SEWING FOCUS

TECHNICAL SEWING INFORMATION

SERVICEHOUSE

Schiffli Embroidery

Checklist for Manufacturing Schiffli Embroidery

Embroidery Parameters:	SCHMETZ Tip:	
Needle size	NM 70 – 170	SCHIFFLI SIZE 2/0 – 7
Needle point	In the industrial manufacture of Schiffli embroidery, needles with round point or ball point are used. Most frequently used point style is the “NORMAL” point that produces in all types of fabric a clear seam appearance. In knitted fabrics the medium ball point “SUK” is used. In the processing of especially coarse knitted or woven fabrics the use of needles with special point for embroidery “STR” is advisable.	
Embroidery thread	In Schiffli embroidery, threads are used that give the embroidery silky lustre. Predominantly polyester filaments, slightly twisted viscose threads or mercerised cotton threads are used. Lurex threads provide additional brightness effects.	
Machine	The manufacture of Schiffli embroidery is done on special Schiffli machines that work with needle and Schiffli thread. Schiffli embroidery machines are available for an embroidery length of 1.6 yards (1.5 m) up to 33.4 yards (30.5 m).	
Other factors:		
Thread tension	The required thread tension depends on embroidery material, applied embroidery threads and the machine. The thread tension should be as low as possible to avoid distortion of embroidery and material or thread breakages.	
Stitch type	Lockstitch (stitch type 301) according to DIN 61400 and ISO 4915.	
Stitch density	Each single stitch is freely variable in stitch length and direction. The smallest stitch unit horizontally and vertically is 0.1 mm.	

SCHMETZ

NEEDLES SINCE 1851

Quick Reference for Typical Embroidering Problems in Manufacturing Schiffli Embroidery

Symptoms	Effect	Cause
Material damage		
Destroyed fabric parts in the area of embroidery	Sub-standard, defective embroidery appearance	Oversized needle and/or unsuitable point style
Damages in thin nonwovens	Reduced tensile strength of the material	Fabric clamped too loose
Mesh damages in knit fabrics		Defective or worn out needles
		Damaged embroidering tools, e.g. cloth presser, needle plate, shuttle
Defective embroidery appearance		
Embroidery motives are only partly embroidered	Poor, defective embroidery appearance	Thread breakage of needle or shuttle thread
Different sizes of bore holes	Undesirable waves in the area of embroidery	Empty shuttle
Sub-standard, defective appearance of bore holes		Borers worn out differently
Transverse stripes in embroidery		Loose thread tension of needle or shuttle thread at single needles
Shuttle thread is visible on surface		Dirty stripes due to soiled embroidery thread
Embroidery looks distorted		Incorrect thread tension
Puckering of fabric in the area of embroidery		

Solution

NM SIZE	Point style	Thread	Machine
			
Adjust needle size to the fabric	Adjust point style to the fabric Check needle point for damage		Tighten fabric Check embroidery tools for damages, e.g. cloth presser, needle plate, shuttle
		Change of soiled thread spools Optimise thread tension	Use of thread stop motion to find point of breakage quickly Examine borer Correct thread guidance Fabric threads should be rectangled after clamping of fabric/Observe course and wale in knitted goods

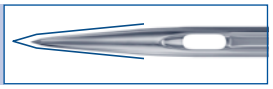
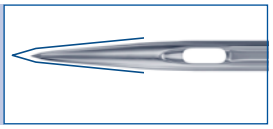
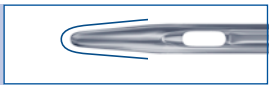
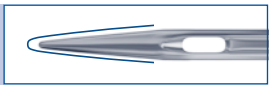
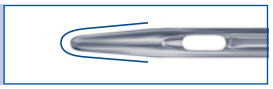
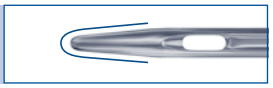
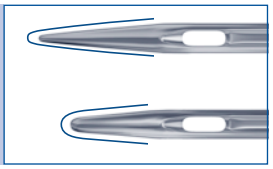
Quick Reference for Typical Embroidering Problems in Manufacturing Schiffli Embroidery

Symptoms	Effect	Cause
Needle breakage		
	Destroyed fabric parts in the area of embroidery	Use of undersized needles
		Needle incorrectly fitted
	Damages in thin nonwovens	Needle deflection too high during penetration of fabric
	Mesh damages in knit fabrics	
	Broken needle parts remain in fabric	Damaged needle tip, resulting in excessive penetration force
Skip stitches/Thread breakage		
No interlacing of needle and shuttle thread	Sub-standard, defective embroidery appearance	Incorrect thread tension
		Incorrect thread guidance
Needle thread breaks	Thread breakage after skip stitch	Incorrect needle system
		Needle incorrectly fitted
Ravelling of the needle thread		Use of an oversized embroidery thread in relation to the needle size
		Cloth presser adjustment too high

Solution

NM SIZE	Point style	Thread	Machine
			
Adjust needle size to fabric Check correct positioning of the needle Regular check of needles/ change if necessary	Check point for damage	Optimise thread tension	Examine embroidery material Adjust embroidery tools, e.g. cloth presser, needle plate, on needle, embroidery thread and material
Adjust needle size to thread size and thickness of embroidery material Check correct positioning of the needle Regular check of needles/ change if necessary	Check point for damage	Optimise thread tension Adjust embroidery thread size to needle size and fabric	Optimise shuttle setting Examine thread guiding elements Reduce embroidering speed Change worn out embroidery tools such as thread guiding elements, needle plate, shuttles Optimise adjustment of cloth presser

Selection of Point Style and Needle Size

Material being embroidered	Needle size NM / Schiffli SIZE	Point style	
Gauze/Nonwovens/ Prepared cardboard	70 – 100 / 2/0 – 2	NORMAL point	
Woven fabrics made of cotton, linen, polyester or blended woven fabrics	80 – 170 / 0 – 7	NORMAL point	
Coarse woven fabrics	80 – 130 / 0 – 4	STR special point for embroidery	
Fine knitted fabrics	80 – 110 / 0 – 3	SUK medium ball point	
Coarse knitted fabrics	90 – 130 / 1 – 4	STR special point for embroidery	
Net fabrics	80 – 110 / 0 – 3	STR special point for embroidery	
Tulle	80 – 110 / 0 – 3	SUK medium ball point STR special point for embroidery	

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1. Manufacturing of Schiffli embroidery

While sewing technology commonly is designated as a joining technology, serving to connect several layers of fabric material, embroidering is looked at as a pure decorating procedure. Special feature of embroidery is that each stitch is freely variable in stitch size and direction. The Schiffli embroidery belongs to the automatic embroidering techniques and is based on a lockstitch. The stitch formation is done by interlacing needle thread and bottom thread, the so-called Schiffli thread.

Schiffli embroidery is a Swiss invention, “Schiffli” is the Swiss word for shuttle. In the year 1863, Isaak Gröbli developed the first Schiffli embroidery machine in the Swiss town St. Gallen. In 1910, an embroidery machine based on the Swiss principle was developed in Plauen, Eastern Germany. Almost unchanged, it is in use until today. Nowadays Schiffli embroidery is manufactured primarily in Asia and in Turkey. The required machines are produced mainly in Switzerland.

Source: Perfecta Schmid AG

1.1 Typical processing problems

In Schiffli embroidery, high-value products are produced. The Schiffli embroidery is used in the field of exclusive garments, e.g. in lace manufacturing, for lingerie, for bride- and evening fashions, as well as in the field of home textiles, e.g. for curtains, table cloths and other accessories. In the manufacture of the traditional Plauen lace, soluble gauze, made of cotton or viscose is used as a base material. The unnecessary non-embroidered material is removed after embroidering and the embroidered pattern forms the lace characteristics. Schiffli embroidery is also done on polyester nonwovens or wovens out of cotton, silk, polyester or blended wovens or other base materials such as tulle and net fabrics or knitted fabrics. In addition to optimal machine adjustment, the correct selection of needle and thread is of great importance. Needle and thread breakages cause skipped stitches and

material damages which may completely destroy the embroidery appearance or may result in costly reworking. Moreover, Schiffli embroidery machines optionally possess supplementary devices which enable the mounting of special embellishment effects e.g. additional bore holes, sequins or cord application. In this case it is important to adapt the machine adjustment so that the embellishment effects do not cause skipped stitches, needle and thread breakages. Furthermore, it is difficult to adjust a uniform thread tension of up to 2,200 needles and shuttles at the machine, to avoid skipped stitches, needle and thread breakages as well as distortion or puckering of the material.

Typical embroidery problems are:

- Material damages
- Defective embroidery appearance
- Needle breakage
- Skip stitches/Thread breakage

1.2 Quality embroidery with the right embroidery parameters

Besides the aesthetic requirements, quality embroidery should also meet the demands regarding form stability and durability. Therefore, all embroidery parameters that influence the production must be adjusted carefully to each other: material, needle, thread and machine setting. If one parameter is changed, the others should be checked in any case. In order to guarantee a successful and trouble-free production, a regular inspection of all parameters is essential. The design should also be well planned in order to receive a faultless, top-quality high-value embroidery.

Needle

2. Selection of the right needle

Decisive for a damage-free embroidery and an optimal end product is – above all – the selection of the correct needle. The needle size and point style is determined by the character of the material to be embroidered. The use of the correct needle size and point style reduces skipped stitches, thread breakages and material damages and guarantees a proper embroidery appearance. Additionally, downtimes due to the needle are avoided during the production process.

2.1 Needle size

Prior to the decision about the point style the needle size should be determined. It is also important to adjust the needle size to the embroidery thread: thread size and the eye of the needle should match each other exactly. Schiffli machines expose the thread to additional friction because each stitch is freely variable in length and direction and the thread must follow each movement of the frame. Therefore, a smooth gliding of the thread in the eye of the needle is the precondition for a proper stitch.
Additionally, the choice of the needle size depends on the material to be embroidered. In the manufacture of Schiffli products, a great variety of materials are embroidered. Soluble gauze, nonwovens or also prepared cardboard are embroidered in the manufacture of air embroidery. Furthermore, cambric or satin materials made of cotton, linen, polyester and blended fabrics are used as base material. Knitted fabrics demand a great deal of the needle because these materials very quickly show damages of meshes if incorrect needles are used.
With tightly stretched base materials there is always the possible danger of material thread breakage. In particular, multiple embroidering on tightly clamped base material often leads to the use of excessively thick needles in order to avoid bending these relatively long needles. When dense patterns are embroidered, the base material may be destroyed to the extent that the individual patterns are cut out completely. For this reason, the needle selected should be as thin as possible.
Schiffli machines are equipped with up to 2,200 single needles depending on embroidery length and pattern repeat so that the selection of the incorrect needle would result in additional downtimes due to refitting.

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

2.2 Point style

For a trouble-free production process and an optimal final result the point style is as important as the needle size. In the manufacture of Schiffli embroidery, round points and ball points are used. Especially for Schiffli embroidery, the round points are only available as “NORMAL” version and the ball points in the versions medium ball point “SUK” and special ball point for embroidery “STR”.

NORMAL point 

The “NORMAL” point is predominantly applied on woven fabrics and nonwovens, where an exact penetration of materials is required but the material is not prone to damages by the penetration of the needle.

SUK medium ball point 

The medium ball point “SUK” is used if the embroidery is done on fine knitted fabrics or tulle. There it is very important that during the penetration the needle pushes the material threads aside and pierces into the space between them to avoid material damages.

STR special ball point
for embroidery 

The use of the special ball point for embroidery “STR” is advisable if extremely coarse material such as net fabric or coarse knit fabric is to be embroidered and thicker material threads are to be displaced during the penetration to prevent damages of the material.

2.3 Colour coding

In order to enable a fast identification of needle size and point style, the SCHMETZ Schiffli needles up to NM 140/Schiffli SIZE 5 are provided with a colour coding. This prevents the installation of incorrect needle sizes and point styles during the replacement of needles and the needle change happens smoothly. Further information on colour coding is available in the PRODUCT FOCUS “Schiffli Embroidery”.

2.4 Changing of the needle

Damages as well as signs of wear at the needle tip affect the quality of the final product. Depending on embroidery material and selected embroidery design the needle is exposed to different stress conditions. Only a flawless point can ensure that the needle penetrates the material without damaging it. Therefore, the needle should be checked at regular intervals.

SCHMETZ Tip:

Check needle tips regularly and change needle if necessary.

Embroidery thread

3. Selection of embroidery threads and stitch parameters

In the home textile and garment industry, lace and embroidery are always used as decorative elements. The most important quality criterion in the manufacture of embroidery is an accurate and faultless embroidery appearance. Furthermore, high-quality embroidery is characterised by durability and sufficient form stability, because later in use it is exposed to wear and care stress. Besides the high lustre, which emphasises the high class of the embroidery, Schiffli embroidery threads should also show sufficient elasticity. Especially in embroidering elastic materials like knit fabrics, elasticity is very important because the material is highly stretched during the embroidering process and after this – in tensionless condition – it shortens again. In each field of application of Schiffli embroidery, the composition and the quality of the embroidery thread considerably determine the quality of the end product.

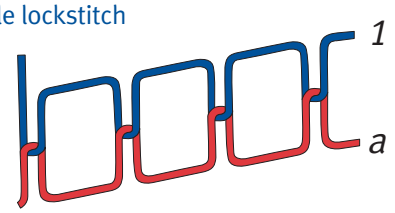
3.1 Composition and size of the embroidery thread

In embroidery it is basically necessary that the thread properties should correspond to the embroidery material in order to prevent later problems in use. However, in practice mostly polyester and viscose filaments are used due to financial reasons. In very high-value cotton and linen embroidery, also mercerised cotton threads are applied. In the field of air embroidery, the thread is selected to withstand the later process of the removal of the base material. In Schiffli embroidery, Lurex threads are used for additional effects, which bring the desired gold and silver brightness into the embroidery. As a guideline, in the selection of needle and shuttle thread the thread size of the shuttle thread is always slightly finer than the needle thread. Examples in practice show, that the range of the needle thread size is mostly from Nm 40 – Nm 80 (~ dtex 250 – dtex 125) and the adequate shuttle threads are to find in the range from Nm 60 – Nm 120 (~ dtex 170 – dtex 85). Special effects sometimes require the use of coarser threads.

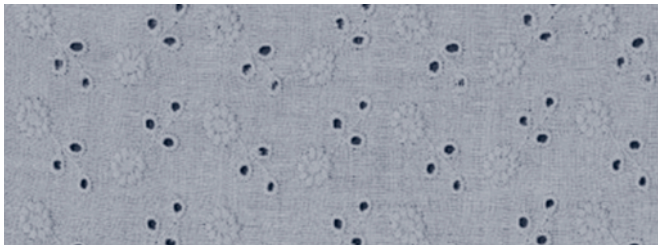
3.2 Stitch type

In Schiffli embroidery, all patterns are applied by using double lockstitch.

Stitch type 301 – double lockstitch



In the Schiffli technique, special embroidery effects can be obtained with special supplementary devices, e.g. with the help of borers holes can be pierced into the embroidery and the fabric or sequins can be attached.



Eyelet embroidery Source: Stoffekontor

3.3 Stitch density

In Schiffli embroidery, there are no guidelines regarding the stitch density as they exist in different sewing processes. The stitch density is dependent on the specification of the embroidery pattern. Each stitch is freely variable in length and direction. Depending on the pattern, parts of the fabric will be embroidered repeatedly in different stitch lengths.

3.4 Thread tension

In the manufacture of Schiffli embroidery, several hundreds of needles penetrate the fabric simultaneously. Each thread tension is adjusted individually, an adjustment on fabric, embroidery thread and machine is necessary. Generally, the thread tension should be adjusted as low as possible in order to prevent thread breakages and consequently a damage of the embroidery appearance. On the other hand, a thread tension which is too loose may cause an incorrect interlacing of needle and shuttle thread. A thread tension which is too tight may evoke the distortion of individual parts of the embroidery which is not corrigible.

After pattern change, slowly starting the new embroidery serves to check the thread tensions of all needle and shuttle threads. Newer models of machines use refined active thread supply systems that deliver the demanded quantity of embroidery thread at the right moment, dependent on stitch length and thread characteristics and therefore prevent embroidery defects caused by incorrect thread tension. For older models, it is advisable to check the thread tension with special tensionmeters and to adjust the thread tension to each material individually.

Machine

4. Machines for the manufacturing of Schiffli embroidery

In the manufacture of Schiffli products, multi-needle embroidery machines are used. The characteristic of those Schiffli machines is, that the material to be embroidered is fed vertically through the machine. The stitch formation results from the horizontal penetration of the needles into the fabric. The needles are arranged side by side in one line and penetrate simultaneously, always in the same height of the fabric. The embroidery pattern is caused by the horizontal and vertical movement of the clamped fabric. Modern high performance embroidery machines offer the possibility to embroider two fabrics simultaneously. In Schiffli machines, that offer the possibility of a colour change within the embroidery, each needle can be actuated individually.

Depending on the machine version, up to 2,200 needles penetrate the fabric simultaneously. To withstand this mechanical stress the fabric is clamped in the frame under high tension. The length of the fabric to be embroidered varies according to the machine length, however, the basic difference between different Schiffli machines is that the fabric can be clamped into the frame either as cut coupon with fixed length or as continuous yard ware.

The pattern repeat schedule of Schiffli machines originates from the French measuring system which defines the basic pattern repeat with 1 French inch. This corresponds 27.07 mm in the metric system. In the technical term, this is called 4/4 repeat. The basic repeat can be expanded as desired to repeats that are a multiple of four. Thus, in a repeat of 8/4 only each second needle works, in a repeat of 12/4 each third needle, and so on.

The transfer of an embroidery design into a pattern which can be embroidered by machine can either happen by the con-

ventional way of punch cards or computerised with modern machines. To guarantee a smooth production flow, automatic thread-cutting systems, thread monitor and active thread supply are available in modern machines.

Source: Lässer AG

Source: Saurer Arbon AG

4.1 Feed mechanism

Schiffli machines – unlike sewing machines – do not work with the feed dog as a classic feed mechanism. In Schiffli machines the material is clamped firmly into the frame. The movement of the frame serves to create the embroidery pattern, the fabric is moved both into horizontal and vertical direction.
In older machines, the movement of the frame is controlled by the so-called punchcards. In modern embroidery machines, the punching happens directly on the screen and replaces the technology of the punchcards. Advantage of the computer-controlled punching is that possible faults during punching can be cleared faster.

4.2 Needle plate/Needle plate size

Schiffli machines have needle plates with openings which the needle passes in order to build the needle thread loop. The vertically standing needle plates are arranged side by side in a line. There is a single needle plate for each needle position which in case of damage allows a quick change of defective needle plates.
The stitch formation begins with the closing of the cloth presser. As soon as the cloth presser presses the base material against the needle plate, no more frame movement is carried out and the needle can penetrate the base material. The opening of the cloth presser completes the stitch formation and releases the base material for the next movement. In Schiffli embroidery it is important that the needle and the thread can pass the needle plate without any difficulty in order to prevent material damages and skip stitches.

4.3 Embroidering speed

In the manufacture of Schiffli embroidery, no high embroidering speeds are realised. Dependent on the pattern, the embroidery machines work with a speed from approximately 100 stitches/min upwards. Modern Schiffli machines offer maximum speeds of up to nearly 700 stitches/min depending on the operating conditions, the article to be manufactured and the threads used.

5. Our advice

You can achieve damage-free quality embroidery if all embroidery 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 embroidery and 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 Schiffli embroidery?
Would you like support in solving your individual embroidery 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.

Our range of service:

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