MANUFACTURE OF CUT AND SEWN GLOVES FROM WARP KNIT FABRICS

Tricot, Simplex And Milanese Fabrics Adaptable To Cut Knitted Gloves

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WARP knitted fabrics are widely used in the manufacture of cut-and-sewn gloves. These fabrics are employed chiefly because they are run-proof and possess good one-way elasticity. Warp fabrics for cut-and-sewn knitted gloves are produced on Tricot, Simplex and to a lesser extent Milanese machines of 25 gauge and finer.

Main factors which determine the quality of a Tricot glove fabric are: (1) Type of yarn; (2) count of yarn; (3) knitted structure; (4) machine gauge; and (5) quality. If the fabric is construct-of ordinary tricot laps, the quality measurement is based upon the stitches per inch, or ounces per square yard. However, cotton yarns necessitate the knitting of a double Atlas structure, whose quality measurements are determined by the number of return courses per given length (visible as a faint line across the fabric).

The table below depicts different machine gauges and their yarn counts.

Gauge	Cotton	Filament Yarns
28	1/50-1/90s	45-100 Denier
30	1/80-1/110s	25-90 Denier
32	1/90-1/120s	15-75 Denier
34	1/100-1/120s	15-60 Denier

Here are some specifications suitable for Tricot knitted glove fabrics:

1. 24 step double Atlas also known as Tricot-Atlas.

(A) Gauge: 28-30
Yarn: 1/80s Egyptian cotton.
Chain notation:
Front: 2- 1/1- 0/ 1- 2 23-24/24-25/24-23
Back: 23-24/24-25/24-23 2- 1/ 1- 0/ 1- 2
Quality: There are three main qualities according to the tightness of stitch as measured by horizontal lines (return courses) per 8 inch: (a) First—40-43; (b) Second—36-40; (c) Third—30-35.

(B) Gauge: 30-32
Yarn: 1/90s Egyptian cotton
Chain notation: 24 step Atlas
Quality: (a) First—47-49; (b) Second—44-46; (c) Third—41-43.

(C) Gauge: 32-34
Yarn: 1/100-1/120s Egyptian cotton
Chain notation: 24 step Atlas
Quality: (a) First—51-53; (b) Second—48-50; (c) Third—45-47.

Fabrics 2 and 3 are also termed Fine Atlas. All the above three fabrics are suitable for summer gloves only. To produce a heavier fabric for the manufacture of an all-year-round glove the above 24 step Atlas should be changed into a 48 step Atlas with one needle underlaps.

Chain notation:
Front: 94-95/96-97/95-94/93-92 3- 2/ 1- 0/ 2- 3/ 4- 5
Back: 3- 2/ 1- 2/ 3- 4/ 93-94/95-96/95-94/93-92

As can be noted, the course following the return course of the back guide bar is only a short lap (1-0/1-2 and 95-96/95-94). This is to decrease the visibility of the horizontal lines due to the return courses. Some typical specifications are as follows:

(A) Gauge: 28-32
Yarn: 1/90s Egyptian cotton
Chain notation: 48 step Atlas with one needle underlaps.
Quality: 26—32 lines per 8 inch.

(B) Gauge: 30-34
Yarn: 1/100-1/120s Egyptian cotton
Chain notation: as above
Quality: 28—32 lines per 8 inch.

Use of Atlas laps for cotton yarns is necessary to conceal the irregularity of this fibrous yarn. On the other hand, man-made filament yarns are of regular thickness throughout their length, and ordinary Tricot laps will prove sufficient to produce an even fabric. The quality should be kept as tight as possible by using 30—34 gauge machines with yarn counts of as fine as 15 Denier up to 60 Denier. Most suitable structures are of the plain Jersey types (Front: 1—0/2—3// and Back: 1—2/1—0//), although for special purposes bigger underlaps may be utilized, such as Satin fabrics, which are later brushed and sanded. The above glove fabrics are suitable for summer wear only.

Duplex Fabrics: This type of cloth consists of two separate fabrics attached to each other back to back. After Dextrin powder has been sprayed on the back of one fabric, a second one is layed on top and both passed through steam rollers under pressure to be glued together into one single fabric. The two components need not necessarily be identical, but in general two cotton Atlas Tricot fabrics are employed. In some cases a wool circular-knit fabric is glued under a Tricot fabric to serve as a kind of lining. Duplex fabrics are now being superceded by Simplex fabrics which have been specially developed to produce a double faced heavy glove material.

Simplex Glove Fabrics: Often wrongly termed double woven Simplex fabrics, they are knitted on the Simplex warp knitting machine. This machine operates on the same principal and with identical knitting elements as Tricot machine. However, th knitting elements are duplicated that is to say, there are 2 nee dle bars working back to bacl with their corresponding sinke and press bars; but only one two guide bar assembly supplies th threads to the knitting elements

Similar to two needle ba Raschel fabrics, the resultan cloth is of double-faced texture with both sides of identical ap pearance. Simplex fabrics are considered the most superior material for the manufacture of fabric gloves. They distinguish themselves by fine, smooth hand and appearance, excellent elasticity strength, and good wearing and washing properties. They also lend themselves well to the various cutting and sewing operations involved in the manufacture of gloves.

Fine Egyptian cotton is the chief raw material of the Simplex trade. Similar to Tricot cotton glove fabrics and for the same reasons, the construction of a Simplex cotton fabric is based upon Atlas structures.

Here are three specifications for standard Cotton Simplex fabrics:

(A) Gauge: 28-30
Yarn: 1/60s Egyptian cotton
Chain notation: 48 step Atlas with one needle underlaps.
Front: 1-0, 2-3/4-5, 6-7/ etc.
Back: 96-97, 95-94/93-92, 91-90/ etc.
Quality: 16—18 lines per 8 inch.

(B) Gauge: 30-32

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COMMON WARP KNITTED GLOVE FABRICS AND APPROPRIATE FINISHING TREATMENTS

Fabric	Tentered	Heat-Set	Brushed	Pre/fully-shrunk	Mercerized	Glued
Tricot cotton 24 step Atlas	yes	no	very seldom	yes	yes	yes
Tricot cotton 48 step Atlas	yes	no	yes	yes	very seldom	no
Tricot filament	yes	yes	very seldom	no	no	very seldom
Simplex cotton	yes	no	yes	yes	no	no
Simplex filament	yes	yes	very seldom	no	no	no
Milanese cotton	yes	no	yes	yes	yes	yes
Milanese filament	yes	yes	very seldom	no	no	yes

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Yarn: 1/90s Egyptian cotton
Chain notation: as above
Quality 17—20 lines per 8 inch.

(C) Gauge: 32-34
Yarn: 1/100—1/120s Egyptian cotton
Chain notation: as above
Quality: 17—22 lines per 8 inch.

36 or 24 step Atlas laps will give the same result as regards the properties of the fabrics but will have a somewhat different appearance due to the closer spacing of the return courses. This should be taken into account when evaluating the quality of the fabric as measured by horizontal lines per given length.

Variations in guide bar threading and chain notation can be utilized to produce fancy fabrics in a similar way as on Tricot machines. A good example is the pigskin leather imitation, which is achieved by means of an irregular part-set threading, irregular Atlas movement, and the introduction of different counts of cotton yarns into each guide bar.

Knitting with filament yarns on Simplex machines follows similar rules to that on Tricot machines. On account of their evenness and and regularity they are satisfactorily knitted into fabrics based upon simple Tricot structures. However, the so-called silk Atlas, (Front: 1—0, 2—3/4—5, 3—2/1, Back: 3-4, 3-2/1—0, 1—2//), originally developed for pure silk fabrics, is still used for man-made filament yarns on account of its superior elasticity and full hand. The increase or decrease of the weight of the fabric can be accompanied by the respective lengthening or shortening of the underlays.

Milanese Glove Fabrics: Orignally made of pure silk, these fabrics bear the name of the machine on which they are produced, namely the Milanese machine. A later development was the introduction of fine cotton yarns, especially for the manufacture of glove fabrics. The major difference between the Milanese machine and all other warp knitting machines is in the construction of an Atlas fabric without return courses; in other words, every thread travels from one selvedge of the fabric diagonally across to the other selvedge prior to its return. The absence of the return courses and the continuous doubling of two different threads result in a fabric of unmatched evenness and elasticity. Both cot-

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ton and man-made fibers are suitable for Milanese fabrics but on account of the latter's light to medium weight—similar to Tricot fabrics—they are not recommended for winter gloves. 1/80—1/40s Egyptian cotton yarns are used on 28—32 gauge machines but man-made yarns have taken over the major part in this industry. The table below gives the machine gauges with their corresponding yarns and counts:

Gauge	Cotton	Filament yarns
28	1/80 —1/100	45—150 Den.
30	1/80 —1/120	30— 90 Den.
32	1/100—1/140	15— 60 Den.

Finishing Processes For Glove Fabrics—The quality of glove fabrics is as good as its finish. No other textile branch depends to such an extent upon the finishing processes for the ultimate quality of its products. Extensive wet and dry finishing operations are necessary to obtain the proper hand, appearance and elasticity which must be of the highest standard for a glove fabric. The two first mentioned characteristics may vary according to yarn and construction but the elasticity must always remain the same; namely, 70 percent in width and completely stable in length. Following is an outline of the main finishing processes for the different kinds of glove fabrics:

1. Tentered and calandered fabrics: Almost all fabrics are passed on a tenter frame, during which time they are subjected to a maximum stretch in length in order to obtain complete stabilization in this direction. The consequent contraction in width will provide the required elasticity of 70 percent widthwise.
2. Pre- and fully-shrunk fabrics: With caustic soda for cotton glove fabrics only, especially Simplex. The chemical action of the caustic soda causes a swelling of the cotton fibers with a consequent tightening and contraction of the fabric texture, giving rise to a suede type finish. The term pre-shrunk and fully-shrunk refer to the concentration of the caustic soda and the resulting area-shrinkage, which are: approx. 28 percent shrinkage with 15 percent caustic soda, approx. 30 percent shrinkage with 30 percent caustic soda.
3. Brushed fabrics: Applicable to all types of yarns, which show short and fine piles. The following variations are known: (a) Brush finish—the

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RD 2 N

Successful Simplex raschel machines

Double-faced fabrics are produced worldwide on RD 2 N raschel machines up to a width of 4318 mm/170″ and E 32 gauge

In the case of double-faced (Simplex) fabrics there is currently a strong demand worldwide for these fine one-and-one rib constructions. A well-known American textile company recently commissioned a large series of nine RD 2 N Simplex raschel machines having a width of 4318 mm (170″) and a gauge of E 32 in order to be able to comply with the fashion demands of garment manufacturers by extending production. The smooth surface in conjunction with a light, soft and elegant drape and the desired extension – even without elastane fibres – are fabric properties which cannot be achieved using any other production method. Because of their specific properties, Simplex fabrics are also used in the moulding of brassiere cups in the underwear sector, for example. As a result of modern machine technology and the increasing demands made by the textile and clothing sectors on functional fabrics with new optical properties one cannot imagine the innovative fabric market without Simplex fabrics.

The RD 2 N double-bar raschel machine with two latch-needle and two guide bars is, in the meantime, being used for the production of high-quality Simplex fabrics and these fabrics can be seen in the collections of well-known garment manufacturers – one reason for referring briefly to these machines. The gauge of up to E 32 achieved for machines 4318 mm (170″) wide presented a great challenge to Karl Mayer, as the distance between the latch needle and the guide is only 0.2 mm. This is extremely small, especially for machines with two latch-needle bars, as the guide bars – in contrast to machines with one needle bar – must simultaneously pass two needle bars. It was therefore necessary to reduce tolerances to a minimum when manufacturing the bars and needles and to use the most modern construction methods to find ways of eliminating expansion influences during production. Using these measures, which will not be gone into in greater detail in this report for obvious reasons, optimum machine operation is achieved, so that any additional adjustments both when first starting and during running are not necessary. The RD 2 N Simplex raschel machine operates without any problems even at a nominal width of 4318 mm (170″) and E 32 gauge at a production rate of 1100/min. This means that 550 courses/min are produced on each of the two needle bars. Depending on the width, the speed can be raised still further to a maximum of 1400/min!

Additionally latch needles, and not compound needles, are used on this type of machine, since the latch needle concept has proved to be the most suitable for this application. One reason for this is that latch needles absorb without any trouble the horizontal yarn tensions between the front and rear needle bars which are inevitable on double-bar machines. Although Karl Mayer have also carried out tests with the compound needle system, the latch needle system has proved to be far and away the best for this machine. To name only a few concrete examples, the compound needle/slider combination would be broken up on this machine, i.e. the compound needle would be drawn by the yarns to the centre of the machine while the sliders would remain in their positions. Further reasons which are in favour of the latch needle system as compared to compound needles on this type of machine are the differential temperature rises of the sliders and needle, the trouble-free functioning of the latch needles even at high numbers of stitches, better access to the knitting elements, clear fabric monitoring in the vicinity of the knitting elements and short change-over times. A further - visual - reason for favouring latch needles in this sector is the Simplex-specific fabric drape which can be optimally achieved with latch needles.

To improve the handling of the machine further the two warp beam positions are fitted with electromechanical EBA-1 yarn feed systems. The yarn lengths are input at the computer.

The machine can, moreover, be fitted with a separate batching mechanism with a batch diameter of up to 1270 mm (50″) and a smoothing device, the advantage of which is that access to the knitting point is made easier in addition to the batch diameter being larger.

Conclusion

Simplex (double-faced) fabrics are a particular specialty of warp knitting which, until the beginning of the nineties, were produced exclusively on tricot machines with bearded needles. Because of the changed product profile, from the earlier glove and riding-boot fabrics to products for underwear, including moulding qualities and the demand for increased productivity, a new method was developed which has, in the meantime, made a breakthrough worldwide on the RD 2 N Simplex machine and has made a convincing case because of the excellent fabric drape, problem-free running and user-friendly handling.

Technical data

Nominal widths:
2332, 3505 and 4318 mm
(93, 138 and 170″)
Machine gauges:
E 28, 30 32 (needles/25.4 = 1″)
Number of guide bars: 2
Number of needle bars:
2 latch-needle bars, individually set needles
Knock-over comb bars:
2 lamellar knock-over comb bars
Stitch comb bars: 2
Maximum stitch density:
30 courses/cm