

# SEWING FOCUS

TECHNICAL SEWING INFORMATION

SERVICEHOUSE



## Protective Sportswear

### Checklist for Sewing Protective Sportswear

Sewing Parameters: SCHMETZ Tip:

Needle size	NM	SIZE
	70 – 130	10 – 21
	Depending on the thickness of the material.	
	We recommend the use of the SCHMETZ SERV 7 needle.	

**Needle point** In the area of protective sportswear, mostly round and ball points are used to sew together upper and lining. Cutting points should only be used for leather, since they may cut the woven or knitted fabric.

**Sewing thread** For outer seams, Velcro, reflectors, synthetic or carbon shells as well as multi-layered laminate, bonded PA 6.6 sewing thread is used due to its excellent abrasion resistance. When sewing Kevlar, self-extinguishing para-aramid threads are used. For knitted and woven lining as well as stretch materials PES–PES/CO core spun threads are used. For sewing membranes they will have an additional waterproof finish and sealing of the seam is applied.

**Machine** Normal industrial high-speed sewing machines with the stitch type 301 and 304 (double lockstitch), 401 (double chain stitch), as well as hot-air tape-sealing machines are used.

**Other factors:**

**Thread tension** The optimum thread tension depends on thread, sewing machine, the material used as well as the number of layers.

**Stitch type** Double lockstitch (stitch type 301 and 304), double chain stitch (stitch type 401) according to DIN 61400.

**Stitch density** The higher the stitch density the higher the elasticity of the seam (depending on material and the number of layers). For elastic materials: approx. 5 stitches/cm (individual tests are necessary). For strong, non-elastic materials: 3 – 4 stitches/cm.

## Quick Reference for Typical Sewing Problems in Manufacturing Protective Sportswear

Symptoms	Effect	Cause
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### Skip stitches / Thread breakage

No interlacing/interlooping of needle thread and bobbin/looper thread	Reduced seam strength, especially with double chain stitch	Incorrect thread tension
Needle thread breaks	Sub-standard, defective seam appearance	Incorrect needle system
Ravelling of the needle thread	Opening of the whole seam especially with double chain stitch	Needle incorrectly fitted
	Thread breakage after skip stitch	Use of an oversized sewing thread in relation to the needle size
		Wrong sized aperture of throat plate, material is pulled into it or jammed and prevents the loop formation
		Mechanical damage to needle, throat plate, feed etc.
		Low quality threads
		“Tipping over” of the needle thread loop
		Incorrect thread guidance

### Thermal damage

	Individual layers of material are sticking together	Excessive needle temperature due to friction especially when sewing densely woven fabrics
	Needle eye and groove is clogged, as a result thread breakage or material damage	Excessive sewing speed
	Melted particles cling to the fabric	Needle smeared or needle eye clogged with melted residue
	Needle thread breaks	Melting of the thread surface and as a result mechanical breakage of the weakened thread

Solution			
NM SIZE	Point style	Thread	Machine
			

<p>Use the SCHMETZ SERV 7 needle</p> <p>Adjust needle size to the material and amount of layers</p> <p>Change needle regularly (after every shift or in a shorter interval depending on the stress)</p> <p>Check needle eye and groove for damage, if in doubt: change needle</p>	<p>Check point for damage</p> <p>Adjust point style to the material</p>	<p>Adjust sewing thread size to the needle size</p> <p>Optimize thread tension</p> <p>Use a bonded sewing thread</p>	<p>Optimize the hook/looper setting</p> <p>Examine the thread guiding elements</p> <p>Adjust the sewing accessories such as throat plate, feed etc. depending on material thickness and sewing thread/needle</p> <p>Change worn out or defective sewing accessories regularly, such as thread guiding elements, hook/looper, throat plate etc.</p> <p>Use of a thread breakage detector which stops the machine when detecting thread breaks</p>
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<p>BLUKOLD needle with Teflon coating. This needle coating prevents or greatly reduces the adhesion of melted residues</p> <p><b>CAUTION:</b> The use of the BLUKOLD needle does not reduce the needle temperature which is caused by excessive sewing speeds</p>	<p>Adjust point style to the material</p>	<p>Use of PES threads</p> <p>Alternatively use an extra thread lubricant (e.g. silicone oil)</p> <p>Use of core spun threads</p> <p>Use evenly twisted thread</p> <p>Select a well finished sewing thread</p>	<p>Reduce sewing speed</p> <p>Use needle cooling through compressed air</p>
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## Quick Reference for Typical Sewing Problems in Manufacturing Protective Sportswear

Symptoms	Effect	Cause
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### Uneven seam appearance

Stitch sequence is irregular, resulting in a zig-zagging seam	Reduced seam strength	Incorrect adjustment of the sewing accessories such as hook/looper, feed etc.	
	Sub-standard, defective seam appearance	Incorrect balance of thread tension	
	Sewing goods slip away from foot when edge seaming		Incorrect thread guidance
			Needle deflection too heavy
			Damaged thread guiding elements

### Material damage

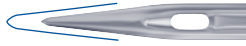


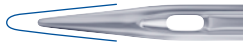
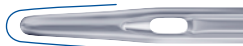
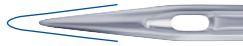
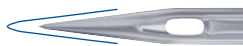
Sewing of different materials, e.g. twill weave fabric with knit wear	Reduced tensile strength of the material	Oversized needle and/or wrong point style
	Sub-standard, defective seam appearance	Excessive sewing speed
Mesh damage	Reduced seam strength	Defective/worn out needles
Pulled out weft and warp threads		Unsuitable finish
Stitch holes visible, weft or warp threads destroyed		Damaged sewing accessories such as throat plate, feed etc.

Solution			
NM SIZE	Point style	Thread	Machine
			

<p>Use the SCHMETZ SERV 7 needle</p> <p>Adjust needle size to the material and amount of layers</p>		<p>Optimize thread tension</p> <p>Check thread flow</p> <p>Choose the right sewing thread size according to the needle size and the fabric</p>	<p>Examine the thread guiding elements</p> <p>Check and adjust the material transport</p> <p>Use of heavy machines (e.g. machines for sewing leather)</p> <p>Use additional feeding devices (e.g. puller)</p>
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<p>Use the SCHMETZ SERV 7 needle</p> <p>Adjust needle size to the material and amount of layers</p>	<p>Adjust point style to the material (SKF for elastic materials, SPI for woven fabric)</p> <p>R Normal round point</p> <p>SPI Acute round point</p> <p>SKF (for elastic materials) Heavy ball point</p> <p>Check point for damage</p>	<p>Choose the right sewing thread size according to the needle size and the fabric</p>	<p>Adjust the sewing accessories such as throat plate, feed etc. depending on material thickness and sewing thread/needle</p> <p>Check and adjust the material transport</p>
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## Selection of Point Style and Needle Size

Material	Number of layers	Needle size NM / SIZE	Point style	Overview Point style
Leather, leather lining	2 3-4	80-90 / 12-14 110-120 / 18-19	R normal round point DH half triangular point D triangular point	 R normal round point
Kevlar	2 3-4 5-6	90 / 14 110-130 / 18-21 140-160 / 22-23	R normal round point SUK medium ball point SKF heavy ball point	 DH half triangular point
Cordura	2 3-4 5-6	90 / 14 100-110 / 16-18 120-130 / 19-21	R normal round point	 D triangular point
Keptec	2 3-4	90 / 14 110-130 / 18-21	R normal round point	 SUK medium ball point
Neoprene	2 3-4 5-6	90 / 14 100 / 16 110 / 18	SES light ball point R normal round point	 SKF heavy ball point
Nylon	2 3-4 5-6	90 / 14 100-110 / 16-18 120-130 / 19-21	R normal round point	 SES light ball point
Knitted interlining	2 3-4	70 / 10 80 / 12	SUK medium ball point	 SPI acute round point
PES and other synthetic materials PU coated materials	2 3-4 5-6	80 / 12 90-100 / 14-16 110-130 / 18-21	R normal round point	
Membrane foils	1-2	80 / 12	R normal round point	
Synthetic/carbon shells	1 + base material	120 / 19	R normal round point DH half triangular point	
Velcro fasteners, reflector	1 + base material	100 / 16	R normal round point	
Three layer laminate bonded material:				
membranes + knitted fabric	2-4	70-80 / 10-12	SES light ball point	
membranes + woven fabric	2-4	70-80 / 10-12	R normal round point	
membranes + coated materials	2-4	70-80 / 10-12	SPI acute round point	
Foam Base material = Cordura, nylon, neoprene, foam	1 + upper material	100 / 16	SES light ball point R normal round point	

General recommendation in manufacturing protective sportswear: Use of the SERV 7 needle version with appropriate point style



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## 1. Manufacturing of protective sportswear

For most of us, sports is an indispensable part of our spare time. It is particularly important for us that we are well protected against any possible physical and health hazards. In the last few years, the clothing industry in Europe, and in Germany in particular, has therefore invested in research and development in order to make high-risk sports safer, and to optimally protect our bodies.

One of the results of this long-standing research project is the development of so-called protectors. These are multi-purpose, elastic and shock-absorbing PU pads, gel pads or hard shells which are integrated into clothing. They are usually sewn into pockets, and can therefore, if necessary, be removed or exchanged easily. The EN norm 1621 determines minimum size as well as the pads' thrust and blow absorption. The protectors are used in motor-cycling, BMX, skiing, carving and snowboarding. In these sports, joints, back and ribcage need to be protected against thrusts and blows particularly well. Protectors work in a similar way to airbags in cars. During high-speed impacts, the extremely high energy that the body is exposed to is distributed evenly across the body and absorbed. Special synthetic, carbon and titanium shells were developed that ensure the durability of protective



Elbow-Protector  
Source: Komperdell

clothing in places that are exposed to extreme strain (e. g. the knees). The demands on material and workmanship are very high, since the protective gear is put under great strain due to friction and thrusts.

In the martial arts, self-defense training and in team sports such as hockey and football, it is essential that soft parts like chest and groin and the sensitive leg and foot bones are protected from punches, kicks and even injury from sports



Protection vest with stabilizing back protector  
Source: Komperdell

equipment (bats, balls) using protectors and foam pads. At the same time, the equipment should be light and comfortable and restrict the wearer as little as possible. EN norm 13277 determines the demands and test procedures for protective headgear without face protection, which are used in unarmed martial arts such as taekwondo, karate, kick-boxing and similar disciplines. This also applies to protective headgear for boxing. FIFA also determines the standard for shin guards, which must be made of suitable material (rubber, plastic, or similar materials) in order to offer appropriate protection from injury. In inline-skating, too, elbows and knees must be protected against falls and fractures. The protective device in this case is a synthetic shell that is sewn or riveted onto foam and carrier material and often also includes shock-absorbing gel cushions.

In the manufacture of protective sportswear, the focus is on safety and functionality. The protector must be abrasion-proof and stable, it must not slip or restrict the wearer in any way – in order to be successful at sports, it is essential that one is able to move freely. The protector must assure safety, but should not be in the way: a protector that is not in the place where it protects may even be the cause of an injury! Protective sportswear must blend in with your normal sportswear and support such physiological wear properties as transporting moisture away from the body, keeping warm, providing ventilation and making the sportsperson more visible with reflectors when light conditions are not optimal.

In the manufacture of protective sportswear, material and workmanship determine the success of the end product. Quality assurance is therefore essential from the initial production phase and is a measure of the quality of the end product.



Knee-Protector Source: Komperdell

## 1.1 Typical sewing problems

In the manufacture of protective sportswear, the textiles used must meet the demands of the end product. Upper and carrier materials are therefore heavy synthetic fiber fabrics such as nylon, cordura, leather, composite materials or neoprene, all of which will be equipped with pads and synthetic and carbon shells as well as built-in pockets for pocket protectors. All these materials share one special characteristic: stability. Although this stability serves to protect the wearer, it causes problems during manufacture.

For the wearer's safety and comfort, protective sportswear has sewn-on reflectors and Velcro fasteners. Membrane and multi-layered laminates (upper, membrane and lining are welded together), which must of course not be pierced, ensure that our skin is kept at a comfortable temperature. In order to ensure that the sportswear is waterproof, the seams must be welded or glued over.

Since protectors are often incorporated into the finished jacket or motorbike gear, warm lining must also often be considered during manufacture. The inner lining is made of knitted materials as well as thin polyester and other synthetic fabrics, all of which ensure that the clothing is comfortable on the skin and on top of underwear. Often, the inner lining is made separately so that it can be taken out of the jacket.

In order to achieve optimal sewing results, type of machine and needle point must be adjusted to material and number of layers, and thread size must be chosen to go with the size of the needle.

Typical sewing problems affecting protective sportswear production are:

- Skip stitches / Thread breakage
- Thermal damage

## 1.2 Quality seams with the right sewing parameters

Due to its wide range and varied range of application, there is no universal standard for protective sportswear: sewing parameters depend on materials that are used, as well as their sewing demands. The EN norm 340 exclusively determines general ready-made clothes within protective sportswear.



Protective sports gear serves to protect the body from outside influences during sports. Seams must therefore be very hard-wearing and durable. Due to these demands, all sewing parameters such as sewing machine, sewing speed, sewing thread and sewing needle must be well coordinated with the individual demands of the end product's material.

## Needle

### 2. Selection of the right needle

Choosing the right needle size and point style is one of the most important decisions and requirements for any quality assurance.

The importance of needle size and point form for seam strength is often underrated. It is however possible to achieve a high-quality sewing result and a better quality product using the right needle size, type of needle and point form.

In the area of protective sportswear, a great number of different materials of varying thickness and with different characteristics are used. This requires the use of a large and often variable needle range.

#### 2.1 Needle size

The needle expands the fabric threads during penetration of the fabric. A too large needle diameter can damage the material threads or even destroy them. Consequently the material will "burst", so it is damaged. If the needle is too thin and the material is stable and thick, the needle may break, get stuck in the fabric and damage it.

In the area of motorbike gear and accessories, care must be taken that exactly the right needle size is chosen for the upper as well as for the (generally) thinner inner lining.

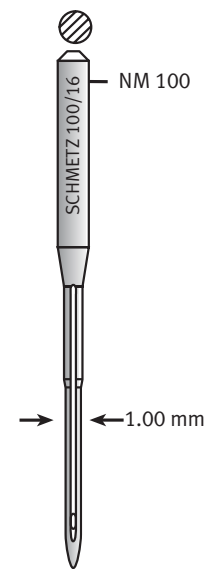
When sewing on carbon shells (e.g. BMX and roller-skating sports) the needle must be chosen so that it can easily penetrate the hard synthetic material without damaging the carrier material underneath.

Great care must also be taken when sewing with multi-layered laminates (upper, lining and membrane are conjoined), which provide the right temperature when wearing the clothing. Unless the seam is welded or glued, the hole that the needle pierces must be so small that it is filled by the

(slightly thicker) bobbin and looper thread. Otherwise the garment will not be waterproof.

Planning is very important here, too. Only the correct needle size in relation to material can prevent the needle damaging the material, depending on type of material, finishing and taking into consideration the material thread's own elasticity.

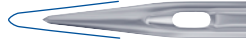
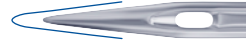
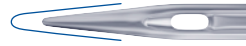
You can find an overview of the recommended needles sizes in the table on page 6.



#### 2.2 Point style

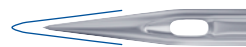
In the manufacturing of protective sportswear both SCHMETZ round or ball points as well as cutting points are used. The material combinations of every individual product calls for needles which can pass easily through the upper material, through the lining/membranes underneath, without causing any damage or needle deflection. Even when designing the model, the sewing-technical properties of the material must be taken into account. We recommend that all sewing parameters are well-coordinated in order to prevent problems during production.

For most of the used upper or base material, for example Cordura, Kevlar, Keprtec, Nylon, polyester and PU coated fabrics, it is advisable to use a normal round point "R" or the light ball point "SES". When sewing coarser fabrics the medium ball point "SUK" or the heavy ball point "SKF" should be used.

**R** normal round point**SES** light ball point**SUK** medium ball point**SKF** heavy ball point

Climate membranes can also be sewn using the “R” point. Each stitch hole, however, damages the membrane. Therefore, the seam must be glued or welded afterwards. Otherwise there is no guarantee that the end product is waterproof.

The point style for sewing single or multi-layered laminates, neoprene and foamed material should be chosen depending on the carrier material. Fabrics and membranes can be sewn with the normal round point “R”, knitted fabrics and membranes with the light ball point “SES”. This point style is therefore more appropriate. In comparison to the normal round point “R” the ball points have a small hemisphere at their tip, the point slides, displaces the fibers and pierces directly into the spaces. For coated materials and membranes the “SPI” point (acute round point) should be used. For optimal choice, point style should be individually tested and matched with material and sewing technique.

**SPI** acute round point

Due to the combination of several different materials in one seam, it is difficult to determine the right point style. The right decision crucially depends on the properties of the various layers of material.

Leather, for example, is usually sewn using a cutting point. However, in this particular area, the normal round point “R” should be chosen. This point easily penetrates 1–2 layers of leather without damaging the lining material.

In addition to the “R” point, for fine leather, imitation leather and synthetic shells as well as Velcro fasteners, we recommend the use of a needle with a cutting point such as the

“SD1”. It cuts approx. 10 % of the stitch hole, 90 % are displaced by its conical shape. This ensures a straight seam, the material is penetrated more easily than with needles with round points, needle deflection is lower and there is less of an incision than with a cutting point. Owing to the 10 % cutting effect of the “SD1” point, very little or no damage is to be expected to the underside of the cover material. If the leather or plastic is of extremely solid quality then a needle with a stronger cutting action is required. In this case the “DH” point (half triangular point) should be used.

**R** normal round point**SD1** round with small triangular tip**DH** half triangular point

**Caution:** As the cutting effect is increased with needle points (like the “DH” point) damage to the sewing thread or material is to be anticipated during backtacking at the beginning and end of seams.

A suitable point style and the right stitch length ensure the general strength of the seam. When sewing firm material and several layers, the SCHMETZ SERV 7 needle should be used.

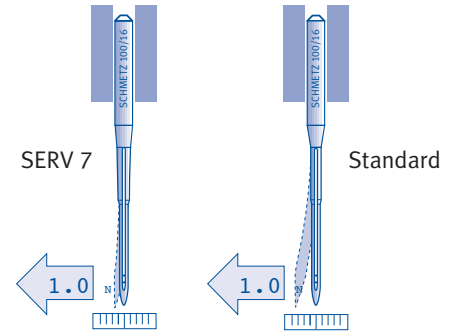
## 2.3 SERV 7 needle construction

The many different materials, which are sewn in the area of protective sportswear as well as the high amount of material layers and sewing plastics, carbon pads and protectors call for a needle which produces quality seams continuously without any interruptions. For these different requirements we recommend especially the use of a high performance needle like the SCHMETZ SERV 7 version.

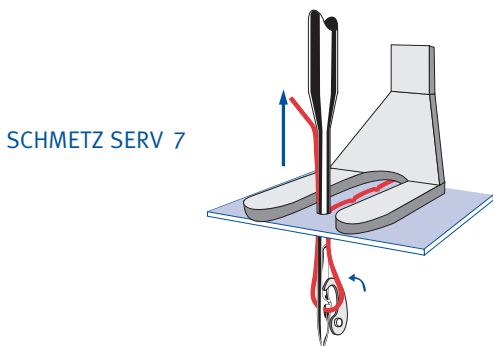
Thread breakage and skip stitches are frequent problems in the manufacturing of protective sportswear. When the hook or looper cannot catch the thread loop, skip stitches occur, the interlacing or interlooping of the upper and lower thread

is interrupted. This greatly influences the strength and course of the seam and therefore the quality of the end product.

SERV 7 is a needle that was specifically developed to prevent skip stitches and thread breakage during production. For the particular requirements of different materials this needle type comes in various point styles. The distinctive features of SERV 7 needles are the so-called hump scarf and their extra blade reinforcement. The hump scarf extends the loop so that the hook or looper can catch it easily; this greatly reduces skip stitches.



**SCHMETZ Tip:**  
**Benefit 1: SERV 7 hump scarf produces optimum loop formation and prevents skip stitches.**



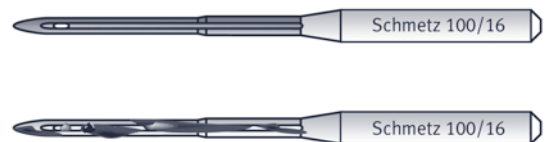
Due to the blade reinforcement the SERV 7 needle is more stable and needle deflection is less. For this reason it is easier to sew multi-layer and strong materials, needle breakage is thus minimized and the centric penetration produces a better seam appearance.

**SCHMETZ Tip:**  
**Benefit 2: SERV 7 needle has higher stability increasing needle life.**

## 2.4 BLUKOLD needle

Synthetic fibers are used almost exclusively in the production of protective sports accessories and protectors due to their excellent properties with regard to stability, tensile strength and cut resistance. Unfortunately, however, this creates additional problems during manufacture. Material damage that is the result of the sewing machine needle heating up too much or thread breakage due to melted residues on the needle are common problems which in turns lead to complaints, thus in quality reduction of the end product.

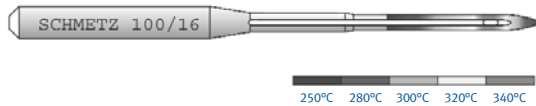
When sewing with too high sewing speed and the use of synthetic threads, it may happen that the thread becomes partly damaged or even melts away entirely due to heat resulting from friction, which in turn leads to thread breakage. Therefore melted residues can possibly stick to the needle, eye or groove. In order to reduce or even avoid these problems SCHMETZ recommend especially for synthetic fabrics the use of the BLUKOLD special needle.



Melted residue (below) either does not settle at the BLUKOLD needle (illustration above) at all or much later.

The special phosphated surface with Teflon® coating ensures that melt residue is deposited either not at all or much later than on a chromed needle. It remains “clean” for longer and ensures a steady sewing process as skip stitches, thread breakage or material damage will happen less often. The Teflon® coating does not reduce the needle temperature however, as is often wrongly assumed.

As with chromed needles, the size and point style of the BLUKOLD needle, too, must be coordinated with the material, and sewing speed may have to be reduced in order to avoid material damage.



Temperature profile during the sewing process without sewing thread

## 2.5 Changing of the needle

The regular changing of the needle should be a stated requirement in the optimization of the product quality in the production – a continuous sewing process with highest quality demands is only possible.

Worn out, smeared or bent needles cause skip stitches, fabric damage and quality defects. In order to avoid this it is advisable to change the needle at the beginning of every shift. If the needle is strained heavily by high numbers of fabric layers or fast sewing speeds and sewing hard, brittle materials the needle should be changed more often. If in doubt about the time of use or the degree of wear it is advisable to change the needle at an early stage in order to avoid sewing problems.

## Sewing Thread

### 3. Selection of sewing threads and stitch parameters

In the manufacture of protective sportswear, very special and particularly durable and hard-wearing sewing threads are used in order to meet the demands of seam safety and stability. There is no statutory norm for material and size of sewing thread for the various protective products. All sewing parameters must therefore be individually adapted to the end product. We can therefore only provide guidelines, which must be tested and selected individually, depending on the quality demands of the end product.

### 3.1 Composition and size of the sewing thread

Seams are the weakest link in the chain of protective sportswear manufacture, since they are relevant to safety, i.e. are on the surface of the clothing and the protectors. Manufacturers of high-quality products use high-quality threads and use invisible stitching: The seams are stitched a second time underneath the upper in order to retain higher seam strength that protects against friction and other strains during wear. Often the seam is glued, or taped on the inside to increase its stability.

For the production, mostly core spun threads are used. These threads made of 100 % polyester have a higher degree of tensile strength and abrasion resistance as well as low degree of shrinking after washing. This ensures a very durable and stable seam, ideally suited for sewing knitted and woven lining as well as membranes and stretch materials.

Furthermore, core spun threads with polyester and cotton are used. They are characterized by great thermal resilience and protect the thread if the needle gets hot. The size of sewing thread depends on the type and number of fabric layer. Light fabrics need fine threads No. 120, medium fabrics need threads such as No. 100 for closing and attaching seams.

Self-extinguishing para-aramid threads are ideal for stitching Kevlar. They are highly temperature resistant (up to 400 °C), extremely tear and cut resistant and also resistant to solvents. Since Kevlar is not however very abrasion resistant, these seams should not be positioned on the outside, where they would be exposed to extreme strains. As a rule sizes No. 60 – dtex 500 or No. 40 – dtex 750 are used for protective sportswear.

Velcro fasteners (especially the hook tape), reflectors, foam padding, but also hard synthetic parts (such as kneepads) are particularly problematic when sewing protective sports equipment. They require sewing threads with a smooth surface, which must be partly bonded in order to prevent the twisting of the inside needle thread when using a 2-needle-doublelockstitch sewing machine. All these demands are met by a Zwibond sewing thread made from polyamide 6.6. This raw material is extremely abrasion resistant, approx. 50 – 100 % higher than that of polyester. Zwibond also compensates higher thread tension much better. No. 20 – dtex 1500 has proved to be the best size. In order to avoid a capillary effect it should

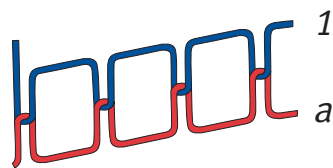
sates higher thread tension much better. No. 20 – dtex 1500 has proved to be the best size. In order to avoid a capillary effect it should be finished in such a way that the seam is waterproof, which therefore prevents the rain from being pushed through the stitch holes by the wind. The seam may additio-

### 3.2 Stitch type

The seams on protective sports equipment are put under a lot of strain, especially during extreme sports. Stitch type should therefore be chosen so that the seam does not tear immediately when stretched, but is still firm enough to ensure that the product fulfills its function. The choice of stitch type crucially depends on the material used, as well as the seam's function, i.e. its elasticity, in order to ensure freedom of movement and also its stability in order to protect.

To fit together firm upper materials, and also for long closing seams, the double lock stitch (stitch type 301) is used. It guarantees optimal seam strength without being elastic. It is also suitable for fell seams and stitching, since the thread interlaces in the middle of the fabric. For sewing on Velcro fasteners, reflectors and synthetic and carbon shells, and also for safe edging of woven tapes, the double lock stitch is also very suitable due to its strength.

#### Stitch type 301 – double lockstitch

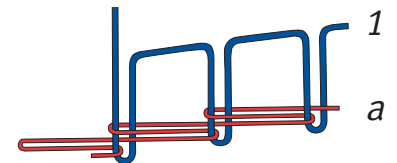


At the surface, where the seam is exposed to much friction and wear and tear, we recommend that main seams are stitched and taped underneath, i.e. in the second layer of the upper in order to ensure seam strength.

For assembly and safety seams, that need to be strong as well as elastic, the double chain stitch (stitch type 401 and 402) is particularly suitable; for example for sewing single and double fell seams. It can be used for elastic (e.g. knitted lining and rubber bands) as well as non-elastic materials.

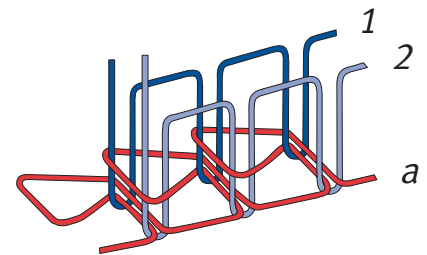
#### Stitch type 401 – double chain stitch

(2-thread chain stitch)



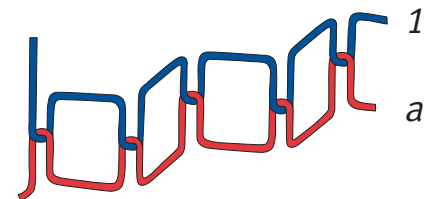
#### Stitch type 402 – double chain stitch

(3-thread chain stitch; 2 needle threads, 1 looper thread)



In the manufacture of sports safety accessories, the zigzag stitch is mainly used to fix knitted edging tapes, to secure elastic bands (because of the necessary seam elasticity) or when anchoring.

#### Stitch type 304 – double lockstitch (zig-zag)



### 3.3 Stitch density

In the manufacture of protective sportswear, stitch density must be adapted to the material combinations, the resulting number of layers and the sewing thread. The higher the stitch density, the higher the elasticity of the seam.

In the case of elastic materials, such as when fixing rubber bands, we recommend that you work with a stitch density of approx. 5 stitches/cm.

For strong, non-elastic materials (e.g. upper materials with nylon, cordura or coated materials and membranes) 3 – 4 stitches/cm are ideal.

For knitted fabrics such as knitted lining, the guideline is 5 – 8 stitches/cm, depending on stitch type and strength of fabric. Very high stitch density however may lead to stitch damage and puckered seams.

### 3.4 Thread tension

Optimal thread tension is a precondition for the right thread distribution and sufficient thread in the seam. If tension is too high, i.e. if it is set too tight, the seam will burst even if exposed to not much strain.

In the case of double lock stitch seams (stitch type 301) for example, looper and bobbin thread tension must be selected so that the interlacing of the two threads takes place in the middle of the fabric or within the seam so that an equal amount of needle and bobbin thread is used, but still loose enough that the seam does not diverge.

In the case of double chain stitch seams (stitch type 401) thread tension is right when the needle thread forms a pointed loop at the bottom of the fabric. Low thread tension increases thread reserve and the seam becomes more elastic with regard to stretching strain.

### Machine

#### 4. Sewing machines for the manufacturing of protective sportswear

Protective clothing and accessories with specific characteristic are essential for almost any sports. Therefore, during manufacture, a large number of sewing machines are used for the various processes. The ideal choice of sewing machine crucially depends on the end product and its protective function.



**Flatbed Sewing Machine**

Closing and attaching seams, flat seams, quilting, edging



**Long-Arm Sewing Machine**

Closing and attaching seams (e. g. on motorbike gear or back protectors/bulky protective padding for martial arts)



**Postbed Sewing Machine**

Sewing together small parts, backstitching and over-stitching of round parts, three-dimensional sewing



**Free-Arm Sewing Machine**

Three-dimensional sewing, backstitching hems, sewing together tubular parts

**Hot-air Tape-sealing Machine**

**Ultrasonic Tape-welding Machine**

(see illustration below)

Gluing waterproof seams, additional securing of waterproof seams by welding on tapes



Ultrasonic Welding Machine (8310)

Source: Pfaff AG

## 4.1 Feed

When manufacturing protective sportswear additional feed units are often required. Their use, however, depends on the specific sewing operation and the material used. The feed combination must be selected depending on number of layers and type of material.



### Compound feed with alternating presser foot top feed

In particular by flatbed and long-arm sewing machine for two-dimensional smooth sewing, e.g. closing and attaching straight and long seams for medium materials as well as for decorative seams



### Compound and roller feed

For three-dimensional sewing, tight curves and for decorative seams and joining seams  
This triple feed is used with postbed and free-arm machines. Because of the small wheel, the fabric can be seen despite the small distance to the outer edge



### Needle feed, roller top feed and roller bottom feed

For displacement-free sewing of decorative and joining seams, e. g. sewing on of belts and reflectors

## 4.2 Throat plate/Throat plate aperture size

Before each sewing operation, the machine must be optimally adjusted to the material. This includes needle size, point style and thread as well as the throat plate.

The throat plate aperture must be adjusted to the size of the needle and the thickness of the material. If the stitch hole is too large, the fabric can be pulled through the gap like through a funnel, which can lead to material damage and skip stitches.

The stitch hole must be big enough however so that needle and thread can pass unobstructed.

## 4.3 Sewing speed

In order to achieve an even seam appearance sewing speed should remain constant. Each stopping and interfering during the sewing process reduces the optimal pressure of the foot, which will affect the seam appearance. Generally, sewing speed depends on the material and the sewing process. In the case of short seams and difficult pieces with curved and corner seams it is better to sew slowly in order to achieve a high-quality end product. Especially for synthetic fabrics, thermal damage, thread breakage and uneven seams are avoided by reducing ones sewing speed. In production of protective sportswear sewing speed is generally between 2,000 and 3,000 stitches/min, however the sewing speed has before to be checked to the material to determine the optimal sewing speed for every sewing process.

## 5. Our advice

You can achieve damage-free quality seams if all the sewing parameters are precisely coordinated with one another.

Material, needle, thread and machine are the key variables. The **SCHMETZ SERVICEHOUSE** offers various service packages:

From recommending the ideal needle for your fabrics to sending out sample needles and providing assistance with special sewing requirements. In addition the **SCHMETZ SERVICEHOUSE** offers competent on-site advice on your production line and training courses for your employees.

**Challenge us –  
let us show you our competence!**

## Form to copy and fax: + 49 (0) 24 06 / 85-186

Do you have further questions about sewing protective sports-wear?

Would you like support in solving your individual sewing problem?

Would you like recommendations on needle selection and sewability of your fabrics in advance of production?

Challenge the **SERVICEHOUSE** experts and take advantage of our offer.

We will be pleased to send you information on:

### Our range of service:

#### CONSULTING

##### SAMPLE NEEDLES

Sample needles, tips and information

##### DOCUMENTED SEWING REPORTS

Sewing reports tailored to match your sewing goods as well as solutions for your complex sewing demands

##### EXPRESS CONSULTING

Express consulting by phone, fax or e-mail

Company name
Attention
Position
Address
Postcode/City
Country
Phone
Fax
E-Mail

#### INFORMATION

##### SEWING FOCUS

Sewing information for special industries and applications

##### PRODUCT FOCUS

Product information for special industries and applications

##### GUIDE TO SEWING TECHNIQUES

Manual for sewing industry

#### TRAINING/SYMPOSIUM

##### TRAINING-ON-SITE

Industry specific training including the latest information on needles, threads, machines and applications

##### SYMPOSIUM

Interdisciplinary knowledge sharing and exchange of expertise for skilled sewing industry staff