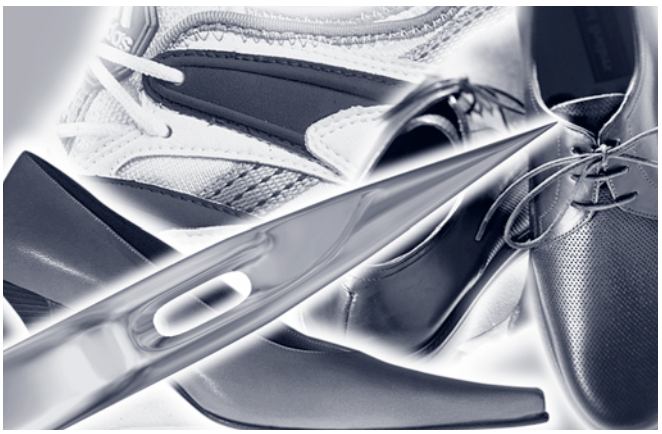
SEWING FOCUS

TECHNICAL SEWING INFORMATION

SERVICEHOUSE



Shoes and Footwear

Checklist for Sewing Shoes and Footwear

Sewing Parameter:	SCHMETZ Tip:
Needle size	NM 60 – 200 SIZE 8 – 25 Depending on the thickness of the material.
Needle point	In the production of shoes, round and ball points are used for sewing woven, knitted and other fabrics. Cutting points are used for sewing leather.
Sewing thread	Needle thread and hook/looper thread are almost exclusively continuous filament sewing threads made from 100 % polyamide or 100 % polyester.
Machine	In the production of shoes, mostly the various kinds of industrial high-speed sewing machines such as flatbed, postbed and free-arm sewing machines are used. Automatic program controlled sewing machines are also used in some production processes.
Other factors:	
Thread tension	The required thread tension depends on fabric, sewing thread and sewing machine. It should be as low as possible to enable optimal stitch formation.
Stitch type	Double lockstitch (stitch type 301 and 304) according to DIN 61400 and double chain stitch (stitch type 401) according to DIN 61400.
Stitch density	The higher the stitch density the higher the seam strength. When using cutting points, stitch density should not be too high in order to avoid too much weakening of the leather. Experience shows however: 3 – 8 stitches/cm.

SCHMETZ

NEEDLES SINCE 1851

Quick Reference for Typical Sewing Problems in Shoe Manufacturing

Symptoms	Effect	Cause
Skip stitches/Thread breakage		
No interlacing/interlooping of needle thread and bobbin/looper thread Thread breakage Ravelling of the needle thread	Reduced seam strength, especially with double chain stitch Sub-standard, defective seam appearance Thread breakage after skip stitch Jamming of the sewing thread due to stitch holes which are clogged Partly or whole melting through of the needle thread	Incorrect thread tension Incorrect needle system Needle incorrectly fitted Adhesion of melted residues, clogging of the needle eye and needle groove 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 Overheating of sewing machine needle Mechanical damage to needle, throat plate, feed etc. “Tipping over” of the needle thread loop Arching up of the material due to insufficient presser foot pressure Jamming of the sewing thread between needle and fabric Incorrect thread guidance

Solution

NM SIZE	Point style	Thread	Machine
			
Adjust needle size to the material and amount of layers and thread size Change needle regularly (after every shift or after a shorter interval depending on the stress) Check needle eye and groove for damage, if in doubt: change needle Use the SCHMETZ SERV 7 needle	Check point for damage Use needles with twisted point groove	Adjust sewing thread size to the needle size Optimize thread tension	Optimize the hook/looper setting Examine the thread guiding elements Adjust the sewing accessories such as throat plate, feed etc. depending on material thickness and sewing thread/needle Reduce sewing speed Change worn out or defective sewing accessories regularly, such as thread guiding elements, hook/looper, throat plate etc. Use the right presser foot and the right adjustment of the presser foot pressure Check throat plate for damage

Quick Reference for Typical Sewing Problems in Shoe Manufacturing

Symptoms	Effect	Cause
Material damage		
Damage to fabric	Reduced tensile strength of the material	Needle size too big and/or wrong point style
Damage of the laminated/coated surface	Sub-standard, defective seam appearance	Excessive sewing speed
Cracks and holes in the leather	Reduced seam strength	Defective/worn out needles
Stitch holes with melted residue of fabric threads		Unsuitable finish
		Wrong sized aperture of the throat plate
		Damaged sewing accessories such as throat plate, feed etc.
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
		Incorrect thread guidance
		Needle deflection too heavy
		Damaged thread guiding elements

Solution

NM SIZE	Point style	Thread	Machine
			
Adjust needle size to the material and amount of layers Use the SCHMETZ SERV 7 needle	R Normal round point SD1 Round point with small triangular tip **CAUTION:** After every change of shifts or in short intervals according to the needle stress we recommend to change the needle	Choose the right sewing thread size according to the needle size and the fabric	Adjust the sewing accessories such as throat plate, feed etc. depending on material thickness and sewing thread/needle Check and adjust the material transport
Adjust needle size to the material and amount of layers Use the SCHMETZ SERV 7 needle		Optimize thread tension Check thread flow Choose the right sewing thread size according to the needle size and the fabric	Examine the thread guiding elements Check and adjust the material transport

Selection of Point Style and Needle Size

Material	Type of seam	Needle size NM / SIZE	Point style
Woven fabric		60 – 140 / 8 – 22	R normal round point SES light ball point
Knitted fabric		60 – 80 / 8 – 12	SES light ball point R normal round point
Leather	stay seams/back seams	65 – 120 / 9 – 19	SD1 round point with small triangular tip
	medium topstitched seams	70 – 120 / 10 – 19	S narrow cross point
	coarse topstitched seams	100 – 200 / 16 – 25	P, PCL and PCR narrow wedge point
	coarse decorative seams	160 – 200 / 23 – 25	LR reverse twist point LL and LLCR twist point

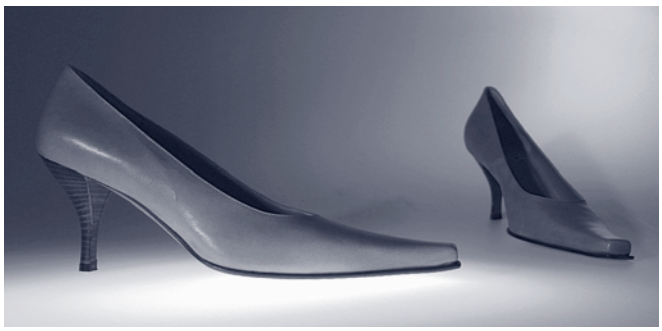
In manufacturing shoes and footwear the use of the SERV 7 needle version should be considered, depending on the field of application and the sewing operation.

Contents

1. Manufacturing of shoes and footwear

Perfect appearance from top to toe begins – of course – with your hairstyle and ends with a pair of good, neat shoes that fit the occasion. Apart from this fashion-related aspects as part of what one wears, shoes also have a significant functional aspect for example as an important part of protective and sports equipment as well as a medical function. The shoes' use therefore largely determines shape and color, material and combination of materials as well as the sewing technologies which are as varied as the use of shoes/footwear themselves.

For the production of upper and sole, many different materials are developed and the appropriate technology for the manufacture of shoes/footwear is being designed. Sewing technology proves to be extremely flexible in adapting to the various requirements and is still essential in some areas. It is this flexibility that also allows high quality finish when selecting the appropriate sewing needle and point style.



1.1 Typical sewing problems

In the production of shoes, typical sewing problems are the result of the sewing good and the sewing technology itself. Difficult combinations of materials, unsuitable sewing thread and needle as well as the wrong sewing machine can all lead to sewing problems. Experience shows the following typical sewing problems in the production of shoes:

- Skip stitches/Thread breakage
- Material damage
- Uneven seam appearance

1.2 Quality seams with the right sewing parameters

All sewing parameters that influence production must be carefully coordinated with one another. Quality seams can both meet the requirements of durability and tensile strength as well as the fashion demands on topstitched seams that are offered in various designs.

This broad range requires the precise coordination of all sewing parameters such as sewing good, sewing thread, sewing needle as well as sewing machine together with the correct settings.

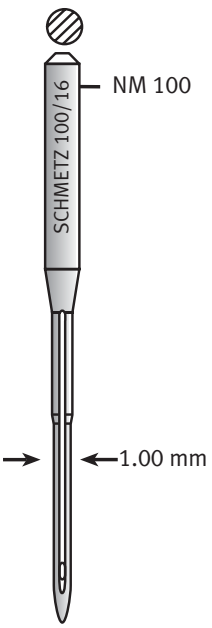
Needle

2. Selection of the right needle

Before deciding on a point style, needle size should be determined. The right sewing thread is very important: The size of the needle eye and thread size must be carefully coordinated so that the thread can pass the needle eye with as little friction as possible.

2.1 Needle size

The choice of needle size depends on the material, the number of layers as well as the sewing thread. Material combinations and the characteristics of the different materials are of great importance. Only the right needle size for the particular occasion ensures undisturbed and high-quality sewing.
An overview of the recommended needle sizes can be found in the table on page 6.



2.2 Point style

For a smooth production process, the right choice of point style is as important as needle size.
For the sewing of knitted and other fabrics round and ball points are used in practice. The shoe industry uses the normal round point “R” and the light ball point “SES”.

R normal round point

SES light ball point

The normal round point “R” is the standard point style. With its pointed conical shape it pierces the fabric threads and thus produces a very straight seam. When sewing different combinations of materials, point style is often a matter of compromise. Therefore, the “R” point is used most often. A further field of application is tougher leather, which a round point can still pierce without any problem.

The light ball point “SES” displaces the fabric threads, pierces directly into the gaps and thus prevents material damage.

When sewing laminates (e.g. Gore-Tex® and Sympatex®) sewing speed often needs to be reduced since synthetic outer fabrics can cause thermal damage. Membrane residues, too, can be deposited on the needle and lead to thread breakage and skip stitches. Optimal needle size and point style should be selected according to the number of layers and the thickness of the material.
In the following table you will find general needle recommendations that should be individually coordinated with material and sewing technique. If there are many material layers, the necessary needle system should be the SERV 7 needle version.

	Point style	Needle size NM	SIZE
Laminates			
Composites	with **woven fabric and membranes** **R** normal round point		
Composites	with **knitted fabric and membranes** **SES** light ball point		
Coated materials and membranes	**SPI** acute round point		
Fine		60 – 65	8 – 9
Medium		70 – 80	10 – 12
Coarse		80 – 90	12 – 14

One of the most important materials for the shoe industry is leather. The point styles used are cutting points. Their cutting effect does not only enable the needle to penetrate the leather more easily, they also have a design-oriented significance. Decorative seams can be produced easily by choosing a particular cutting point from the range of needles. The “LR” point for example cuts the leather at an angle of 45° to the direction of the seam, which together with the right sewing yarn results in a decorative seam with a stitch position slightly diagonal to the left (see seam appearance “LR” on the bottom below).

Depending on material structure and number of layers, round or small cutting points should be used for sewing faux leather and laminated faux leather.

R normal round point

SD1 round point with small triangular tip

The round point with small triangular tip “SD1” cuts approx. 10 % of the stitch hole, 90 % are displaced by its conical shape. Compared with the normal round point “R”, the needle with the “SD1” point does not deflect as much and cuts the material very carefully.

Compared with leather, faux leather exhibits greater notch sensitivity. This characteristic can have a detrimental effect on seam durability and strength when using cutting points with a strong cutting effect; the material may tear.

For sewing leather and laminated leather, mostly cutting points but also round points are used. This depends on the number of layers and the consistency of the leather.

LR reverse twist point

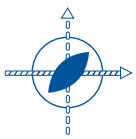
LL twist point

PCL narrow wedge point with left twisted point groove

PCR narrow wedge point with right twisted point groove
It is especially used as a left needle in a 2-needle machine

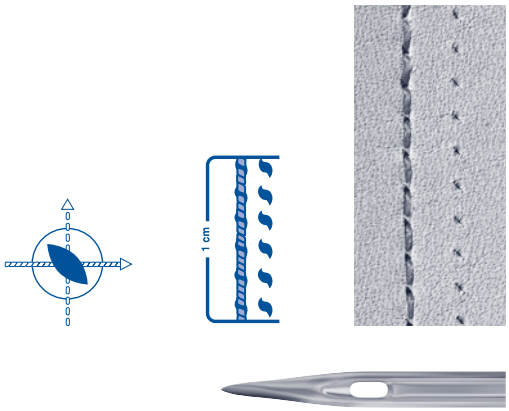
For sewing decorative seams, mostly “LR” points are used. The reverse twist point makes an incision at an angle of 45° to the threading direction of the needle; it thus produces a decorative seam tilted slightly to the left.

With the above mentioned cutting points, attention must be paid that stitch density is not too high. Otherwise the leather is perforated too much and impairs the strength of the seam.



LR reverse twist point

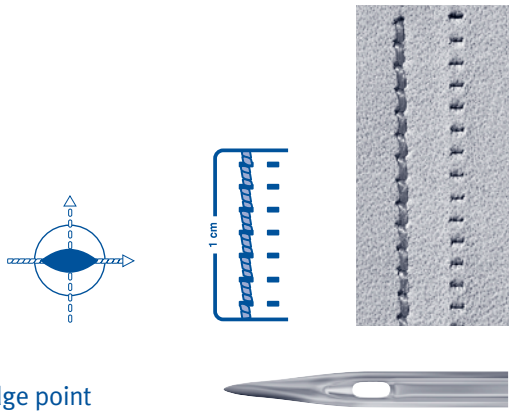
An “LL” cutting point does not produce such a decorative seam appearance but rather a slightly drawn in, straight seam. The incision is exactly opposite to the point style “LR”, at an angle of 135° to the threading direction of the needle. There is also the “LL” needle with a right twisted point groove (CR). Usually, an “LL” point is used for a two-needle decorative seam.
The left needle should have a “CR” point groove (twisted to the right) in order to improve the seam appearance of the left needle.



LL twist point

The narrow wedge point “P” is a cutting point with a lens shaped incision in the threading direction. Seams that are put under a lot of strain (e.g. back seam, see pict.1) require stitches that are very close together. Needles that cut the material transverse to the sewing direction and still leave enough distance between the stitches fulfill this requirement. This eliminates the risk that the material is perforated by stitch holes coming into contact with each other. The small distances between stitches result in fine, pearl-string-like seams – as top seams – and are very decorative.

Pict.1: Backseam



P narrow wedge point

For these requirements nothing can go wrong when using the “P” point and its innovative variants “PCL” and “PCR”.
The peculiarity of the “PCL” and “PCR” needles lies in their point groove, which is either twisted to the left (PCL) or to the right (PCR). It provides room for the thread and protects it from being crushed against groove and needle eye edge or against the cutting edge. With needles that are threaded from left to right, the “PCL” must always be used.

PLEASE NOTE: When using cutting points, attention must be paid that stitch density is not too low. This would result in the leather being perforated. As a result, the seam would be weakened or even destroyed.

2.3 SERV 7 needle construction

Different sewing demands and material thickness require a needle that can produce the desired quality seams undisturbed despite various combinations of materials.
Apart from material damage, skip stitches are a common sewing problem. Skip stitches occur during stitch formation when the thread loop is not caught by the hook/looper interrupting the interlooping of upper and lower thread. Skip stitches considerably impair the appearance and the strength of the seam and thus the quality of the end product.
The SERV 7 needle is a special needle that avoids skip stitches and needle breakage. This type of needle has several point styles depending on the demands of the material – it is available in different round points or as ”SD1“. The SERV 7 needle’s distinctive features are its so-called hump scarf and its blade reinforcement. The hump scarf creates a larger loop which ensures that the hook/looper an pick it up securely. Skip stitches are thus reduced considerably.

SCHMETZ Tip:

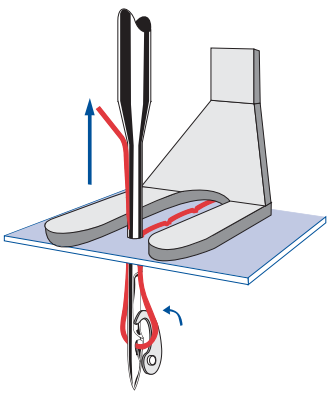
To prevent skip stitches and ensure greater needle stability, we recommend the SCHMETZ SERV 7-version.

The special feature of the SERV 7 needle is particularly useful when sewing several fabric layers and tighter materials. The SERV 7 blade reinforcement makes this needle especially stable and deflects less easily. Needle breakages are thus kept to a minimum and the centric incision creates a better seam appearance.

SCHMETZ Tip:

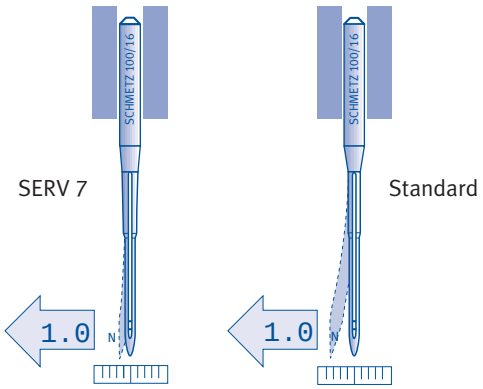
Benefit 1: SERV 7 hump scarf produces optimum loop formation and prevents skip stitches.

SCHMETZ SERV 7



SCHMETZ Tip:

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



2.4 Changing of the needle

Even minimal damage to the needle point as well as wear and tear due to various sewing processes impair the quality of the end product. Depending on the number of material layers, material thickness and combinations, we recommend that the needle is changed at the start of every shift or at least once per working day. Experience shows that keeping to such time periods makes it possible to sew with constant high quality. Only a perfectly smooth round point ensures that the needle can pierce the fabric without damaging it. Similarly, only a sharp undamaged cutting point can guarantee an optimal seam appearance. The needle should therefore be changed often and at regular intervals.

SCHMETZ Tip:

Check the point of the needle regularly or change the needle at regular intervals.

Sewing thread

3. Selection of sewing thread and stitch parameters

In the production of shoes, many different material combinations are used. The right sewing thread is of crucial importance for a quality end product. The most important criteria are seam strength, and a damage free and straight seam appearance. Seam strength is additionally influenced by the choice of stitch type, stitch density and thread tension.

3.1 Composition and size of the sewing thread

Composition and quality of the sewing thread significantly contribute to seam quality. In the production of shoes, e.g. when sewing back seams and stay seams, continuous multi filament sewing threads made from 100 % polyester or 100 % polyamide are used almost exclusively.

Continuous filament

	Polyamid 6.6 (Nylon)				Polyester			
Stitching technique	**Yarn size**		**Needle size**		**Yarn size**		**Needle size**	
	No*	**tex***	**NM**	**SIZE**	**No***	**tex***	**NM**	**SIZE**
Coarse decorative seams	4	750	280 – 330	28 – 30	4	750	250 – 300	27 – 29
	5	600	250 – 300	27 – 29	5	600	250 – 280	27 – 28
					6	500	230 – 250	26 – 27
	7	429	230 – 250	26 – 27	7	429	200 – 230	25 – 26
	8/9	375/333	200 – 250	25 – 27	8/9	375/333	180 – 200	24 – 25
	10/11	300/273	160 – 230	23 – 26	10/11	300/273	140 – 180	22 – 24
	12	250	160 – 230	23 – 26	12	250	140 – 180	22 – 24
Coarse seams	13	231	160 – 200	23 – 25	13/14	231/214	130 – 160	21 – 23
	15	200	160 – 180	23 – 24	15	200	125 – 140	20 – 22
					18	167	120 – 130	19 – 21
	20	150	120 – 160	19 – 23	20	150	110 – 130	18 – 21
					24/25	125/120	100 – 110	16 – 18
	30	100	100 – 140	16 – 22	30	100	100 – 110	16 – 18
					35/36	86/83	110 – 120	18 – 19
Medium	40	75	100 – 120	16 – 19	40	75	100 – 110	16 – 18
					50	60	90 – 100	14 – 16
	60	50	80 – 100	12 – 16	60	50	80 – 90	12 – 14
					70	43	75 – 80	11 – 12
	80-90	38/33	70 – 90	10 – 14	80/90	38/33	70 – 80	10 – 12
Stay seams (heel seams)	40	75	100 – 120	16 – 19	40	75	100 – 110	16 – 18
	60	50	80 – 100	12 – 16	60	50	80 – 90	12 – 14
	80/90	38/33	70 – 90	10 – 14	80/90	38/33	70 – 80	10 – 12
					100	30	65 – 70	9 – 10

Core Spun

	Polyester/Cotton				Polyester/Polyester			
Stitching technique	**Yarn size**		**Needle size**		**Yarn size**		**Needle size**	
	No*	**tex***	**NM**	**SIZE**	**No***	**tex***	**NM**	**SIZE**
Coarse decorative seams	4	750	230 – 280	26 – 28				
	5	600	180 – 250	24 – 27				
	6	500	180 – 200	24 – 25				
	8	375	180 – 200	24 – 25	8	375	160 – 200	23 – 25
	12	250	160 – 180	23 – 24	12	250	140 – 180	22 – 24
Coarse seams	15	200	140 – 160	22 – 23				
	20	150	140 – 160	22 – 23	20	150	120 – 160	19 – 23
	24	125	130 – 160	21 – 23				
	25	120	120 – 140	19 – 22	25	120	110 – 140	18 – 22
	28	107	120 – 140	19 – 22				
	30	100	120 – 140	19 – 22	30	100	110 – 130	18 – 21
	35/36	86/83	110 – 130	18 – 21	35/36	86/83	100 – 120	16 – 19
Medium	40	75	100 – 120	16 – 19	40	75	100 – 110	16 – 18
	50	60	100 – 110	16 – 18	50	60	90 – 100	14 – 16
	60/75	50/40	90 – 100	14 – 16	60/75	50/40	90 – 100	14 – 16
	80	38	90 – 100	14 – 16	80	38	80 – 90	12 – 14
	90	33	80 – 90	12 – 14				
	100	30	80 – 90	12 – 14	100	30	70 – 90	10 – 14
Stay seams (heel seams)	40	75	100 – 120	16 – 19	40	75	100 – 110	16 – 18
	60/75	50/40	90 – 100	14 – 16	60/75	50/40	90 – 100	14 – 16
	80	38	90 – 100	14 – 16	80	38	80 – 90	12 – 14

* No = Label number

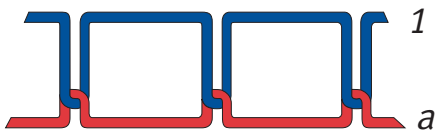
* tex = Unit of size 1 g/1000 m (e.g. 75 tex = 1000 m yarn weigh 75 g)

Sewing thread made from polyester is particularly color-fast and light-fast. The thread made from polyamide has high abrasive and tensile strength.

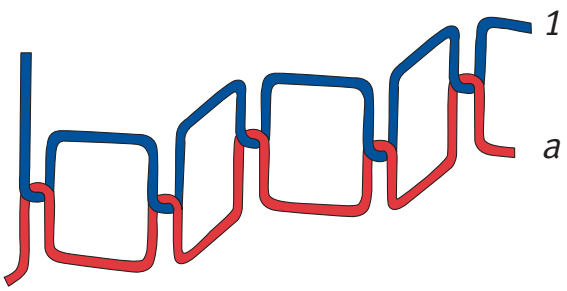
3.2 Stitch type

In the production of shoes, mostly two types of stitches are used; there is first of all stitch type 301 (double lockstitch) and its relative, stitch type 304 (zig-zag stitch) as well as stitch type 401 (double chain stitch). Because they form stitches in different ways, (interlacing in the case of the double lockstitch and zig-zag stitch in the middle of the material, interlooping in the case of the double chain stitch at the bottom side of the material) the double lockstitch is used where the seam is visible at the bottom side of the material. The top and the bottom of the seam have identical stitch appearance.

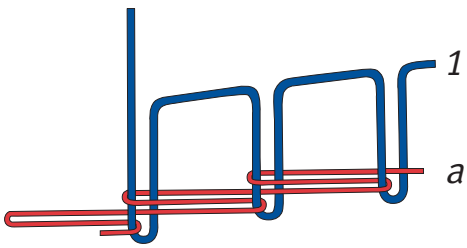
Stitch type 301 – double lock stitch
at the underside of the sewing good



Stitch type 304 – zig-zag stitch
for decorative stitching



Stitch type 401 – double chain stitch
(2-thread chain stitch)



3.3 Stitch density

Stitch density depends on material composition, number of layers, the desired seam strength, the needle point style and on any decorative effects that may be required.

Stitch density varies depending on application from between 3 to 6 stitches per cm.

3.4 Thread tension

The required thread tension depends on fabric, sewing thread and sewing machine.

It is assumed that the sewing thread has a certain amount of elasticity of its own. If this is too high, however, undesired puckering can occur.

Machine

4. Sewing machines for the manufacturing of shoes and footwear

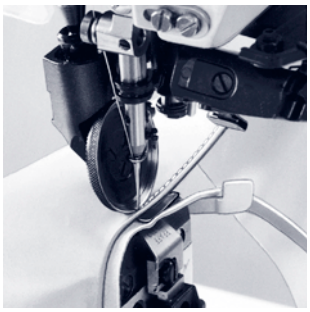
In the production of shoes, mostly 1 or 2 needle machines are used. Special devices and accessories (e.g. folders) as well as special presser feet (e.g. Teflon®- roller or puller feet) enable easier handling.

Flatbed Sewing Machine Closing and attaching seams, decorative seams

Long-Arm Sewing Machine Decorative seams for particularly wide pieces

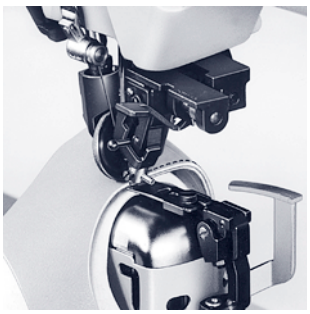
Postbed Sewing Machine For decorative and securing seams on curved pieces, three-dimensional sewing

Free-Arm Sewing Machine For decorative and securing seams on curved pieces, three-dimensional sewing



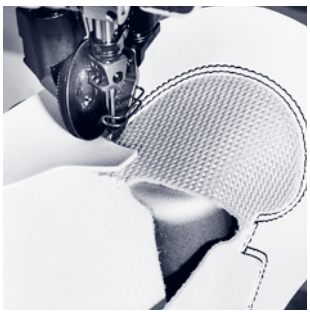
Stitching lining with underedge trimming (edging)

Source: Pfaff AG



Stitching lining with upperedge trimming (edging)

Source: Pfaff AG



Vamp stitching (e.g. closing upper)

Source: Pfaff AG

4.1 Feed

As a rule, sewing machines for sewing shoes have a triple feed unit. Depending on the sewing operation, the following combinations can be used:

Compound feed with alternating presser foot top feed
This combination is mostly used with flatbed and long-arm sewing machines, whenever two-dimensional, smooth sewing is required, e.g. in the case of back seams

Compound and roller feed
This combination is mostly used with three-dimensional sewing of tight curves and half-finished products. This triple feed is used with postbed and free-arm machines, e.g. when sewing in lining

Needle feed, roller top feed and roller bottom feed
For displacement-free sewing of decorative and joining seams, e.g. when sewing on clips and straps, for back seams

Drop feed
For displacement-free sewing of light to medium materials, for example decorative seams on shoe uppers

4.2 Throat plate/Throat plate aperture size

Each sewing machine is fitted with sewing accessories for the particular use or sewing operation for which they are intended.

This includes type of feed and throat plate aperture which is adjusted to needle size and can be changed if necessary.

Attention must be paid that the throat plate aperture is not too large for the chosen needle size. This could otherwise cause the material to be pulled into the throat plate aperture. The result would be material damage and skip stitches.
On the other hand, needle and thread must be able to pass the throat plate unimpeded.

4.3 Sewing speed

In shoe production, sewing speed is generally between 2,000 and 3,000 stitches/min. Sewing speed depends on the material used as well as the particular sewing process. In the case of short seams and difficult pieces with curved and corner seams, effective sewing speed often lies below the maximum possible sewing speed.

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** SERVICE**HOUSE** 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** SERVICE**HOUSE** 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 shoes and footwear?
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 SERVICE**HOUSE** experts and take advantage of our offer.

We will be pleased to send you information on:

Our range of service:

Company name

Attention

Position

Address

Postcode/City

Country

Phone

Fax

E-Mail

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

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

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