	25,4
3	20,8	RWS	84			16		400	20,8
4	15,1	RWCS		73	27			250	20,8
5	17,0	RWCS		61		39		250	22,0
6	22,9	RWS		86		14		400	18,3
7	22,8	RWCS		52			48	250	20,3
8	27,4	RWS		80			20	400	17,6

Finishing

The fabrics were winch-scoured at 40°C, rinsed and then dyed at 98°C. Fabrics containing nylon were dyed to solid shades. Of the fabrics containing polyester, only the wool content was dyed. The fabrics were dried and heat set at 160°C and finally steamed and decatised.

Physical tests

Physical properties of the yarns were determined as shown in Table II. The physical properties of the finished fabrics are given in Table III. The fabrics were also graded for handle and appearance.

RESULTS AND DISCUSSION

Yarn Properties

Table I lists the finest yarns which were spun with acceptable spinning performance. A yarn linear density of 11 tex was possible when the RWCS technique was used with 19,2 μm wool and 20 dtex textured nylon. Replacing the 19,2 μm wool with 20,8 μm wool limited the yarn linear density to 15 tex. Although the RWS technique enabled yarns having a higher wool content to be produced, the minimum yarn linear densities which could be spun, were higher than those obtained using the RWCS technique. RWS(ST) yarns finer than 24 tex could not be spun satisfactorily combining either the 19,2 μm or the 20,8 μm wool with 20 dtex f7 textured nylon due to breakdown of the roving at the self-twist rollers. The results in Table II show that, as expected, the number of thick and thin places and neps generally decreased as the yarn linear density in-creased. The tenacities of the RWS yarns were appreciably lower than the equivalent RWCS yarns, but there was little difference in the yarn extension values.

TABLE II
YARN PHYSICAL PROPERTIES

Yarn Lot	Yarn Type (ST)	Yarn Linear Density (tex)	Breaking Strength (cN)	Tenacity (cN/tex)	Extension (%)	Irregu-larity CV(%)	Thin Places per 1000 m	Thick Places per 1000 m	Neps per 1000 m	Yarn Hairiness (Hairs/m)	Friction (cN)
1	RWCS	11,3	203	17,9	27,7	25,5	916	914	484	16	25—26
2	RWCS	15,0	270	18,6	26,4	21,8	445	466	347	17	24—25
3	RWS	20,8	140	6,7	23,3	19,9	269	167	78	21	30—31
4	RWCS	15,1	204	13,5	26,5	22,9	690	514	229	20	22—24
5	RWCS	17,0	282	16,6	25,0	22,5	569	483	283	17	26—27
6	RWS	22,9	141	6,1	20,6	20,0	272	128	52	22	26—28
7	RWCS	22,8	432	19,0	29,8	18,6	124	120	108	17	24—26
8	RWS	27,4	218	8,0	28,2	18,8	154	109	39	18	24—26

TABLE III
FABRIC PROPERTIES

Yarn Lot No.	Yarn Type (ST)	Fabric Structure	Wool content (%)	Knitting Machine gauge (n/in)	Fabric Mass (g/m^2)	Bursting Strength (kN/m^2)	Martindale Abrasion		Drape Coefficient** (%)	Snagging ICI Rating* (After 600 cycles)		Relaxation Shrinkage (IWS TM186) (%)		Felting Shrinkage (IWS TM185) (%)	
							Percentage mass loss (after 10 000 cycles)	Pill rating* (after 2 000 cycles)		Length-way	Width-way	Length	Width	Length	Width
1	RWCS	Interlock	64	28	208	776	4,6	3,1	36,2	4,1	4,0	5,0	0	7,2	−1,2
2	RWCS	Interlock	56	28	260	963	1,5	3,9	42,3	4,3	3,8	1,7	−0,2	3,1	−0,5
3	RWS	Punto-di-Roma	84	18	217	768	11,8	2,5	36,4	2,0	2,5	7,2	1,9	9,3	2,6
4	RWCS	Interlock	73	28	254	883	3,9	2,8	38,1	4,5	4,5	5,3	1,0	6,7	0,7
5	RWCS	Interlock	61	28	276	981	1,2	3,5	47,7	4,2	4,5	2,6	0	4,5	−1,2
6	RWS	Punto-di-Roma	86	18	265	819	10,4	2,8	42,3	2,3	2,8	6,2	1,0	8,9	3,1
7	RWCS	Punto-di-Roma	52	18	255	1143	1,2	3,5	53,0	3,2	2,7	3,1	1,0	5,3	0,7
8	RWS	Punto-di-Roma	80	18	301	981	5,6	2,6	44,6	2,8	3,8	1,9	5,8	2,2	2,2

*5 = good **24 cm dia. disc.
1 = poor

Knitting Performance

Approximately 25 m of fabric were knitted from each of the eight yarn lots. Fly build-up on the knitting machine was low and had no adverse affect on the knitting performance. Large slubs occasionally caused knitting machine stoppages. Otherwise, all yarns knitted without difficulty.

Fabric Properties

With one exception (fabric no. 7) the bursting strength of the fabrics increased with an increase in fabric mass. The high bursting strength of fabric no. 7 was probably due to the fact that this fabric had the highest textured filament yarn content. Fabrics knitted from RWS yarns into a Punto-di-Roma structure had the poorest abrasion resistance and the lowest pill ratings. The high number of thick and thin places and neps recorded for all the yarns was not reflected in the finished fabrics.

The Punto-di-Roma fabrics having a high wool content were ranked the best in terms of handle. The wool/polyester interlock fabrics were considered to be superior to the wool/nylon interlock fabrics. The appearance and handle of all the fabrics were considered acceptable.

SUMMARY AND CONCLUSIONS

The potential of Repco wrapped core-spun (RWCS) yarns and Repco wrapped spun (RWS) yarns, incorporating shrink-resist treated wools and textured filament yarns, was investigated for medium and fine gauge double jersey fabrics. A range of yarn linear densities was selected in accordance with the minimum required for satisfactory spinning. It was found that, depending on composition, the minimum linear density at which an efficient spinning performance could be maintained, varied from 11 to 27 tex, the corresponding wool content varying from 52% to 86%. All the yarns were knitted without problems in self-twist (ST) form (i.e. not uptwisted), into either interlock (28gg) or Punto-di-Roma (18gg) structure. The fabrics were dyed and finished and their physical properties measured.

A high number of thin places, thick places and neps were recorded for all the yarns. These tended to increase with reduced linear densities. The high number of imperfections was not, however, reflected in the finished fabrics. In general, the fabric physical properties were quite acceptable. Fabrics knitted from RWS(ST) yarns had the poorest resistance to pilling and abrasion.

The fabrics were assessed for handle and appearance and were considered acceptable in these respects. In general, those fabrics with a higher wool content were ranked the best in terms of handle, the wool/polyester interlock fabrics being preferred to the wool/nylon interlock fabrics.

ACKNOWLEDGEMENTS

The authors wish to thank Mr S G Marsland for spinning the yarns, Messrs D A Dobson and J Abrahams for knitting the fabrics and the staff of the Department of Textile Physics for testing the yarns and fabrics. Permission by the S A Wool Board to publish these results is gratefully acknowledged.

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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A SUMMARY OF SAWTRI'S FINDINGS IN THE FIELD OF FUSING

by G A ROBINSON

Since 1980, SAWTRI has carried out a number of studies[1–8] dealing with dimensional changes of outer fabrics (men's wear) and fusible interlinings dur-ing fusing, steaming and dry-cleaning, and also the effect of these processes on the bond-strength of laminated fabrics.

Experimental work was carried out in SAWTRI's laboratories as well as in factories within the South African clothing industry, covering all-wool, wool-polyester or 100% polyester outer fabrics. Although various types of interlinings were used, most of the work centred around woven interlinings (cotton/rayon). Dimensional changes were recorded immediately after fusing and again after conditioning at standard atmospheric conditions (20° C and 65% RH).

Dimensional Changes

In the case of wool fabrics, shrinkage in both warp and weft directions generally increased with an increase in *fusing temperature,* the change in dimensions generally being smaller after conditioning. An increase in fusing *time* increased the weft shrinkage.

In the case of polyester fabrics, both *fusing temperature* and *time* had a significant effect on the warp shrinkage as measured after conditioning. The warp skrinkage increased with temperature up to a maximum temperature of about 155° C, and with time up to 16s after which their effects became negligible. Weft shrinkage was also affected by fusing temperature, but not by fusing time. When a range of different interlinings (woven, warp knitted and non-woven) were used, the results followed a similar trend, except that in general the actual fusing temperature (at the glue line) changed according to the type of interlining.

In general, the type of interlining had a significant effect on the shrinkage of all-wool outer fabrics. There was a trend for the interlinings to shrink slightly more than the wool outer fabrics at *press settings* above about 170° C, with the reverse being true at *press settings* below about 170° C. Conditioning the fabrics reduced the fusing shrinkage of the wool outer fabrics by almost 2% (absolute) compared to the values obtained immediately after fusing. The average area shrinkage was found to be about 2,5% before conditioning, and just below 1% after conditioning, values for the latter ranging from 0% to 5%. The warp knitted interlining generally exhibited greater shrinkage than the woven interlinings, an all-cotton interlining having the lowest shrinkage of all.

The direction in which the fabrics were aligned, when they were fed to the automatic fusing press, had no apparent effect on the fusing press shrinkage, although there appeared to be a small effect due to the *relative* alignment of outer fabric and interlining. This was not the case with non-woven interlinings.

Bond Strength

In general, bond peel strength was found to increase with increasing fusing temperature, pressure and time, while washing or dry-cleaning the fused laminate generally reduced the bond peel strength.

All-wool fabrics appeared to be less affected by dry-cleaning than the polyester fabrics.

All-wool fabrics generally had lower bond strength than polyester fabrics, values for their blends being intermediate. The average bond peel strength of all the fabrics tested was 8N/2,5cm strip width. According to this study, it should be possible to achieve this bond strength by fusing at 127° to 132°C (glue line) for 20s at a pressure of 300 kPa (3 bars).

It was found that the application of dry steam to a laminate did not significantly affect shrinkage of laminated fabrics containing wool, but affected 100% polyester fabrics. Dry-cleaning had little or no effect on the dimensions of outer fabrics, but often caused shrinkage of the interlinings and therefore also of the laminates.

Steaming the laminate appeared to improve the bond peel strength when the outer fabric was all-wool or wool/polyester, but reduced the bond strength when the outer fabric was 100% polyester. Commercial dry-cleaning generally tended to reduce bond strength.

Collaborative trials with various factories indicated that fusing press shrinkage, measured after conditioning, was generally at acceptable levels whereas bond strengths were often inadequate, particularly for all-wool outer fabrics. In many cases, large variations in the *settings* employed on similar fusing presses even in the same factory were observed, these ranging from about 132°C to 210°C for temperature, 7s to 25s for time and 1 to 10 bars for pressure. Ambient atmospheric conditions did not appear to have a significant effect on either shrinkage or bond strength.

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