AMANN
GROUP
Intelligent threads

FOCUS

THE COMPENDIUM OF THREADS


INNOVATION
SINCE 1854

FOREWORD

Since 1854, AMANN has been one of the leading global producers in the field of high-quality sewing and embroidery threads. Its technical expertise, reliability and flexibility in production and service makes AMANN a strong partner worldwide. In close cooperation with its customers, AMANN develops sewing and embroidery threads, as well as smart yarns for tomorrow's market requirements.

More than 2,260 motivated employees in more than 100 countries worldwide make AMANN's success possible. AMANN Group exclusively produces at its own production sites. The company headquarters are located in Bönnigheim, Germany.

The knowledge built up over decades and the experience gained in the production and application of sewing threads and embroidery threads are now bundled in the new FOCUS edition. AMANN's FOCUS – the digital specialist book for experts & textile-interested people.

CHAPTER OVERVIEW

RAW MATERIALS

CHAPTER OVERVIEW

TEXTILE RAW MATERIALS

Textile fibres are available either as staple fibres or as filaments. Depending on their source, they are classified either as natural fibres or as industrially manufactured chemical fibres. Depending on their field of application the threads may often be manufactured from two fibre groups in order to take advantage of the characteristics of both fibre types.

NATURAL FIBRES

Natural fibres are categorised as:

Plant fibres (cellulose based)

- plant fibres (cotton, kapok, etc.)
- stem fibres (flax or linen, jute, ramie, hemp, bamboo, etc.)
- leaf fibres (sisal)
- fruit fibres (coco)

Animal fibres (protein based)

- animal hair (wool, mohair, cashmere, camel hair, lama, alpaca, angora, horse hair, etc.)
- fibres from thread-making insects (silk)

The modern sewing process imposes great demands on a sewing thread. Not every raw material is suitable for thread production due to its properties. Out of all natural fibres, today only cotton is suitable as a raw material for industrial sewing threads.

Cotton

In the following, cotton is used as an example to describe the process from the extraction of natural fibres to raw yarns, the precursor of sewing threads. The cotton plant (genus gossypium) is a bush or tree-like plant (0.5 to 6 m tall), belonging to the malvaceae family. It thrives in a tropical or subtropical climate (sunny, humid and warm, 18 to 28°C) and requires a certain quality of soil (loose and moist). Once the cotton ball is mature, it bursts open and the seed fibres swell to the size of a fist. The seed fibres (up to 55 mm) of the burst cotton balls are used for manufacturing of fibre. After the harvest, the fibres are separated from the seeds ("ginning"), pressed into 100 kg heavy bales and delivered to the cotton processing plants, where they are further processed into raw yarns using the so-called three-cylinder spinning process.

Refining of the cotton thread using the "mercerising" process (named in 1844 after its inventor Mercer) provides the surface of the fibre with a higher breaking strength as well as a silk-like gloss and an increased colour brilliance.

The quality of the cotton is mainly evaluated based on the following characteristics:

- staple length (fibre length)
- linear density (thickness of the fibres)
- strength
- grade of maturity
- colour/gloss
- consistency/uniformity

The longer the single cotton fibre is, the higher its strength and linear density and therefore the higher its quality. Furthermore, the fibre is even more valuable the more mature, pure and the more white. Differences incotton quality result in particular from different climate and soil conditions as well as from the various cotton types.

Cotton field

The most important countries that grow cotton and have the required climate are the USA, China and India, followed by Pakistan, Uzbekistan, Turkey, Australia, Argentina, Egypt (maco cotton) and Greece.

Cotton sewing threads are still mainly found in domestic use and in craftwork. Because of its performance, in particular its lack of elasticity, cotton sewing threads are not often used in industrial production. It has an inferior sewing performance compared with today's commonly used synthetic sewing threads. Special areas of application, like garment dyeing or organic clothes, require the use of cotton sewing threads, even in the industrial apparel production. MercifilGD, the cotton spun thread from AMANN, is produced only from long staple types and can be dyed with a high degree of colour fastness.

CHEMICAL FIBRES

Chemical fibres are categorised as:

Fibres from natural polymers (basis: cellulose, protein, etc.)

- viscose, modal, cupro, acetate, corn protein, casein, etc.

Fibres from synthetic polymers (basis: petroleum, coal, etc.)

- from polycondensation products (polyester, polyamide types PA 6.6; PA 11)
- from polymerisation products (polyamide type PA 6, polyvinyl chloride, polyacrylonitrile, polyvinyl acetat, polyvinylidene chloride, polyolefin [polyethylene, polypropylene], multipolymerised
- from polyaddition products (polyurethane)

Fibres with an inorganic basis

- glass fibre, glass polyester, etc.
- metal fibres

Based on the special properties of synthetic fibres, they are perfectly suitable as sewing threads. Moreover, also in terms of sewability, they offer a more secure sewing performance during industrial production processes.

In all branches of the textile industry, polyester fibres have become the most produced fibres. In addition to the two prevailing chemical fibres polyester and polyamide, other synthetics like aramide and polyacrylic fibres are used in special application areas (heat protection, chemical protection, etc.).

Polyester and polyamide

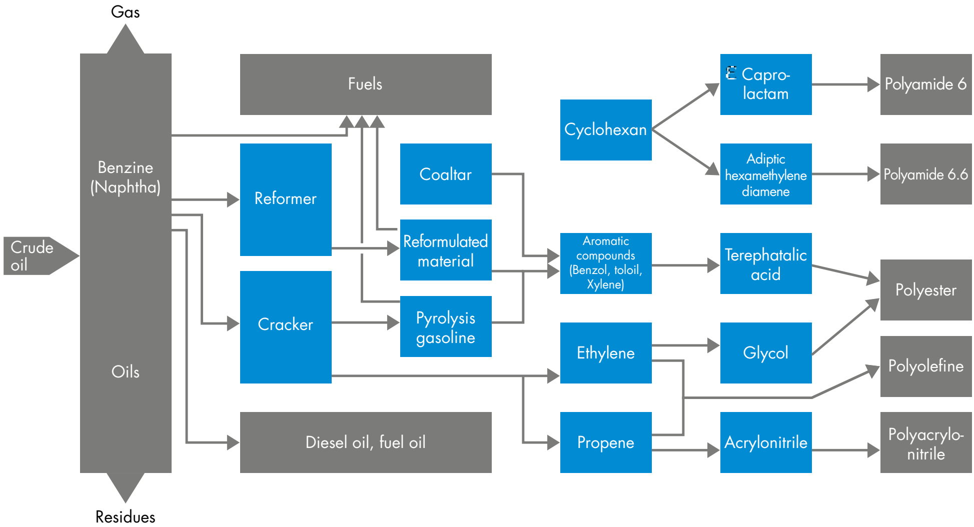
The following describes the sewing thread production using synthetic fibres on the basis of polyester and polyamide.

Hydrocarbons obtained mainly from petroleum products form the basic substance for synthetic fibres. Synthetic chain molecules are created by a chemical reaction. Depending on the structure of the basic molecules, the chain molecules are joined together through polymerisation, polycondensation or polyaddition.

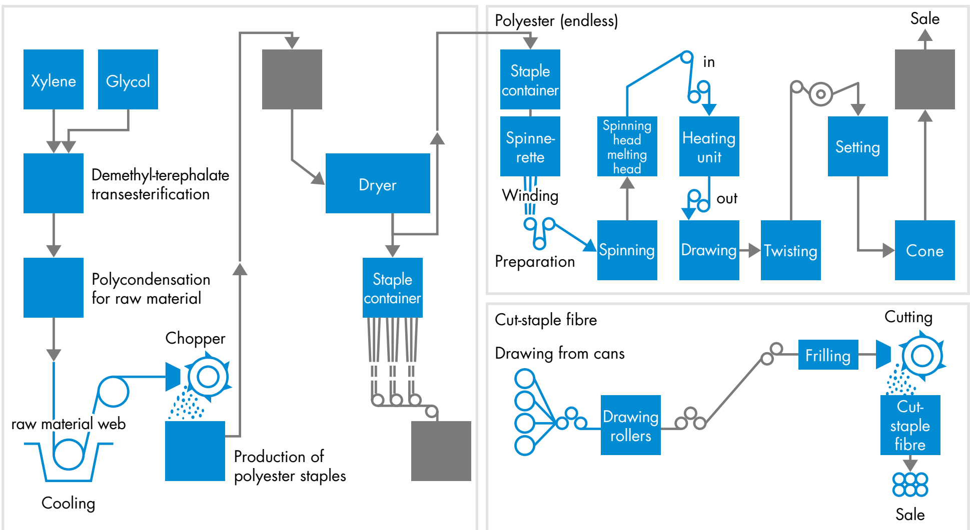
In the polymerisation process monomers of the same type (small molecules) are joined together to form chain molecules (polymers). Various types of small molecules join together to produce long chain molecules during the polycondensation process when the by-products (e.g. water and alcohol) are separated off. On the other hand, during the polyaddition process two different types of monomers join together to form polymers – without separating off the by-products.

In order to produce polyester, the basic materials of terephthalic acid and ethylene glycol are obtained through a chemical process and purified in large industrial plants and are subsequently joined together during the polycondensation process to form polyester macromolecules.

Individual fibres are produced by spinning the polyester melt and pressing it through spinnerets with fine openings. The spun fibre is “continuous”. It can therefore be wound and processed further in this form, but can also be cut or torn (staple fibre) and spun again into a fibre yarn.



From crude oil to the fibre



Production of polyester fibres according to the melt spinning process

For further information concerning chemical fibres, please visit www.ivc-ev.de

RAW MATERIAL CODES

Uniform codes are used in order to distinguish textile fibres in international correspondence. These are defined in DIN 60001-1:2001 (Natural fibres and Letter codes) as well as in DIN EN ISO 2076:2014 (Textiles – Man-made fibres – Generic names).

The following table lists the most commonly used raw materials and their international codes.

Natural fibres	Material code	Chemical fibres	Material code
Alpaca	WP	Acetate	CA
Cotton	CO	Aramide	AR
Flax/Linen	LI	Elastane	EL
Hemp	HA	Carbon	CF
Jute	JU	Metall	MTF
Coco	CC	Modal	CMD
Mohair	WM	Polyacryle	PAN
Virgin Wool	WV	Polyamide	PA
Silk (Mulberry)	SE	Polyester	PES
Sisal	SI	Polyethylene	PE
Ramie	RA	Polypropylene	PP
Cow hair	HR	Polytetrafluorethylene	PTFE
Tussah silk	ST	Triacetate	CTA
Wool	WO	Viskose	CV

For further information, please visit www.din.de, www.iso.org, www.beuth.de

IDENTIFICATION OF FIBRE RAW MATERIALS

In addition to the various physical-technological fibre examination tests, quick tests – the so called "burn test" or a chemical test – can determine the raw materials of a fibre.

BURN TEST

The burn test (observation of the flame; according to DIN 54 330/33) can identify and differentiate textile fibre materials. The following overview lists the most important raw materials and their respective burning behaviour and reactions:

Natural fibres

Fibre type	Burning behaviour	Odour while burning	Residue
Cotton	quick burning, with a light coloured flame	burnt paper	grey-white, light ashes (fly ash)
Flax/Linen	quick burning, with a light coloured flame	burnt paper	grey-white, light ashes (fly ash)
Silk	hardly inflammable, hesitant, bubbling flame	burnt hair	black crumbly ash
Wool/Hair	hardly inflammable, hesitant, bubbling flame	burnt paper/horn	black crumbly ash

Chemical fibres

Fibre type	Burning	Odour while	Residue
Acetate	quick burning, melts, drips	acidulous, pungent	threads can be pulled from the melting residue, when cold hard as glass
Aramide	inflammable, but self-extinguishing, non-melting	undefinable	ashes
Modal	quick burning, with a large, light-coloured	burnt paper	grey-white, light ashes (fly ash)
Polyacrylic	bubbly (like wool, silk and acetate) smoky, shrinks	aromatic, pungent	dark, cinder-like ashes, hard, not completely crumbly
Polyamide	does not burn, melts	aromatic, like celery	threads can be pulled from the melting residue, when cold hard as glass, non-tearable
Polyester	hardly inflammable, then bubbly, drips, smoky	aromatic	threads can be pulled from the melting residue, when cold hard as glass, non-tearable
Polyethylene	melts, shrinks	undefinable	dark, melted clump
Polypropylen	does not burn but melts without colour, not smoky, shrinks	undefinable	threads can be pulled from the melting residue, when cold hard as glass, non-tearable
Triacetate	burns quickly, melts	acidulous	threads can be pulled from the melting residue, when cold hard as glass
Viscose	quick burning, with a large, light-coloured flame	burnt paper	grey-white, light ashes (fly ash)

CHEMICAL TEST

Another possible method for identifying fibre materials is to test the individual raw materials for chemical resistance.

Fibre type	Chemical behavior
Cotton	dissolves in a cold, concentrated solution of sulphuric acid
Polyamide 11	dissolves in a solution of boiling sulphuric acid
Polyamide 6.6	dissolves in an 85% cold solution of formic acid
Polyester	dissolves in a cold, concentrated solution of sulphuric acid
Polypropylene	dissolves in xylene after reaching the boiling point
Silk	dissolves in a 10% sodium hydroxide solution after reaching a boiling point for approx. 15 minutes
Viscose	dissolves in a cold, concentrated solution of sulphuric acid
Wool	dissolves in a 10% sodium hydroxide solution after reaching a boiling point for approx. 15 minutes

One possible method for easily identifying polyester, polypropylene and polyamide is the float test on water. It is known that water has a density of 1 g/cm^3 at 4°C, and if the density of the tested chemical fibre is less than that of the water then it remains on the surface.

Polyester (PES) and polypropylene (PP) float (density is <1 g/cm^3);
Polyamide (PA) does not float (density is >1 g/cm^3).

TEXTILE RAW MATERIALS FOR SEWING THREADS

Not every textile raw material is suitable for sewing threads. Only a few meet the high demands of the sewing process and the subsequent use of the thread. Besides construction and linear density, the qualities of a sewing thread also depend on the choice of raw material(s). The raw material is the deciding factor in performance with respect to breaking strength and abrasion resistance, elasticity, sewability, colour fastness and much more.

The modern sewing process imposes great demands on a sewing thread. In double stitching, for example, a thread is pulled 70–80 times through the eye of the needle. In addition, there is a jerky stress when accelerating and stopping the sewing machine. In its subsequent use, the sewing thread must also fulfil all requirements with respect to abrasion resistance, breaking strength, etc. On the following pages, the most important raw materials that AMANN uses for production will be specified.

COTTON (CO)

Production

The seed fibres of the cotton plant are processed into a fibre fleece (roving) through various production steps, which is in turn spun into a finished yarn.

Characteristics

- the longer the fibres are, the more valuable they are and the higher their strength
- glossy after mercerizing
- low breaking strength
- low elasticity
- average moisture absorption
- high tendency to crease
- resistant to organic solvents, loses strength in strong alkaloids, dissolves and decomposes in acids

Temperatures

- decomposes or ignites at 400°C, non-melting, burns easily, smells like burnt paper

Well-known AMANN products: MercifilGD

POLYESTER (PES)

Production

Polymer is a product of polycondensation process. Fibres are produced through the melt spinning process.

Characteristics

- high breaking strength and abrasion resistance
- high elasticity, crease resistant
- very good resistance to sunlight, weather, decay and mildew
- easy-care (easy to wash and quick-drying)
- moisture resistant
- high temperature resistance in comparison to other synthetic fibres
- low specific weight

Temperatures

- dry heat resistance: up to 150°C
- melting point: 250°C to 260°C according to type

Well-known AMANN products: Saba, Serafil, Serabraid, Isacord and Serabond

POLYAMIDE (PA)

Production

Polymer is formed through the polycondensation process in PA 6.6, and in case of PA 6 through polymerisation. Fibres are produced through the melt spinning process.

Characteristics

- shigh breaking strength and abrasion resistance
- high elasticity, good crease resistance
- resistance to sea water, decay and mildew
- easy-care (easy to wash and quick-drying)
- moisture absorbent
- thermoplastic
- photosensitive

Temperatures

- melting point: PA 6.6 approx. 255°C to 260°C according to type
- melting point: PA 6 approx. 215°C to 220°C according to type

Well-known AMANN products: Strongfil, Onyx, Oxcel and Strongbond

META-ARAMIDE (M-AR)

Production

Meta-aramids are produced through polycondensation process and are spun through the dry spinning process.

Characteristics

- modified polyamide (aromatic)
- hardly inflammable, self-extinguishing, non-melting
- good resistance to acids and bases
- high resistance to fungi and bacteria
- good abrasion resistance

Temperatures

- permanent temperature resistance: up to approx. 220°C
- decomposition temperature: approx. 370°C

Well-known AMANN products: N-tech and A-tech

PARA-ARAMIDE (P-AR)

Production

Para-aramids are produced through polycondensation process and are wet spun into fibres.

Characteristics

- modified polyamide (aromatic)
- very good cut resistance
- hardly inflammable, self-extinguishing, non-melting
- good resistance to acids and bases
- high resistance to fungi and bacteria
- low loop strength
- sensitive to UV → long exposure to light leads to yellowing and a loss of strength of up to 75%

Temperatures

- permanent temperature resistance: up to approx. 170°C
- decomposition temperature: approx. 425°C

Well-known AMANN products: K-tech and Kc-tech

POLYACRYLICS (PAN)

Production

Polymer is a product of polymerisation process. Polyacrylic filaments are spun by using the wet spinning process.

Characteristics

- very good resistance to sunlight and weather
- slight elasticity
- low breaking strength and abrasion resistance
- slight tendency to crease
- thermoformable
- good ability to fluff
- very good resistance to acids and alkaloids, dissolves in dimethylformamide, nitric acid and dimethylacetamide
- very good UV resistance

Temperatures

- permanent temperature resistance: up to approx. 125°C
- decomposition temperature: approx. 250°C

Well-known AMANN products: D-tech

POLYETHYLENE (PE)

Production

Polymer is a product of polymerisation process. The polyethylene fibres are obtained through the melt spinning process.

Characteristics

- high abrasion resistance
- high resistance to alkaloids and acids
- good decay resistance
- low density

Temperatures

- melting point: approx. 160°C to 175°C according to type

Well-known AMANN products: Xtreme-tech with Dyneema®

POLYPROPYLENE (PP)

Production

Polymer is a product of polymerisation process. Polypropylene filaments are produced with the melt spinning process.

Characteristics

- similar as with polyethylene (PE)
- low density
- high resistance to alkaloids and acids, dissolves in chlorinated hydrocarbon at 70°C (Toluol, Xylol)
- good decay resistance
- potential as electrical insulation

Temperatures

- melting point: approx. 160°C to 175°C according to type

Well-known AMANN products: PP-tech

POLYTETRAFLUORETHYLENE (PTFE)

Production

Polymer is a product of polymerisation process. The polytetrafluorethylene fibres are produced through the so-called matrix spinning process, a type of wet spinning process.

Characteristics

- very high heat resistance
- very high resistance to chemicals; insoluble in organic solvents
- very good resistance to UV, weather, decay and moths

Temperatures

- decomposition temperature: approx. 325°C

Well-known AMANN products: Gore® Tenara®

POLYTRIMETHYLENE TEREPHTHALATE (PTT)

Production

Polymer is a product of polycondensation process. The polytrimethylenterephthalate fibres are obtained through the melt spinning process.

Characteristics

- high elasticity
- soft feel
- resistant to yellowing
- extremely durable
- excellent elongation behaviour
- good crease resistance
- biopolymer containing renewable raw materials; energy efficient production (Sorona® by DuPont™)

Temperatures

- melting point: approx. 225°C

Well-known AMANN products: Sabaflex

POLYETHERETHERKETONE FIBRES (PEEK)

Production

The polymers are produced by polycondensation process. The fibres are obtained through the melt spinning process.

Characteristics

- high temperature stability
- good resistance to radiation and chemicals
- high rigidity

Temperatures

- permanent temperature resistance: up to approx. 250°C
- melting point: approx. 330°C

Well-known AMANN products: Zyex®

CARBON FIBRES

Production

Production through thermal treatment (carbonisation) of suitable carbonated materials such as polyacrylnitrile or viscose.

Characteristics

- high strength and rigidity
- relatively low density

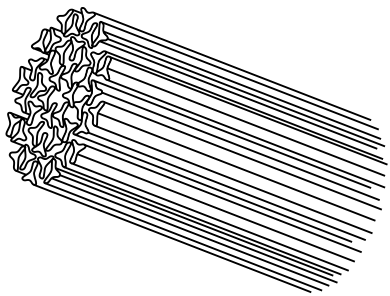
Temperatures

- in combination with oxygen: oxidation (loss of strength) at approx. 400°C)
- under the exclusion of oxygen stable up to 3,000°C
- deviating temperature resistance as sewing thread, since carbon fibres are used in sewing threads only in combination with other raw materials

Well-known AMANN products: C-tech

TEXTILE RAW MATERIALS FOR EMBROIDERY THREADS

As with sewing threads, numerous raw materials are suitable as a basis for embroidery threads. Besides the technical demands on a yarn, the appearance of a thread is an important aspect. Embroidery deals with the surface of a fabric and is also called "needle painting". The colour as well as the texture of the embroidery thread, for example fine/coarse or matt/glossy, allow for an endless variety of possibilities within the same embroidery pattern. Therefore, there are a variety of raw materials which can have an effect on the appearance of the embroidery thread:



Cross section trilobal fibre

HIGH GLOSS EMBROIDERY THREADS

These are exclusively continuous filament yarns, meaning endless chemical fibres such as viscose, polyester or metallic effect threads. A particular characteristic of the polyester embroidery thread lies in the special profile of each single filament. In order to achieve a higher gloss, the polyester melt is pressed through spinnerets with a clover leaf profile. This shape is called “trilobal”.
The three curves in the filament profile enable a stronger refraction of light and therefore a higher gloss than possible with the standard round filament profile.

Well-known AMANN products: Isacord for brilliant and fashionable embroideries, and Isamet for metallic embroideries.

MATT EMBROIDERY THREADS

In the past, mercerised cotton was the classic matt embroidery thread. Today, polyester or polyester/cotton core spun threads are used.

Well-known AMANN products: MercifilGD, Saba and Rasant

TECHNICAL AND FUNCTIONAL EMBROIDERY THREADS

Not only fashion embroidery, but also functional embroideries like logos and emblems on work wear, are gaining in importance. In part only special threads are able to fulfil the higher standards in this field. For flame-retardant and heat protective applications meta-aramide threads such as A-tech and N-tech are in use.

BOBBIN THREADS

Bobbin threads for embroidery are generally made from polyester. The excellent properties of this raw material result in a thread with the strength that is required at higher yields.

Well-known AMANN products: Isa and Isabob

TEXTILE RAW MATERIALS FOR SMART YARNS

Stainless steel, brass and silver are textile raw materials that are oftern used for smart yarns.

STAINLESS STEEL

Characteristics

- high breaking strength
- high corrosion resistance
- electrical conductivity
- heat conductivity
- melting point at approx. 1,500°C

BRASS

Characteristics

- excellent mechanical features
- excellent fatigue strength under reversed bending
- melting point declines with increasing zinc concentration; about 900°C to 925°C

SILVER

Characteristics

- corrosion resistance
- highest specific conductivity
- antibacterial
- melting point at approx. 961°C

Well-known AMANN products: Silver-tech/Silver-tech+

SEWING THREAD CONSTRUCTION

CHAPTER OVERVIEW

The properties of sewing threads are determined based on the raw material, the linear density (numbering) as well as the construction of the yarn (construction type, twist, ply and cord).

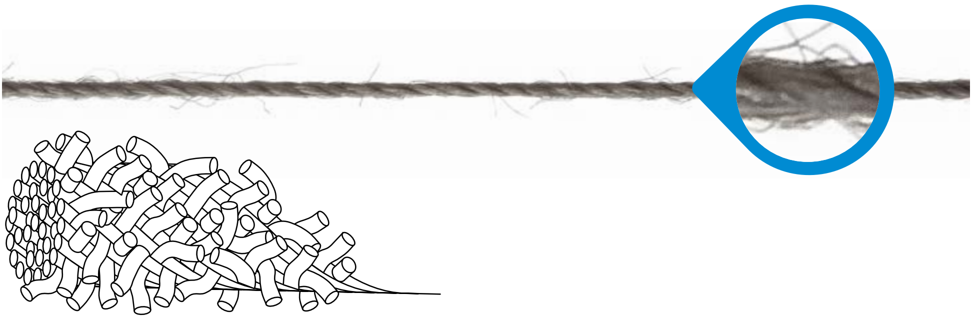
While the construction of the yarn defines the individual thread type, twist, ply and cord define the general construction parameters for all sewing threads. The same applies for embroidery threads.

CONSTRUCTION TYPE

The construction type is defined based on the different processing methods of the fibres and filaments (schappe or cut staple spuns, smooth continuous filaments, monofilaments, texturised filaments) and their combination.

It is important to point out that the construction types are described based on the structure of a single yarn. In general, however, a finished sewing thread consists of two or multiple single yarns, which are twisted together.

SPUN THREAD



Spun thread (illustration)

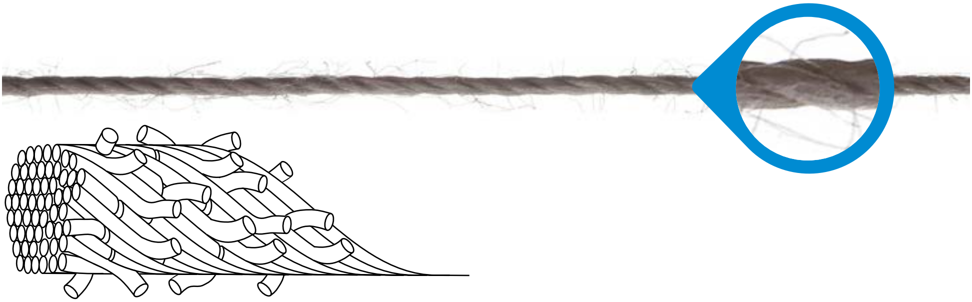
With this type of sewing thread the single yarns consist of short, cut staple fibres, twisted together to form a thread. The most frequently used raw materials for this construction type are cotton, polyester and aramids.

While natural fibres have a limited length (staple fibres), synthetic fibres are available either as cut staple or as schappe spuns. The filaments of schappe spuns are pulled lengthwise and break at the weak points. This results in irregularly long fibres (20 to 70 mm) with fibre ends of varying thickness. The surface of spun threads is very smooth. In case of cut staple spuns, the filaments are cut to a uniform length (approx. 40 mm, e.g. based on the model of high-quality cotton). The cutting of the fibres results in smooth and equally thick fibre endings. The spun thread obtains a textile look.

Cotton spun threads are primarily used for special applications in the apparel sector. The cotton sewing thread in the AMANN product range is MercifilGD. For technical applications, there are synthetic fibre yarns made of para- or meta-aramide.

Well-known AMANN products: K-tech and N-tech.

CORE SPUN THREAD



Core spun thread/core yarn (illustration)

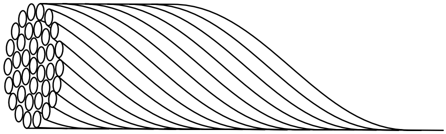
With core spun threads, the single yarns consist of a continuous filament core surrounded by fine fibres. In sewing thread production, this finished hank is called core yarn. The ratio of core to cover is usually two thirds to one third (the core is sheathed but not fully covered). This can vary according to the specific application field of the sewing thread.

The continuous filaments that form the core are usually made from polyester. Very occasionally other raw materials may be used. The spun cover is made of polyester or cotton fibres. A polyester core with polyester cover would be referred to as a polyester/polyester core spun, whilst a polyester core with a cotton cover would be called polyester/cotton core spun. Polyester/polyester core spun threads may have a cut staple or schappe spun cover. The latter is however seldom in use today. Almost all polyester/polyester core spun threads have a cover of polyester cut staple spuns that are cut to a length of 40 mm to match high-quality cotton.

Like spun threads, core spun threads have a smooth and textile surface. Thanks to the combination of continuous filament core and spun cover, core spun threads are extremely high performing. Breaking strength and abrasion resistance are higher in comparison with spun threads. Core spun threads display an outstanding sewability and this provides for trouble-free processing, even in difficult applications such as multidirectional sewing operations and buttonholes in thin fabrics. Therefore, core spun threads are well suited for a huge spectre of applications.

The polyester/polyester core spun thread Saba is among the most important products in the AMANN range of products. Rasant is AMANN's polyester/cotton core spun thread.

CONTINUOUS FILAMENT



Continuous filament (illustration)

The single yarns are made of endless fibres (filaments) for continuous filament threads. Partially, up to 200 single filaments make up a single yarn (continuous filament). Raw materials are primarily polyester and polyamide, for technical applications other raw materials like aramids, polyethylene, polytrimethylenterephthalate, polypropylene and polyetheretherketone are used. While the coarser sizes are usually of 3-ply construction, the finer qualities mostly have 2-ply constructions (see Sewing Thread Construction/Ply).

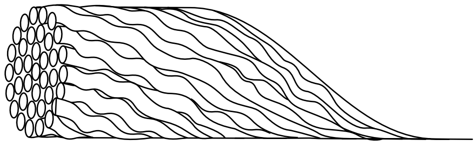
Thanks to their construction continuous filaments have a smooth, glossy surface and a consistent thread character. Furthermore, they display a very high breaking strength and abrasion resistance. Continuous filaments are mainly used for Shoes & Accessories, Home Interior and Techtex. The main products in the AMANN product range: Serafil (polyester continuous filament) and Onyx (polyamide continuous filament). For Techtex: Nc-tech, Kc-tech, C-tech, I-tech, Zyex®.

The apparel industry generally utilises only the finer counts. The major field of application here are overlock seams for cut edges and blindstitch seams.

Continuous filaments made of trilobal polyester are a classic construction type for embroidery threads. The trilobal filament shape enlarges the light-reflecting material surface and ensures that the finished embroidery design has the desired gloss.

Well-known AMANN products: Isacord

CONTINUOUS FILAMENT, TEXTURISED



Continuous filament, texturised (illustration)

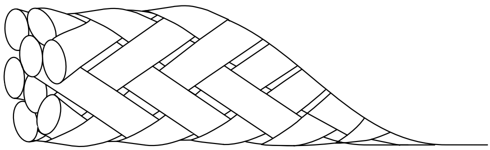
For this construction type continuous filaments are crimped by a false twisting process. These texturised continuous filaments are mainly made of polyester or polyamide and are bulgy and bulky. Hence, they are often referred to as "bulk yarns".

The crimping of the continuous filaments also provides for a soft grip, a matt look and a high yarn or thread elasticity.

Due to their special properties, typical fields of application are serging and flatlock seams in underwear and apparel production as well as edge covering of carpets.

Well-known AMANN products: Sabatex

CONTINUOUS FILAMENT, BRAIDED



Continuous filament, braided (illustration)

In order to obtain a braided continuous filament, 12 to 16 filament yarns (continuous filament bundle) – depending on the ticket size of the finished thread – are wound together on so-called clappers in a circular weaving process. Therefore, it takes longer to produce a braided thread (18 times longer than the production time of a comparable non-braided continuous filament thread). Polyester is the most commonly used raw material for braided continuous filaments. Thanks to their construction and the continuous filaments in use, braided continuous filaments have a smooth and decorative surface. They have excellent breaking strength and abrasion resistance.

Braided continuous filament threads are used for decorative seams on shoes, upholstery and leather products. Because of their special construction type they accentuate the seam.

AMANN's braided polyester continuous filament is Serabraid. Its ticket numbers are based on the optical diameter. Therefore, its ticket numbers deviate from all other sewing and embroidery threads. Serabraid 800 has an optical diameter of 0.8 mm, etc.

Serabraid is available in three different finishes:

- T60 for machine sewing
- T90 (waxed) for hand sewing
- WR (water-repellent) for machine sewing

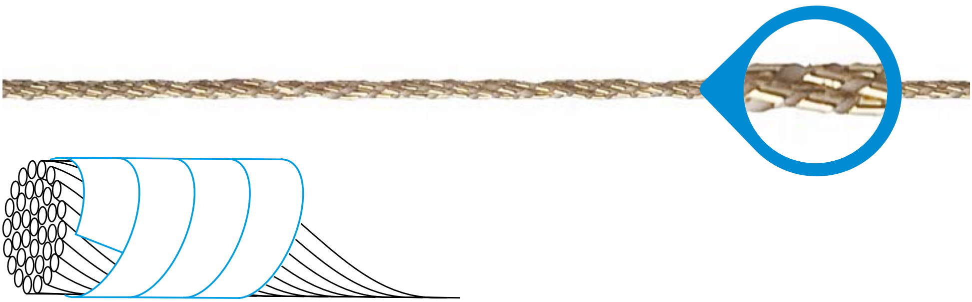
CONTINUOUS MICROFILAMENT, TEXTURISED

Continuous microfilament, texturised (illustration)

For specially soft seams, a texturised polyester microfilament is recommended. Due to the multitude of fine filaments, the sewing thread becomes extremely soft and smooth, and the seams are barely noticeable.

Well-known AMANN products: Sabasoft

WRAPPED YARNS



Wrapped yarn (illustration)

This is the classic construction type for metallic embroidery threads and sewing threads. A continuous filament core (polyester, polyamide) is wrapped with a band of metallic foil in order to create the characteristic shine.

Single yarns are used for embroideries in order to achieve a filigree look.

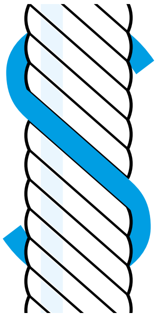
Well-known AMANN products: Isamet

Inspired by coarser decorative seams in the apparel industry, the polyester/polyester wrapped yarn Meta completes the AMANN product range. It creates a decorative, metallic accent on leather and denim as well as on ladieswear and fashionable menswear.

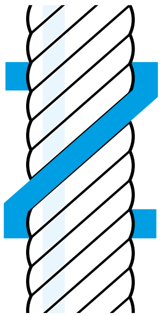
TWIST

Yarns and threads are twisted. Their fibres or filaments are twisted on a longitudinal axis, interconnecting the fibres. The compactness increases the strength and determines the sewing performance.

There are two distinct twist directions that may be simply referred to by the letters S and Z. Depending on the twist direction, the centre stroke of each letter coincides with the diagonal twist of the yarn or thread.



S-Twist



Z-Twist

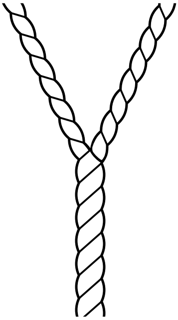
Single yarns are usually twisted in the S-direction while threads twist in the Z-direction. It is important for the threads and yarns to have a counter-rotating twist in order to stabilise the thread and to provide a perfect sewing behaviour. The reason why the "Z" direction is used for threads, and the "S" direction for yarns is that threads with a Z-twist are better suited for sewing operations on standard lockstitch machines. Due to the needle and hook positions in a lockstitch machine and the movement of the needle thread from the eye of the needle, sewing threads with a Z-twist will twist further, which does not have a negative effect on the sewing process. On the other hand, yarns with an S-twist lose twist, resulting in a poor seam look and disturbing the sewing process.

The twist level is of utmost importance for guaranteeing an optimal sewability and thread performance. Threads with a twist level which is too low display an "open" character. This has a direct adverse effect on the sewing performance. In the stitch forming process, e.g. on lockstitch machines, the hook might pick up a single yarn rather than the whole thread, resulting in thread breakage. Sewing threads with too much knots and loops, lead to disturbances in the sewing operation and even to thread breakages.

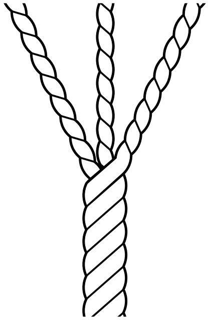
Coarser yarns or threads are less twisted than finer threads. The level of twist must match the respective fineness and the requirements of the sewing process. AMANN sewing threads therefore have exactly defined twist levels, allowing for only small tolerances which are regularly reviewed in the course of the quality assurance process.

PLY

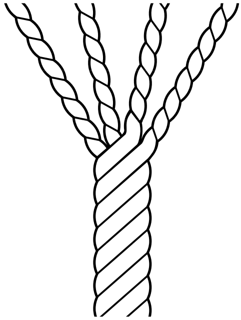
As an additional feature of the sewing thread construction, the ply identifies how many single yarns make up a thread. Most sewing threads are 2- or 3-ply constructions, i.e. they consist of 2 or 3 single yarns. Very rarely you will find 1- or multiple ply threads.



2-ply-thread



3-ply-thread



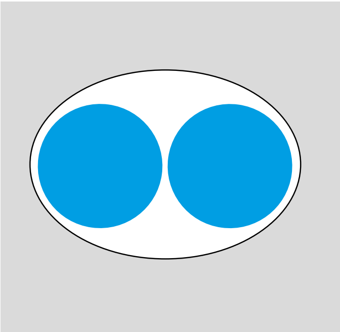
4-ply-thread

The use of different plies can be demonstrated with the help of AMANN's polyester/polyester core spun thread Saba:

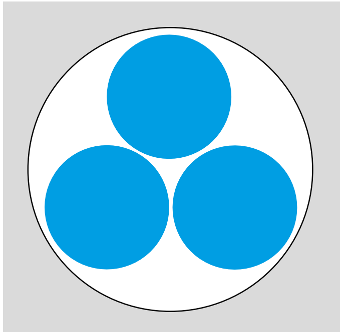
Product	Ply (number of single yarns)
Saba 8	12
Saba 12	8
Saba 18	6
Saba 30	3
Saba 35	2
Saba 50	3
Saba 80	2
Saba 100	2
Saba 120	2
Saba 150	2

The ply influences the sewing performance and the look of the sewing threads. Because of their almost circular cross sections, 3-ply threads are preferred for coarser, decorative seams. 2-ply threads often dispose of a higher twist and are therefore suited for challenging sewing operations, e.g. multidirectional sewing. Furthermore, due to their flat character the 2-ply threads are preferentially used in embroidery.

Comparison of thread cross-sections



2-ply-thread

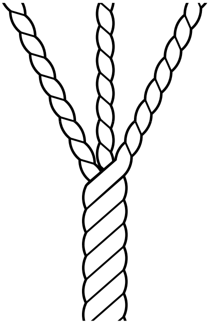


3-ply-thread

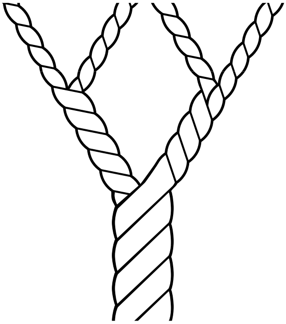
When indicating the thread ticket, the ply can be specified as well. In the Nm-system the ply number is added behind a slash and in the Tex-system by a number added after a multiplication sign. Details concerning linear density of sewing and embroidery threads can be found in the chapter Numbering.

CORD

Practically all commonly used sewing threads are one-level or direct threads. This means that the thread consists of two, three or seldom four yarns and that it has been "directly" made from these yarns. In contrast, multi-level or corded threads are made of more than one thread. This requires more than one production step: From yarn to thread, and from thread to corded thread. These corded threads, however, are rarely used nowadays and only where coarser threads are to be applied, as in cases where the required fineness cannot be attained through the ply of available ticket numbers.



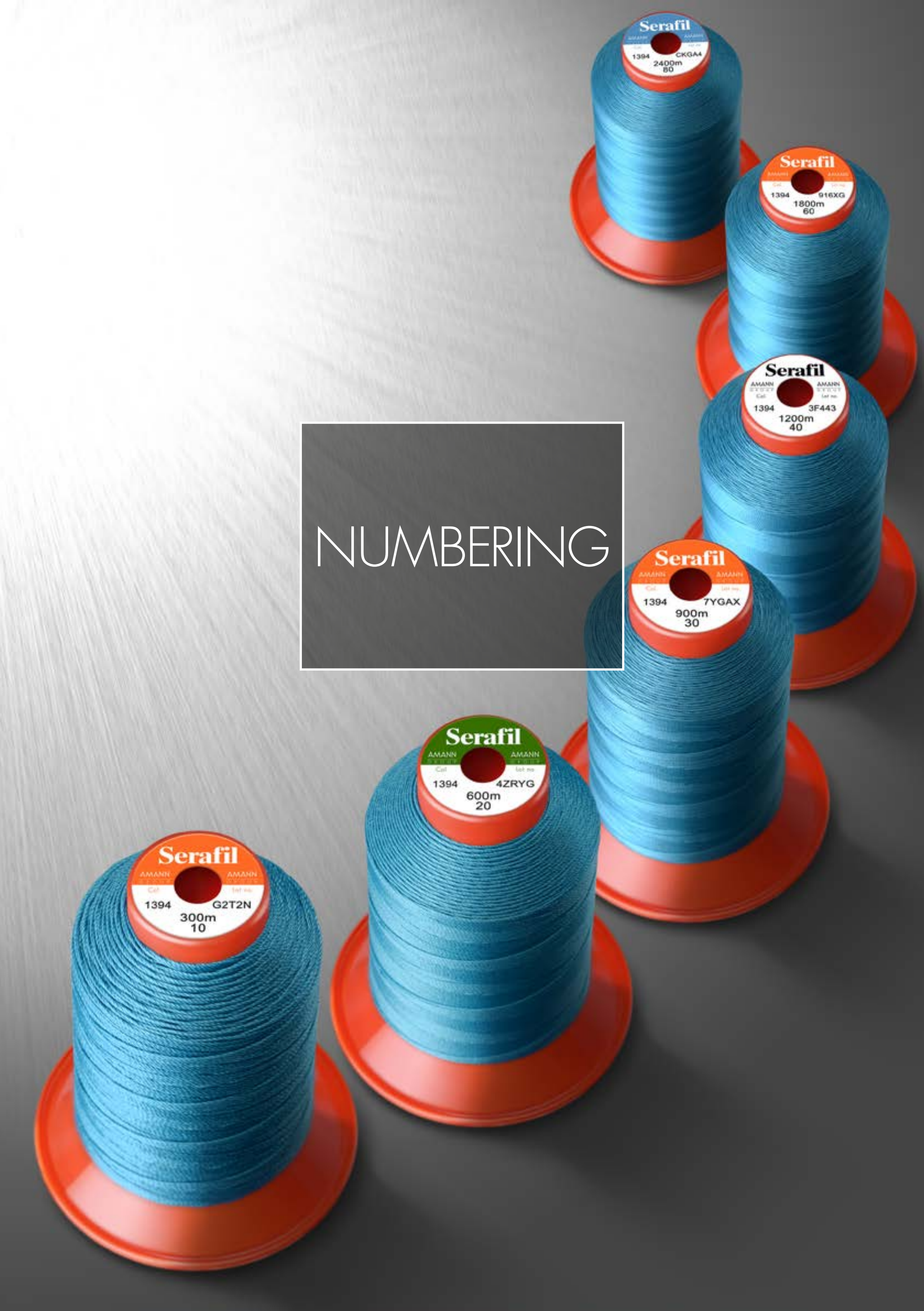
1-ply-thread



multiple-ply-thread

Specific product properties, e.g. bonding, water-repellent finishing, UV protection, infrared absorption etc., can be put into effect via special finishing during the sewing thread production. You will find further information in chapter Production.

NUMBERING


Serafil
1394 CKGA4
2400m
80
Serafil
1394 916XG
1800m
60
Serafil
AMANN AMANN
1394 3F443
1200m
40
Serafil
AMANN AMANN
1394 7YGAX
900m
30
Serafil
AMANN AMANN
1394 4ZRYG
600m
20
Serafil
AMANN AMANN
1394 G2T2N
300m
10

CHAPTER OVERVIEW

TEXTILE NUMBERING SYSTEMS

The linear density of textile fibres, filaments, yarns, threads, etc. is expressed in the ratio of weight to length. Diverse numbering systems are being used internationally depending on the defined reference value. Thus, numbering systems may vary between raw materials and countries even today. This can cause difficulties in comparing linear densities. It is therefore important to have a detailed knowledge of the existing numbering systems and of their conversion. Basically, one differentiates between the fixed length system and the fixed weight system.

FIXED LENGTH SYSTEM

In the fixed length system, the weight is fixed, and the thread length varies.
That means one divides the length of a specific thread sample by a constant weight, e.g. 1 g.

Formula:

$$\text{Count (by length)} = \frac{\text{length}}{\text{weight}}$$

The following rule applies when using this system: The higher the count, the finer the thread.
This means that the fixed length system is inversely proportional.

Linear density indicators

Nm (metric count)	=	Length (m) per 1 gram (g)
Example:		Nm 10 means that 1 g of a sample is 10 m long.
Ne_B (British cotton count)	=	Length (m) per 0.59 g
Example:		Ne_B 10 means that 0.59 g of a sample is 10 m long.

This system is historically based on British measuring units: Ne_B indicates how many hanks (strings) with a length of 840 yards (768.1 m) each, weighs 1 lb (British pound = 453.6 g).

FIXED WEIGHT SYSTEM

In the fixed weight system, the thread length is fixed, and the weight varies. This means that one divides the weight of a specific thread sample by a constant length, e.g. 1,000 m.

Formula:

$$\text{Count (by weight)} = \frac{\text{weight}}{\text{length}}$$

The following rule applies when using this system: The lower the count, the finer the thread. This means that the fixed weight system is proportional.

Linear density indicators

Tex	= Weight (g) per 1,000 m
Example:	10 Tex means that 1,000 m of a sample weighs 10 g.
Dtex (decitex)	= Weight (g) per 10,000 m
Example:	10 dtex means that 10,000 m of a sample weighs 10 g.
Td (Titer denier)	= Weight (g) per 9,000 m
Example:	110 Td means that 9,000 m of a sample weighs 10 g.

In 1967, the various linear density indicators (Nm, NeB, Td) were officially replaced by the internationally established Tex-system which is now valid and obligatory for all fibres, semi-finished products, yarns, threads, and all related areas, regardless of the fibre type. Today, the Tex-system is the most frequently used textile numbering system, and is used by all partners in the textile chain worldwide.

At the same time, however, other linear density indicators can still be seen – names that have been used over the years remain in people's minds, and cannot be easily changed by way of standardisation. An example would be tights, which are still classified according to the Den-system (Titer denier). This established and well-known linear density indicator for tights will most certainly be used in the future in order to avoid unnecessary consumer confusion by switching to a standardised system. There are also historical peculiarities for the linear density indication of sewing and embroidery threads, the so-called ticket numbers, which will be addressed in the following.

The following tables display formulas for converting the different numbering systems, and a comparison table illustrates the linear densities used in practice. In this case, it must be noted that the values are valid for the thread, but the ply is not taken into account.

Conversion table

Known is		Looking for				
Linear density	Abbr.	Nm	Ne_B	Tex	dTex	Td
Metric count	Nm	–	Nm × 0.59	1,000 : Nm	10,000 : Nm	9,000 : Nm
British cotton count	Ne_B	Ne_B : 0.59	–	590 : Ne_B	5,900 : Ne_B	5,310 : Ne_B
Tex	Tex	1,000 : Tex	590 : Tex	–	Tex × 10	Tex × 9
Decitex	dTex	10,000 : dTex	5,900 : dTex	dTex : 10	–	dTex × 0.9
Titer Denier	Td (den)	9,000 : Td	5,310 : Td	Td : 9	Td : 0.9	–
Example	50 Tex	1,000 : 50 Tex = 20 Ne_B	590 : 50 Tex = 11.8 Ne_B	–	50 Tex × 10 = 500 dTex	50 Tex × 9 = 450 Td

Comparison table

Nm	Ne_B	Tex	dTex	Td	Thread length per kg
1	0.59	1,000	10,000	9,000	1,000 m
2	1	500	5,000	4,500	2,000 m
3	2	333	3,333	3,000	3,000 m
4	2	250	2,500	2,250	4,000 m
5	3	200	2,000	1,800	5,000 m
6	4	167	1,667	1,500	6,000 m
7	4	143	1,429	1,286	7,000 m
8	5	125	1,250	1,125	8,000 m
9	5	111	1,111	1,000	9,000 m
10	6	100	1,000	900	10,000 m
11	6	91	909	818	11,000 m
12	7	83	833	750	12,000 m
13	8	77	769	692	13,000 m
15	9	67	667	600	15,000 m
18	11	56	556	500	18,000 m
20	12	50	500	450	20,000 m
25	15	40	400	360	25,000 m

Nm	Ne_B	Tex	dTex	Td	Thread length per kg
30	18	33	333	300	30,000 m
35	21	29	286	257	35,000 m
40	24	25	250	225	40,000 m
45	27	22	222	200	45,000 m
50	30	20	200	180	50,000 m
55	32	18	182	164	55,000 m
60	35	17	167	150	60,000 m
65	38	15	154	138	65,000 m
70	41	14	143	129	70,000 m
75	44	13	133	120	75,000 m
80	47	13	125	113	80,000 m
85	50	12	118	106	85,000 m
90	53	11	111	100	90,000 m
95	46	11	105	95	95,000 m
100	59	10	100	90	100,000 m
105	62	10	95	86	105,000 m
110	65	9	91	82	110,000 m
115	68	9	87	78	115,000 m
120	71	8	83	75	120,000 m
125	74	8	80	72	125,000 m
130	77	8	77	69	130,000 m
140	83	7	71	64	140,000 m
150	89	7	67	60	150,000 m
160	94	6	63	56	160,000 m
170	100	6	59	53	170,000 m
180	106	6	56	50	180,000 m
190	112	5	53	47	190,000 m
200	118	5	50	45	200,000 m
210	124	5	48	43	210,000 m

The comparison table was compiled in accordance with DIN 60 905. Some values have been rounded off for practical reasons.

LINEAR DENSITY INDICATION FOR SEWING AND EMBROIDERY THREADS

According to the worldwide standard, linear densities of sewing and embroidery threads are indicated in Tex. At the same time, their linear densities are also often indicated in Nm. This is the case since the ticket numbers of the sewing and embroidery threads are linked to this length system and many of the technicians are still more familiar with this system.

In practice, however, two different indications are in use: either the final linear density or the single linear density. In order to be able to compare sewing threads, it is important to know the threads' ply. Ideally, the ply is directly added to the linear density indication:

- in the Tex-system using a multiplication sign and the relevant ply, for example 10 Tex × 3. This means that the sewing thread consists of 3 yarns, each having a linear density of 10 Tex. The final linear density is 30 Tex (1,000 m of a single yarn weigh 10 g; 1,000 m of the thread weigh 30 g).

- in the Nm-system using a slash and the relevant ply, for example Nm 120/3. This means that the sewing thread consists of 3 yarns, each having a linear density of Nm 120. The final linear density is Nm 40 (1 g of a single yarn has a length of 120 m; 1 g of the thread are 40 m long).

Examples:

Linear density indication sewing thread	Final linear density (thread)	No. of plies (yarn)	Weight and length of yarn	Weight and length of thread
10 Tex × 3	30 Tex	3	10 g/1,000 m	30 g/1,000 m
15 Tex × 2	30 Tex	2	15 g/1,000 m	30 g/1,000 m
Nm 120/3	Nm 40	3	120 m/1 g	40 m/1 g
Nm 80/2	Nm 40	2	80 m/1 g	40 m/1 g

For purposes of better understanding and with the development of new sewing thread constructions, the optical diameter in millimetres of sewing and embroidery threads is often determined. This is done by using a microscope and indicates, as the name suggests, the visible thickness of a thread.

Due to the type of sewing thread construction and the density of the raw material, the optical diameter may vary within the same numbering. In light of past experience a continuous filament thread of Nm 120/3 appears to be thinner than a spun thread of Nm 120/3.

TICKET NUMBERS

Besides the mentioned linear densities which express the actual linear density of a thread, so-called ticket numbers are used for sewing and embroidery threads. These ticket numbers are displayed on the box as well as on the single make-up (cones, cops, kingspools, etc.). They form an integral part of the article description, defining the strength/linear density of the respective article.

The ticket numbers are based on
- the fixed length system Nm of a 3-ply thread for synthetic sewing threads,
- the fixed length system Ne_B of a 3-ply thread for cotton sewing threads,
- the fixed length system Ne_B of a 2-ply thread for machine embroidery threads and in exceptional cases, they are supplemented by the indication of the ply.

This explains why it is so difficult to implement a uniform, standardised numbering system in the sewing and embroidery thread industry. The current ticket numbers refer to the fixed length system. Many technicians may even assume that the ticket number is identical with the actual linear density according to the fixed length system Nm. This assumption, however, is wrong.

The actual correlation between ticket number and linear density of sewing threads historically goes back to the introduction of a meaningful labelling. Back then, almost all sewing threads were 3-ply constructions and the ticket number stated the linear density of the yarn in Nm (for synthetic threads), or in Ne_B (for cotton threads).

Likewise, most embroidery threads on the one hand were made from cotton and, on the other hand, 2-ply constructions. Therefore, the ticket number also indicated the linear density of the single yarn in Ne_B.

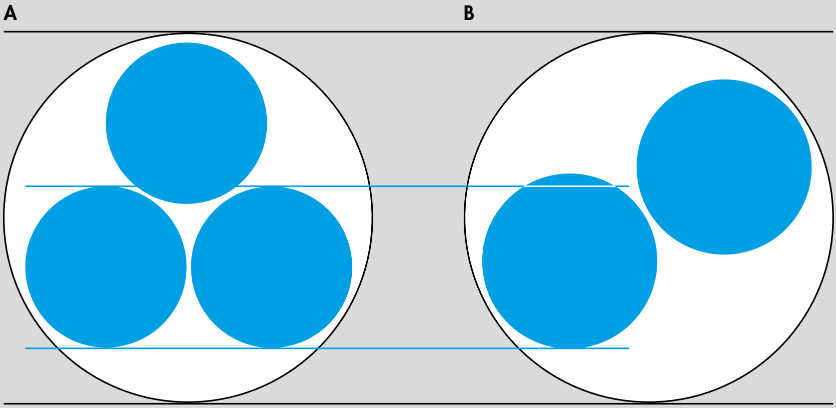
The actual linear densities were rounded off to numbers of 5 or 10 in order to simplify and to achieve a uniform numbering system. Thus, the ticket number follows a fixed classification according to suitable strength classes (e.g. no. 120, no. 100, no. 80, no. 75, no. 50).

Example:
- A synthetic sewing thread with the linear density ~ Nm 120/3 received the ticket no. 120.
- A cotton sewing thread with the linear density ~ Ne_B 40/3 received the ticket no. 40.
- An embroidery thread with the linear density ~ Ne_B 40/2 received the ticket no. 40.

SEWING THREADS

As the development of sewing threads progressed, more and more 2-ply constructions entered the market, making it impossible to maintain the above rule for labelling sewing threads. This is clearly illustrated by comparing two sewing threads:

Example 1:



Product A:
Sewing thread, linear density Nm 120/3
Ticket no. 120

Product B:
Sewing thread, linear density Nm 80/2
Ticket no. 120

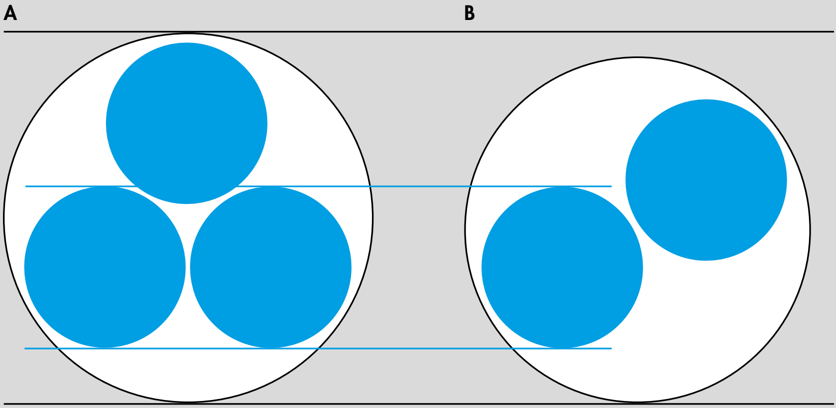
Calculation for example 1:

Product A: Nm 120/3 = Nm 40 (final linear density);
40 (final linear density) × 3 (historically assumed ply number) = ticket no. 120

Product B: Nm 80/2 = Nm 40 (final linear density);
40 (final linear density) × 3 (historically assumed ply number) = ticket no. 120

The ticket number is derived from dividing the linear density by the actual number of plies, and then multiplied by the historical ply number (3). This gives the calculated ticket number (120). Both products have the same final linear density and are comparable in their strength.

Example 2:



Product A:
Sewing thread, linear density Nm 80/3
Ticket no. 80

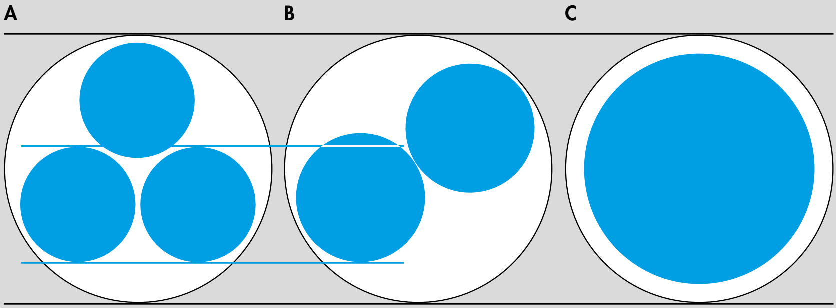
Product B:
Sewing thread, linear density Nm 80/2
Ticket no. 120

The products have different ticket numbers, despite having the same linear density for their yarns. The reason lies in the different number of plies.

Calculation for example 2:

Product A: Nm 80/3 = Nm 26.6 (final linear density) × 3 = ticket no. 80
Product B: Nm 80/2 = Nm 40 (final linear density) × 3 = ticket no. 120

Example 3:



Product A:
Sewing thread,
linear density Nm 150/3
Ticket no. 150

Product B:
Sewing thread,
linear density Nm 100/2
Ticket no. 150

Product C:
Sewing thread,
linear density Nm 50/1
Ticket no. 150

All three products consist of yarns with different linear densities, however, because of the different thickness of the single hanks they have the same final linear density, and therefore carry the same ticket numbers.

Calculation for example 3:

Product A: Nm 150/3 = Nm 50 (final linear density) × 3 = ticket no. 150
Product B: Nm 100/2 = Nm 50 (final linear density) × 3 = ticket no. 150
Product C: Nm 50/1 = Nm 50 (final linear density) × 3 = ticket no. 150

There is no standard or mandatory regulation for indicating ticket numbers of sewing threads. The labelling system explained above is the one commonly used in Europe. In other countries – especially in the Asian region – other labelling systems are in use. It is crucial to know the actual linear density (in Tex or Nm) for evaluating the thread counts, and to select the suitable thread.

EMBROIDERY THREADS

Regardless of the raw material, embroidery threads are numbered in accordance with the English cotton fixed length system Ne_B. The reason for this lies in its history: the mercerised cotton threads were used ever since the first embroidery machines were invented at the end of the 19th century, and they were labelled as described in the Ne_B-system. At the time there were no high gloss synthetic threads, silk was too expensive and was only used for hand embroidery. Thus, mercerised cotton was the raw material used for glossy threads.

With the emergence of the first synthetic embroidery threads in the middle of the 20th century, it seemed natural to orient the linear density to the cotton system again. This was mainly the case because a punched card with an embroidery pattern for a 40 yarn could be further used with a 40 yarn. A conversion to another, technologically correct system was already rejected at the time. In contrast to the sewing threads, however, one chose 2-ply constructions as the labelling basis. This is understandable considering that almost all the embroidery threads are 2-ply constructions. The ticket number for embroidery threads indicates the linear density of the single yarn in Ne_B.

Example:
An embroidery thread with the linear density ~ Ne_B 40/2 has the ticket no. 40.
An embroidery thread with the linear density ~ Ne_B 30/2 has the ticket no. 30.

In contrast to the sewing thread range, the entire embroidery thread range – including the polyester, cotton, wool and metallic qualities – covers only five to six strengths: 12 to 75.

The most important ticket number is 40, with an estimated share of more than 80% worldwide.

Because it is often difficult to correctly assign the ticket numbers of embroidery and sewing threads, the following table collates the most important embroidery thread ticket numbers and the relevant sewing thread ticket numbers. This comparison is helpful when sewing threads are used instead of embroidery threads for embroidery.

Ticket no. embroidery thread	Ticket no. cotton	Linear density	Corresponding ticket no. sewing thread
Nr. 12	Nr. 18	Nm 20/2	Nr. 30/35
Nr. 25/30	Nr. 35/45	Nm 50/2	Nr. 75/80
Nr. 40	Nr. 60	Nm 70/2	Nr. 120
Nr. 50	Nr. 75	Nm 85/2	Nr. 140/150
Nr. 60	Nr. 90	Nm 120/2	Nr. 180
Nr. 75	Nr. 112	Nm 130/2	Nr. 220/2/300

RUNNING LENGTH OF SEWING AND EMBROIDERY THREADS

The running length is often mentioned in connection with the sewing and embroidery thread strength as well. Officially, the running length is not regarded as a linear density indicator such as Tex or Nm; in practice, however, it is often used as such. The running length states how many meters of thread weigh 1 kg. With the indicator m/kg, the running length is closely connected with the fixed length system Nm (m/g). Therefore, the running length is mainly used in Europe where the linear density is expressed in Nm. As with all fixed length systems, the following also applies for the running length: The higher the ticket number or effective count of a thread, the finer is the thread and the larger the running length per weight unit.

In order to calculate the approximate running length of a thread, one divides the ticket number by 3 and multiplies the result by 1,000.

Example:
Saba 120 has a running length of approx. 40,000 m/kg
(Calculation: 120 : 3 = 40; 40 × 1,000 = 40,000).

The effective count should be used for the calculation of the exact running length of an article. Thus the following applies for the calculation: Effective count divided by the ply, the result multiplied by 1,000.

Example:
Saba 120 has an effective count of Nm 72/2 and thus a running length of 36,000m/kg
(Calculation: 72 : 2 = 36; 36 × 1,000 = 36,000).

SELECTION OF THE SUITABLE SEWING THREAD SIZE

Besides the raw material and the construction of a sewing thread, its linear density or size also determine the sewing thread's field of application. Thereby, the size of a sewing thread has a great influence on both the sewing operation and on the quality of the seam. In order to assure a perfect sewability and a trouble-free sewing operation, the sewing thread must be adjusted to the following determinants:

- sewing material or fabric
- needle
- sewing machine
- seam type
- stitch type

Sewing tests remain the best method of selecting the appropriate size of thread required. The sewing material or fabric and the sewing machine determine the type of needle as well as the seam and stitch type, and thereby the suitable sewing thread. Finest fabrics, for example, require the use of the thinnest needles and sewing threads.

The recommended needle sizes for AMANN's sewing and embroidery threads are featured on the AMANN website, as well as on the brochures and colour cards. Depending on the sewing material or fabric and machine type, bigger needles may also be required. These should be tested under similar conditions or before production in order to avoid subsequent seam quality degradation.

The size of the sewing threads influences the seam's cross breaking strength, the seam elasticity, the abrasion resistance, the look as well as the feel. Changing to a finer sewing thread in order to achieve finer seams has noticeable consequences for the seam strength due to a lower breaking strength of finer threads.

The look of prominent decorative seams can only be achieved by selecting a coarser sewing thread. The right needle size for the respective fabric should be determined beforehand, for example, through testing. Depending on the texture of the outer fabric, it can be damaged when using a needle size that is too big (fabric or mash blasting damage).

MAKE-UP

CHAPTER OVERVIEW

MAKE-UP STYLES

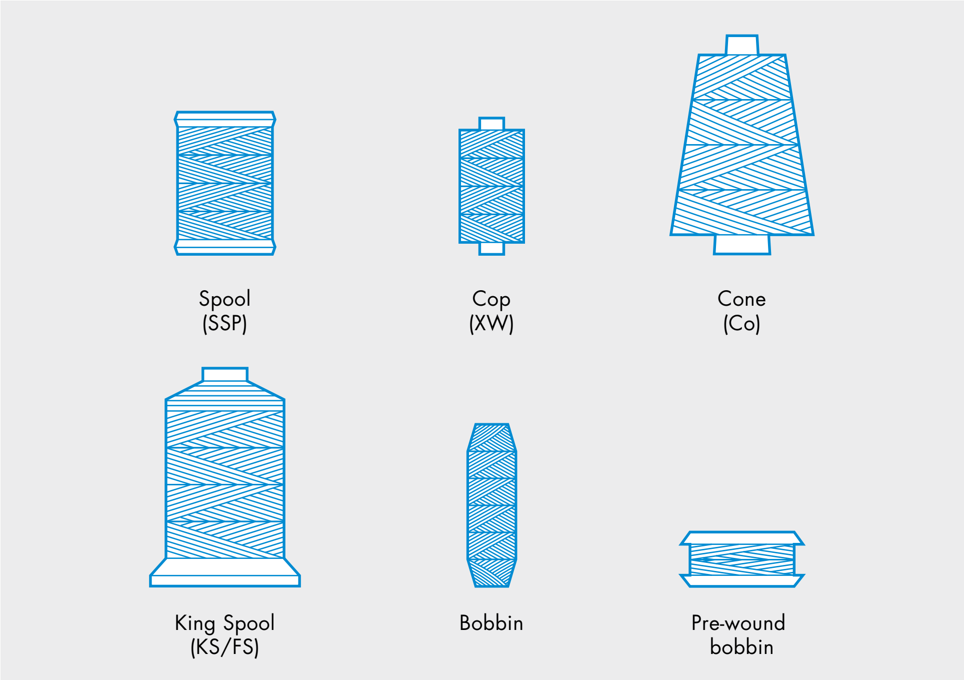
In order to provide maximum support for the sewability of sewing and embroidery threads, it is essential to select the correct make-up style. There is a large number of different make-ups, which can be individually adapted to the production methods and machines used in the sewing industry. Make-up requirements are:

- to support a good off-winding performance (without snagging or trapping),
- to offer lengths necessary for the specific purposes,
- to provide a thread holder for special fields of use.

On almost all sewing machines or automated machines, the sewing and embroidery threads are delivered over the top of the spool. The make-up must therefore assure an unhindered and trouble-free thread delivery, even at high sewing speeds as well as in case of partially inconsistent traction.

In general, thread make-ups are offered in length units (1,000 m, 5,000 m, 10,000 m or more). Only in rare exceptions are they offered by weight (e.g. 1 kg or 25 g) and can be found only in individual cases. The range of different lengths per article can be very large, and reflects the requirements of the different industries. The fashionable apparel industry, with its small production quantities and its colour variety, needs small make-ups in order to feed multiple sewing machines simultaneously and to minimize excess quantities at the end of a season. The mattress industry, with its multi-needle quilting machines, high thread consumption and small variety of colours, however, needs long lengths in order to achieve the least possible rethreading times and thus a high profitability. In general, the same applies for sewing threads for overlock seams, or for sewing threads in the underwear industry with its high thread demand. Every application field has its clearly defined requirements for the best make-up style. Thus, specific make-up sizes have been established, which are useful, profitable and that cover almost all market requirements. At the same time, new make-up styles are always in a state of development as needed for new production methods, sewing machines, or changing market demands.

The make-up style (shape and size) must be matched to the different sewing threads, their properties as well as the sewing machines. Sewing threads with a textile, fibrous surface can be wound differently than sewing threads with a smooth surface. Multi-needle machines or embroidery machines with their sometimes very limited space impose other demands on the type of make-up than the single-needle machines with plenty of room. The following illustration displays an overview of the various make-up styles.



COPS

For cops (XW), the sewing thread is crosswound on parallel tubes. Cops guarantee a constant thread delivery even under high sewing speeds. This make-up style is used in various fields of applications, especially in the apparel industry. If there is need for a large range of colours in small production quantities only, then the cop is the right choice of make-up. With a maximum length of 1,000 m, the cop represents a small packaging unit that satisfies the demands for profitability and high colour flexibility. Most core spun threads and spun threads are offered on cops.

CONES

Cones (Co) are cone-shaped tubes of different sizes, depending on the thread lengths they hold. The thread is also crosswound in order to guarantee a trouble-free thread delivery, even in the case of very long lengths.

The cone has the capacity to hold longer lengths. There is a large range of different thread lengths available, depending on the market requirements and the thread strength. Typical cones for the apparel industry would be make-ups of 5,000 and 10,000 m and the 20,000 and 30,000 m cones for overlock seams and underwear applications. Consequently, coarser threads have shorter length capacities.

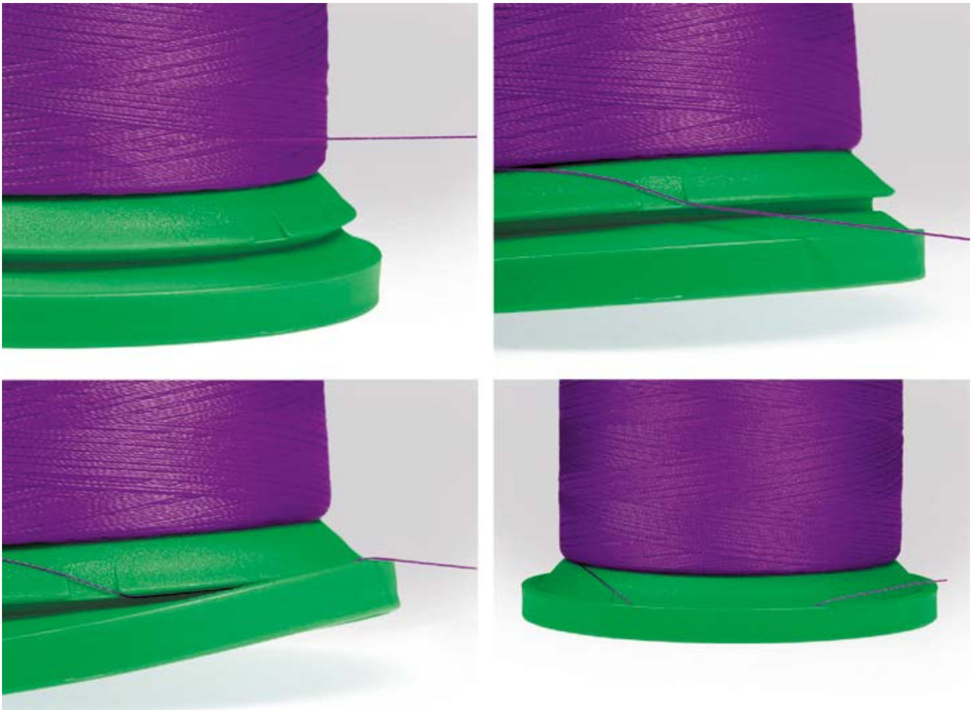
KING SPOOLS

King spools (KS) are cylindrical tubes which have a cone-shaped foot on the narrow bottom side serving as a platform. Because of their shape, they are often called foot spools (FS). These are the traditional make-ups for continuous filament threads. Due to the smooth surface of these threads, there is a risk of spillage (thread layers slipping from the thread body) in sewing operations or during downtimes. The spool's foot and the usually incorporated receiving groove will contain any spillage, thus guaranteeing a perfect off-winding performance. The sizes of king spools can differ according to the sewing thread size and the make-up style. Besides mini king spools that hold only a few hundred meters, there are also a large number of standard spools for most different lengths, ranging from 300 m up to 20,000 m, depending on the thread size and the required quantities.

Some of the king spools are available with an additional thread holding feature.

The thread end may be fixed in a so-called snap groove in order to prevent a spillage of thread layers during transport or storage. In case of embroidery threads this additional function is especially important because embroidery threads are very rarely used up completely, and it is common to store the started spools after finishing an embroidery job.

The standard lengths for embroidery threads are: The 1,000 m mini king spool and the 5,000 m king spool.



Thread holding feature of a king spool (snap groove)

PRE-WOUND BOBBINS

As a timesaving alternative to the conventionally wound metal bobbins for the bobbin thread, the pre-wound bobbins are primarily used in the embroidery industry.

Since the underthread is invisible from the embroidery's front side, the most widely used underthread colours for embroideries are black and white. Due to the limitation of two colours only, pre-wound bobbins for automated multi-head embroidery machines are much more common than they are for automated sewing machines. The so-called embroidery bobbins are offered in packing units of 144 bobbins (equals one gross). Fine spun threads or continuous filament threads are used in order to achieve high running lengths. There are two variations of pre-wound bobbins: Unsupported bobbins, which need a slight bond for fixing continuous filament thread packages and bobbins with cardboard edges on the sides, which require no extra handling.

We recommend non-bonded bobbins due to their smoother off-winding performance. There are the two sizes L and M for pre-wound bobbins, where M is the larger and L the smaller one. The size L is mostly used for embroidery machines worldwide. With Isabob 190, AMANN offers a slightly bonded bobbin with excellent off-winding properties and a high running length.

MAKE-UP AIDS

For additional support of trouble-free thread delivery, AMANN offers spool holders for various make-up styles. They guarantee that the sewing thread maintains a vertical position in relation to the thread stand. This prevents the thread layers from entangling underneath the thread spool. The spool holder provides a smooth off-winding performance without any tension peaks. Where the thread package is not held in a stable vertical position, the sewing thread would erratically stick to the front side.

Crocked cones (without spool holder) impair the off-winding performance

Perfect off-winding performance with spool holders

The AMANN range offers a special plastic cover for the big Transfil disc spools which is often referred to as “container”. It protects and controls the ballooning of the thread that may develop during the off-winding process and results in an optimal sewability.

In special cases, net hoses are slipped over the sewing and embroidery threads in order to calm the thread delivery. For metallic embroidery threads, net hoses will prevent twirling often caused by the stiff character of these wrapped yarns. The suited net hoses are packed into every box of Isamet embroidery threads. It is advisable to place the spool on the bottom line of the net so that it does not slip around.

PRODUCTION

CHAPTER OVERVIEW

SEWING AND EMBROIDERY THREAD PRODUCTION

The production of sewing and embroidery threads is a complex process comprising a number of production steps on different machines and production plants. The production diagram at the end of this chapter shows an overview of the main sewing and embroidery thread types in AMANN's production.

In contrast to the general sewing industry, which is generally labour-intensive due to the operation of sewing machines, sewing thread production predominantly involves a high level of machine utilisation. Ultra-modern and often computer-controlled, fully automated production plants characterise the manufacturing process.

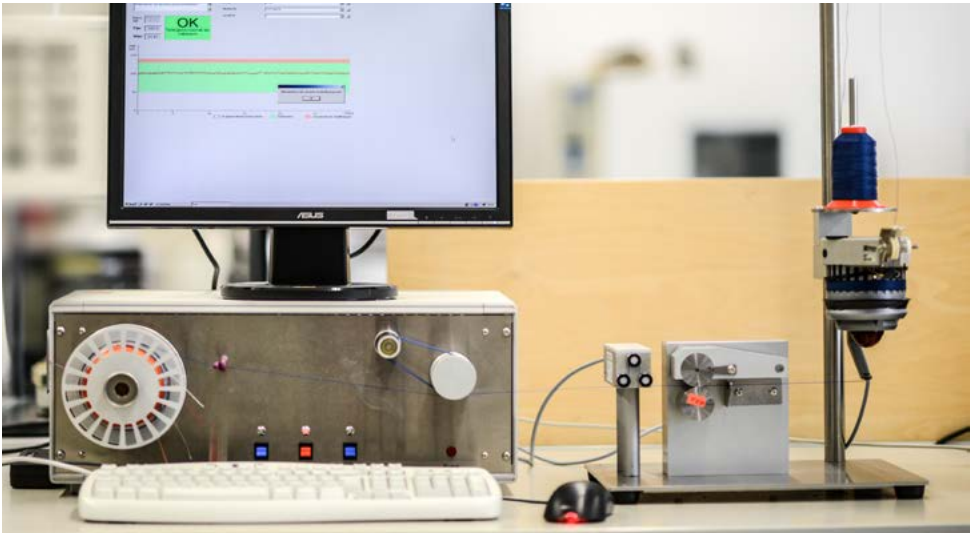
Ring twister machine

The production staff are required mainly for the feeding and cleaning of the machines. The production control is usually fully automated throughout most production steps. Malfunctions are detected by automatic sensors and remedied by the staff. Many production steps have long lead times. In contrast to the apparel production, for example, which calculates in minutes, some positions in the sewing thread production have lead times of several hours, sometimes even days. An optimised process scheduling and controlling is therefore essential for sewing thread production.

Today, sewing thread production refers to the processing of synthetic or partly synthetic preliminary products. Apart from few exceptions, threads completely made from natural fibres are of minor importance nowadays. Because cotton thread is the most important article it is included here in the production diagram at the end of this chapter as well as in the description of the production steps. The production methods for each sewing thread type (core spun thread, spun thread, continuous filaments, texturised continuous filaments, etc.) differ in their process chain and in specific production steps, which are necessary only for specific sewing thread types. In addition to the production diagram, the most important process steps in sewing thread production are described in the following.

QUALITY CONTROL

Of major importance within the process chain is quality control, which is carried out after every important production step. Depending on the relevant production step (raw yarn, raw thread, finished thread), different quality criteria (linear density, strength, fibre purity, etc.) are checked to comply with narrow production tolerances and are systematically recorded. At each production step, only batches that fulfil all the required criteria are allowed to proceed to the next step. The gathered data flows into weekly and monthly quality reports, which provide exact information on the quality level and possible tendencies and problems.



Gliding performance tester

This complex quality control is necessary to assure continuous high quality levels for all batches and to comply with the agreed delivery specifications required by customers from the automotive industry, for instance. It is usually not possible to repair defects in quality at the finished product stage. Therefore, they must be detected and remedied as soon as possible.

In addition to quality control in the laboratory, AMANN has implemented expensive quality controls at the production level. In part, fully automated machines have taken over the monitoring of single quality criteria, for example by thread monitors at the twisting machines, or the electronic thread sensors at the winding machines. Furthermore, quality control staff in production continuously control production conditions, and thus ensure a fault free product.

Besides the technical quality control, it is important to monitor dyeing in order to assure an exact, continuous colour run for all batches of a specific colour. Here, the experienced eye of the dyer plays as important a role as the use of colour monitoring devices utilising modern test technology. In the chapter Quality Features/Colour/Colour Matching, you will find detailed information on visual and instrumental colour assessment.

PRODUCTION OF A SINGLE YARN

Yarns are the preliminary product in thread production. They are partly produced at the sewing thread manufacturer and in part at suppliers' sites – spinning mills and producers of chemical fibres.

Raw material extraction and processing up to fibre materials has already been described in the chapter Raw Materials/Textile Raw Materials. The principle of yarn production is the same for all yarn types and independent of the type of raw material.

The following are the yarn types with reference to the construction types in chapter Sewing Thread Construction:

SPUN YARN

The original sources here are cotton fibres or synthetic cut staple or schappe spun fibres, which are supplied in the form of pressed bales. The loose fibre material is processed in several production steps into rovings:

- opening and scutching
- orientation and parallelisation of the fibres
- producing slivers
- drawing
- spinning to produce rovings

AMANN processes rovings made of cut staples and schappe spuns. With cut staples, the fibre length exactly matches the average staple length of cotton fibres, so that the rovings may be processed on ring spinning frames in the so-called three cylinder-spinning mill.

A fibre yarn of the required linear density is produced using multiple drawing and doubling processes. Pre-spinning and a first twist is inserted into the yarn on the ring spinning machine in the so-called three cylinder-spinning mill.

The production of rovings from raw cotton fibres has already been described in the chapter Raw Materials. Cotton yarns are spun in three-cylinder spinnig mills on ring spinning machines. The twist is inserted into the yarn on the ring-spinning machine.

CORE YARN

To produce core yarns a cover of cut staples must be spun around the core of continuous filament raw material. The production technique for spinning the cover is similar to the one for spun yarns. The fibre material is supplied in the form of pressed bales and is processed into rovings accordingly. Through the spinning process on the ring spinning machine the cover is combined with the continuous filament core. Finally, the yarn is twisted. The core yarn is the base product for the core spun thread.

CONTINUOUS FILAMENT YARN

The base material is continuous filament that is directly supplied by the chemical fibre industry. This material consists of fine, single filaments that are parallel wound, with only a slight protective twist or twirl. The number of single filaments varies greatly, and depends mainly on the total fineness of the material. In part, continuous filament bundles of up to 200 filaments are used. The required yarn twist is inserted just before the plying and twisting process on the twisting machine.

CONTINUOUS FILAMENT YARN, TEXTURISED (BULK YARN)

The raw materials are polyester or polyamide continuous filaments, which are further processed into bulk yarns through texturing. There are different texturing methods. For this kind of bulk yarn application, one usually uses the false twisting method. In this case, the smooth filament material, consisting of numerous single filaments, is lead through a heated zone, at the end of which there is a twister that generates the required number of twists. The twist is set through heat treatment and subsequent cooling. Then, the yarn is untwisted while the crimping remains and provides for the known bulk effect.

BRAIDED YARN

Braiding yarns refers to the process where the yarns are braided on a horizontal level. With 12 respectively 16 clappers, 6 respectively 8 rotate in the clockwise direction around a common axis, and 6 respectively 8 rotate against the clockwise direction. The clappers follow a wavy pattern since they have to go round each other. The braided yarn created in this process is wound on a so-called tambour. As the yarn has a hollow, tubular form with no twist, it has to be wound by a rolling method. The overhead feed method usually used for standard sewing threads would rotate the braided yarn and therefore results in a poor seam appearance. This is why the braided yarn is unwound over the whole process chain up to the sewing machine.

CLEANING

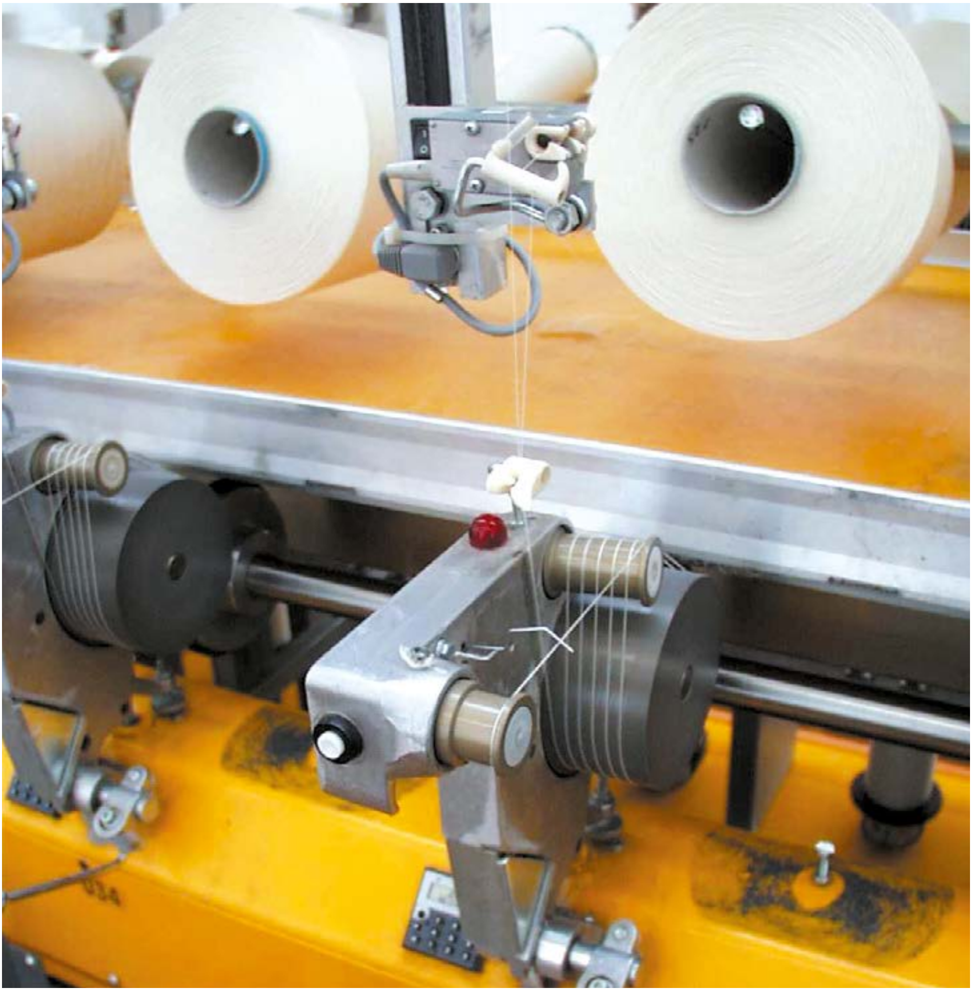
Spun yarns and core yarns have thicker and thinner spots, which cannot be entirely avoided in fibre processing at the spinning mill. These yarn defects are caused by fibre fly, impurity and piecing up, for example, in the spinning mill. These defects are repaired during the clearing process on winding machines. Within the same process, the supplied raw material is simultaneously connected (swirled with air) to make longer, knot free running lengths. The splices are much thinner than a knot (approx. 40%) and provide for an acceptable strength at the spliced points. A splice point in the yarn has no adverse effect on the sewing performance of the thread. Sensors on the winding machines check the yarn quality and compare the detected thin or thick sections with default values. Thick areas that are thicker than splices are cut out automatically and are replaced by splices. The result is a cleared preliminary product that provides for a maximum running length for the subsequent production step, and represents a good basis for a sewing thread quality with only few knots.

This processing step is not necessary for raw yarns of filament material. On the one hand, there are no defects in filament raw yarns. On the other hand, filament yarns are already supplied in long running lengths by chemical fibre manufacturers.

Braiding machine

PLYING

Threads consist of two or more yarns, which are combined in the plying process and are then ready for the subsequent twisting process. Depending on the sewing thread type, the plying is done on a separate machine or in combination with the twisting process. Spun yarns and core yarns are plied in a separate processing step and are given a protective holding twist to prevent a displacement of the single yarns on their way to the next machine. This protective holding twist should not be mistaken for the thread twist, which is inserted in the subsequent twisting process only. For continuous filament yarns the plying and twisting can be carried out on one machine.



Plying machine

TWISTING

This process is the actual twisting of the yarns to make a thread. The plied yarns are twisted around their longitudinal axis, and thus closely connected. A spindle rotating at high speed generates the twist. Depending on the spindle's rotating direction, threads with an S or Z twist are produced (see chapter Sewing Thread Construction/Twist). The off-winding speed and the spindle speed determine the number of twists. Today, one produces almost exclusively direct or one-level threads in the twisting process, i.e. several yarns are twisted together in one single processing step. For double or multi-level threads, which are rather unimportant today, two or more subsequent twisting processes are necessary (see chapter Sewing Thread Construction/Ply).

Double-twist frame machine

The lead times for twisting processes are very long. Ultra-fine continuous filament threads, which are processed on the twisting machine in comparatively long running lengths, for example, have a lead-time of twelve days.

One-ply sewing threads are also twisted in order to achieve a more even and stable preliminary product. This is called uptwisting, as in this case only one yarn is twisted around its longitudinal axis instead of combining more yarns by twisting them together.

Final twisting machine of a double level twisting unit

Twisting machines for continuous filament threads insert the yarn twist and the final thread twist into the filaments. Therefore, pre-wound continuous filament yarn is fed into the twisting machine, which is first twisted in the S direction, then plied, and finally twisted in the Z direction. This is a very effective production method, which is primarily used for filament materials.

DRAWING AND SETTING

Synthetic yarns or threads must be usually drawn and set to achieve the required standards for the shrinking and elongation properties. This process plays an important role for the quality of the sewing and embroidery threads, especially for the sewing performance and the look. In the drawing process the thread is pulled off and wound up again to effect a drawing and elongation adjustment. Thus, the existing elongation of the thread is reduced. Depending on the sewing and embroidery thread type, this drawing and setting process is carried out at different points of the process chain using different methods.

Core spun and spun threads are tension wound on so-called drawing spools, which are set on setting carts in an oven. The drawing and the reduction of elongation is permanently stabilised through the exposure to air at high setting temperatures. Sewing threads treated in this manner maintain their elongation and shrinking properties up to this temperature range in subsequent use.

Sewing threads of continuous filament material are drafted through fast running cylinder pairs, of which one is heated. The use of a ring tube facilitates the drawing process. The correlation of the different cylinder speeds affects the drawing degree. One usually does without the subsequent thermal setting process with continuous filament threads.

DYEING

In this production step, all threads are wound onto dye packages. The hollow spindles are perforated so that the dye bath liquor can flow through the package, from the inside to the outside and vice versa. Another important factor for good dyeing results is a suitable winding design and controlled tension when rewinding. The goal is to achieve an even colouring of the sewing and embroidery threads, regardless of their position on the dyeing spindle (i. e. whether inside or outside).

Dye house

Polyester threads are dyed using the so-called high temperature (HT) method. These are coloured using disperse dye. Important dyeing parameters are pressure, temperature and the bath relationship. Dyeing takes place in a closed production cycle in modern dyeing plants. Even the composition of the dye recipe is done by computer. In the mixing room, the single dyestuffs and dyeing aids are prepared according to very specific requirements and then mixed with water. Through a pipeline system the dye bath flows in the dye-house and into the single dyeing kiers. These have different capacities, ranging from approx. 10 to 700 kg. Polyester threads are dyed at a temperature of approx. 135°C and a pressure of 4 to 6 bar for about 60 minutes. The resulting colour tone is checked right after the dyeing process so that any colour deviations can be corrected by an immediate replenishment dye, if necessary. Coarser threads must sometimes be dyed twice in order to achieve an optimal dye penetration and to avoid non-dyed spots at the crossing points of the threads.

The selection of the dyeing method is mainly determined by the thread's raw material. Cotton and polyamide, for example, require different methods than polyester. For Polyester/cotton core spun threads it is necessary to consider two dyeing methods due to the raw material combination of polyester and cotton. Within a single process, but with two subsequent steps, the polyester is dyed first and then the cotton.

Pure cotton threads are often dyed in hanks, for which special dyeing machines are required. Cotton threads are usually dyed reactively. For special applications, however, the substantive or indanthrene dyeing methods are used. AMANN uses substantive dyes for a small number of polyester/cotton core spun dyes, which creates the desired Used-Look in the denim sector (bleached look).

Optical brighteners are partly used in order to achieve white, neon colours as well as light, mellow pastel tones. Thus, UV light can be converted and reflected from the invisible spectral area into visible light. This effect creates optically brightened colours of great brilliance, which is particularly striking in the dark. Raw cotton's brownish yellow natural colour is undesirable for these colours and therefore needs to be bleached before dyeing.

For the development of a new sewing or embroidery thread colour, the dyeing laboratory needs a flat, non-transparent colour sample (usually a fabric sample). Using a colorimeter (see chapter Quality Features/Colour/Colour Matching/Objective or Instrumental Colour Matching), the colour sample is measured and reflected as a reflection curve. The dye recipe software calculates different dye recipes with the predetermined dyestuffs, out of which the dyer selects the best one based on their qualitative and economic aspects. The dye result is initially checked by means of a dye in the laboratory. Dye recipe is adjusted if necessary and if the dye result matches, the colour is registered in the colour archive and is released for production.

Dye house laboratory

AMANN places special emphasis on environmental aspects of its dye-houses. The use of efficient systems and careful monitoring has enabled AMANN to considerably reduce its overall consumption of primary energy. Through ongoing process optimisations in its dye-houses, AMANN was able to substantially reduce the use of fresh water. The use of dyes and dye carriers have been reduced to a minimum. All dye-houses have their own closed water circulation systems.

AMANN operates fully integrated biological and chemical sewage plants in order to comply with the local environmental regulations. Their capacity ranges from 500 to 1,000 m^3 sewage per day. The purified sewage is permanently monitored at the disposal point of the local sewage pipes for compliance with the strict parameters BOD (biological oxygen demand), COD (chemical oxygen demand), percentage of dissolved suspended particles, pH level as well as temperature. Furthermore, regular sampling and analysis is performed by the local environmental authorities. Thus, AMANN makes a substantial contribution to environmental protection.

AMANN complies with all the national and international environmental rules and regulations. The Augsburg production site with its large dye-house is certified according to the environmental management system DIN EN ISO 14001. The ISO 50001 certification states that the production site Augsburg has a sustainable energy management as well as a very high degree of energy efficiency and environmental compatibility.

LUBRICATING (FINISHING)

Sewing and embroidery threads must be lubricated, i.e. finished with a slipping agent, in order to assure an optimal sewing performance. This lubricating agent consists of a combination of silicones, paraffins, waxes, and anti-statics. The exact formula is the secret of every sewing thread manufacturer. The correct formula is designed for every product based on extensive experience and numerous test series.

The lubrication is applied in the dyeing machines immediately after the dyeing process, or after the dyeing in separate machines. The selection of the suitable method is determined primarily by sewing thread's linear density and its type. When the threads are lubricated in the dyeing machines, one must ensure that the entire dyeing package is thoroughly rinsed with the lubrication agent so that the product is perfectly finished (including the inner thread layers). When the finishing is done on separate machines, computer-controlled pumps provide precise doses of the agent finish for the single threads.

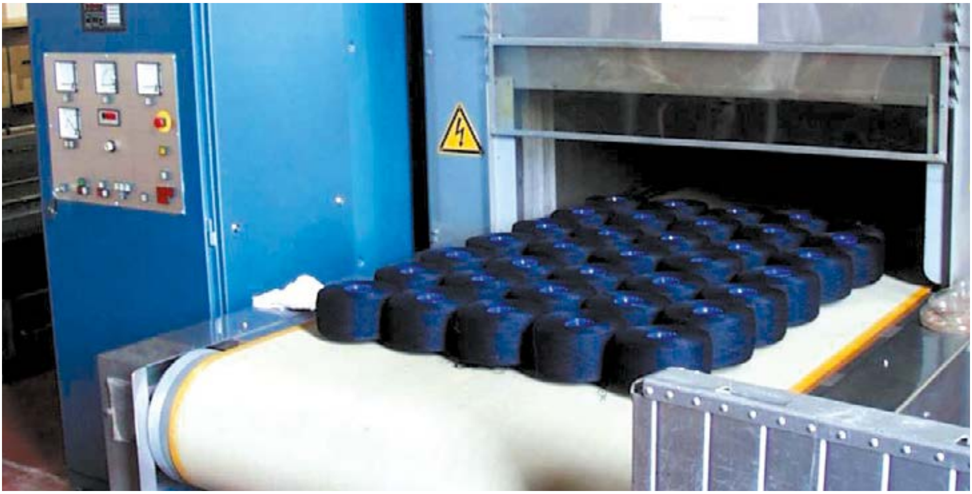
The applied lubricating agent usually represents about 2 to 4%, i.e. it makes up about 2 to 4% of the total weight of the sewing thread. An exactly dosed and evenly applied lubricating agent is essential for achieving the required thread performance.

The lubricating agent's crucial tasks for sewing and embroidery threads are:
- improving the gliding performance
- improving the abrasion resistance
- needle cooling
- reducing the tendency for static electricity

These points are described in detail in chapter Quality Features/Lubrication.

DRYING

The dyed and partly lubricated product needs to be drained and dried before the next production step can follow. The drying process is carried out after a first drainage through spin-drying the threads in a high-frequency dryer or in pressure dryers with a subsequent hot air treatment.



Microwave dryer

SPECIAL FINISHING PROCESSES

Special applications or finished products often require special, additional finishes or finishing processes. They are sandwiched at different points in the production process and achieve special effects or properties.

GASSING OR SINGEING

In the gassing or singeing process the fibre parts that stick out are burnt off. The surface of sewing threads which are made of spun yarns is smoothened with this finishing process. Thereby, the thread receives a higher gloss. The burning is done with a gas flame (that is why it is called gassing), or with an electrically heated burner. The high winding speed guarantees that the processed material remains unburnt. Only the fibre parts that protrude are singed off and removed immediately by a suction system.

In the AMANN product range, the cotton thread MercifilGD as well as the polyester/polyester core spun thread Saba in the decorative seam ticket number 30, are singed.

MERCERISING

Cotton threads are mercerised before they are dyed. During the mercerisation, the cotton is treated with soda lye while under tension, resulting in fibre swelling and changing of the fibre profile. In practice, the mercerization is usually done on the hanks. This additional processing step is necessary to give the cotton threads a silky gloss, to increase their breaking strength, and to improve their receptiveness for dyestuffs.

The AMANN product MercifilGD is mercerised.

POLISHING AND DRESSING

Polyester/cotton core spun threads and pure cotton threads are partly polished or dressed in order to give them a more enclosed and smoother surface, and to increase their abrasion resistance. In this finishing process, the dyed threads are dipped in starch or a synthetic wax preparation, and then brushed. Thereby, fibre parts that stick out are brushed in one direction to make them cling to the yarn surface. From a technical sewing point of view this finish also has the advantage that it protects the more enclosed thread surface better from becoming untwisted.

In the AMANN product range almost all coarse thread sizes of Rasant and Rasant-Oxella are dressed.

BONDING

During this special treatment, an additional synthetic preparation is applied to the thread after the dyeing process to form a film (a bonding substance). Thereby, the sewing threads are first put through a bath containing the bonding substance, and then run through a presser, where the excess bonding substance is squeezed out. A directly connected heating flue provides for the dehydration or drying of the bonding.

The bonding substance in the bath is a hydrous dispersion or a solvent based product. Depending on the selected bonding substance, the sewing threads must receive a final lubrication to assure the usual standard sewing performance.

Other procedures may be used besides this traditional and popular bonding method: For polyamide filament threads, for example, the bonding process could be an acid treatment. Here, the bonding effect is achieved by etching the polyamide filaments affected by an acid.

The bonding process (also referred to as “gluing”) provides for a better cohesion of the thread's single yarn elements. The bonding substance gives the yarns a special superficial bonding, resulting in a better thread finish. Bonded sewing threads are easily recognized. On the one hand, they feel stiffer than normal sewing threads due to their additional treatment (this is noticeable when the thread is drawn from the package). On the other hand, bonded threads are harder to untwist. The resistance is clearly noticeable, which is a consequence of the bonding effect.

This special treatment is usually considered only for synthetic filament threads in the coarser sizes, starting at ticket number 60. For filament threads which display a less perfect thread finish due to their single yarn's smooth surfaces, this preparation often becomes necessary or sensible for special applications. The traditional areas of application are in sewing operations that cause the loosing of the twist in the thread and/or a twist displacement during the sewing operation, for example in case of multidirectional seams on airbags, or zigzag seams on sails (depending on the direction of the zigzag stitch, inserting additional twists or losing twists).

The AMANN product range offers three bonded qualities referred to as Strongbond, Oxcel and Serabond.

WATER-REPELLENT FINISH (WR/WRe)

For some applications, shoes or outdoor textiles for example, it is sensible to add a hydrophobic finish. Sewing threads with a hydrophobic finish have a remarkable ability to delay the penetration of water through the seams. The utilisation of hydrophobic sewing threads, however, does not result in water-proof seams. The hydrophobic finish is usually applied together with the standard finish on separate finishing machines.

AMANN's products Onyx, Serafil, Saba, Rasant, Sabaflex and Serabraid are offered with this special finish in selected sizes. On request, further articles from the AMANN range are available with WR/WRe finish.

AMANN's Road to Zero: The new WRe finish is even more eco-friendly, since it is completely free of PFC! They feature the additional designation of WR (water-repellent).

NON-SILICONE FINISH

The standard lubricating agents for sewing threads contain silicones. If these have an adverse effect on the final application, for instance in the filter production for paint shops or in the clean room production, the sewing thread's lubrication recipe can be made without silicone.There are several alternatives depending on the field of application. Some silicone-free lubrications contain paraffins. If these are also undesirable, it is possible to treat sewing threads with aliphatic esters, silicone- and paraffin-free.

UV PROTECTIVE FINISH

For seams that are exposed to long-term and intense UV light, such as sails, awnings and winter garden shades, additional UV protection may be necessary for the polyester sewing threads in use. One possibility is to include the UV protection in the lubrication, the effect of which is often overestimated. For a UV protective finish, a UV blocker is added to the standard preparation. This finish is applied as described above.

MAKE-UP AND LABELLING

In the winding department the finished threads are wound in the different make-up styles (cops, cones, king spools, etc.). Modern automated winding machines provide for an optimal, uniform winding design. Today's machines are fully automated, which means that the automated winding machine is both fed and wound automatically. The machine also ensures the correct length and monitors the sewing thread quality.

During labelling, the labelling data are either printed directly on the spools or on labels, which are subsequently glued onto or inside the spools. In the labelling process, the products are marked with the important article data such as article description, ticket number, sewing thread raw material, make-up length, colour and batch numbers.The automotive industry in particular puts emphasis on the batch number in order to guarantee the batch traceability of products. In the meantime, the articles are also marked with the relevant barcodes on the boxes, indicating the article, colour and batch number.

Final winding machine

PACKING AND STORAGE

Depending on the make-up styles, the articles are packed in different cardboard boxes. Packers fill the cartons partly supported by modern packing machines, which fold and lay the boxes. This method automatically provides for a final visual quality control. The carton and thread units inside the boxes are adapted to the needs of the market. The sales units are partly determined by the package sizes.

For example, the cop: one sales unit (one carton) holds ten cops. Single cops are usually not shipped. For bigger make-ups, such as cones, the sales unit is the single cone.

The finished threads are stored in the central storage warehouse Bönnigheim-Erligheim and in various external warehouses. The central storage warehouse is equipped with a fully automated high-rack storage facility with a capacity of approximately 900 tons or 85,000 standard containers.

Due to the raw material variety and the different production and processing methods, there is no general statement on the optimal storage of AMANN's sewing and embroidery threads. However, in order to maintain the product quality, poor storage conditions (temperature, air humidity, UV light exposure, etc.) should be avoided. A combination of these factors may have an adverse effect on the quality of the sewing and embroidery threads. Normal storing conditions do not affect the quality of AMANN's sewing and embroidery threads.

If one adds up all the articles in the AMANN product range, considering all possible colours and make-up sizes, one gets an astonishing number of approximately 45,000 different positions.

45,000 positions, which need to be stored in the right quantities in order to ensure prompt shipment of the full quantities once the customer has placed the order. This is a demanding task, which AMANN achieves through precise production scheduling, early market information and the willingness for a high capital expenditure.

AMANN high-rack warehouse

AMANN'S SEWING THREAD PRODUCTION

Production diagram for core spun threads and spun threads:

Finished product	Preliminary product (yarn)	Testing (Technology)	Cleaning	Plying	Twisting	Testing (Technology)	Drawing	Setting	Mercerising	Rewinding on dye packages	Dyeing/Lubricating	Drying	Testing (Colour)	Singeing	Finishing	Make-up	Testing (Technology)	Labelling	Packing
Polyester/ polyester core spun thread	Core yarn	■	■	■	■	■	■	■	–	■	■	■	■	□	–	■	■	■	■
Polyester/ cotton core spun thread	Core yarn	■	■	■	■	■	–	–	–	–	■	■	■	–	□	■	■	■	■
Synthetic spun threads	Cut staple/ schappe spun yarn	■	■	■	■	■	–	–	–	■	□	■	■	■	–	■	■	■	■
Cotton threads	Raw cotton yarn	■	■	■	■	■	–	–	■	–	■	■	■	–	–	■	■	■	■

Production diagram for continuous filaments:

Finished product	Preliminary product (yarn)	Testing (Technology)	Rewinding	Plying/Twisting	Testing (Technology)	Rewinding on dye packages	Dyeing	Drying	Testing (Colour)	Lubrication	Drawing	Make-up	Testing (Technology)	Labelling	Packing
Continuous filament	Multifilament yarn	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Production diagram for texturised continuous filaments:

Finished product	Preliminary product (yarn)	Texturing	False twisting process	Testing	Twisting (Uptwisting)	Testing	Dying/Lubrication	Drying	Testing	Make-up	Testing	Labelling	Packing
Texturised continuous filaments	continuous filaments	False twisting process (external)		e	e	■	■	■	■	■	■	■	■

■ yes □ partly – no e external

QUALITY FEATURES

CHAPTER OVERVIEW

The individual properties of the described sewing and embroidery threads result in different quality features. These determine the sewing performance and the value of the finished seam or embroidery. Depending on the raw materials selected as well as the defined production methods and parameters, sewing and embroidery threads develop different processing and functional properties, and therefore different quality levels.

The product data sheet provides information on important technical data and properties and is available for every customer upon request.

AMANN inspects these technical properties on regular basis, and in some instances we inspect every single batch. Moreover, other physical or colorimetric properties are tested to enable a comprehensive evaluation of the product quality. This information is crucial for our quality control professionals in production, product development and technical sewing service.

STRENGTH

The sewing thread's strength influences its sewability and is a decisive factor for seam strength. Sewing threads with low strength are prone to break during the sewing operation when the stress is too high, for example, when the thread is being tensioned too strongly during the stitch formation process. This can impair the production flow and even cause production stoppage, especially if sewing or embroidery units are in use.

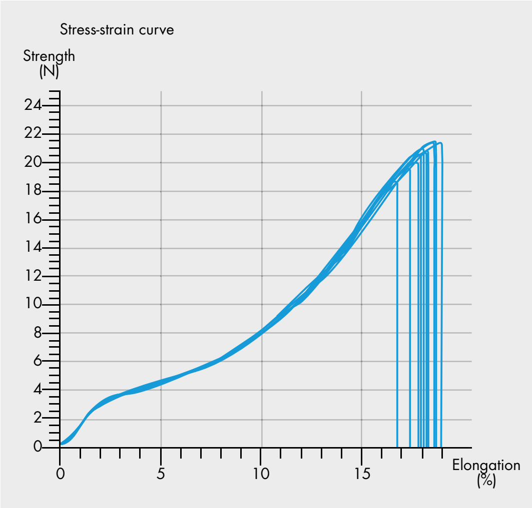
One distinguishes the following different strength types or data:

MAXIMUM TENSILE STRENGTH

The maximum tensile strength is the maximum linear tensile strength a thread can tolerate before it breaks. It is also known as tear strength, breaking force or linear breaking strength.

It is tested with a simple tensile test in accordance with ISO 2062, and rated in cN. This simple tensile test is one of the most important thread tests for assuring compliance with the defined quality requirements.

The maximum tensile strength test is conducted more than 5,000 times daily on fully automated tension-testing machines in the AMANN testing laboratories worldwide, and expressed as stress-strain curve. The curve of the diagram shows the elongation in percentage and the influence of the force in Newton until the thread breaks. In the displayed diagram the values of multiple tests are placed on top of each other. In general, these notable inspection efforts are necessary because all different production steps – yarn, raw thread and finished thread – are tested in order to guarantee an optimal quality.



Example chart of a maximum tensile strenght test

Often, the technicians in the apparel industry rate the maximum tensile strength in grams or kilograms instead of centi-Newton or Newton. 1 g is ~ 1 cN, and 1 kg is ~ 10 N. Many people are still more familiar with the weight ratings. Depending on the raw material, the sewing thread type and the linear density, AMANN products have very diverse levels of strength. Fine polyester continuous filament threads, such as Serafil fine 300 (200/2), have a maximum tensile strength of approx. 640 cN; coarse polyester continuous filament threads can even have a maximum tensile strength of over 20,000 cN (equal to 20 kg).

Tension testing machine

TENACITY

The maximum tensile strength in relation to the linear density is rated in cN/Tex for sewing threads and offers a strength comparison for different sewing thread types.

Example:
Saba 120 has a linear density of 14 Tex × 2 and a maximum tensile strength of 1,200 cN. Thus, it has a tenacity of 42.9 cN/Tex.
(Formula: 14 × 2 = 28; 1,200/28 = 42.9)

The following tenacity comparison of different sewing thread types clearly shows the different strength potentials of different raw materials and thread constructions.

Product	Tenacity (cN/tex)
Polyester continuous filament (Serafil)	50 to 65
Polyester/polyester core spun (Saba)	40 to 50
Cotton spun (MercifilGD)	25 to 35
Polyester bulk yarn (Sabatex)	30 to 40
Kevlar® continuous filament (Kc-tech)	approx. 160

LOOP STRENGTH

The loop strength is the tensile strength of sewing threads of the same linear density, which are stressed in the tensile testing machine in the form of two interlinked loops.

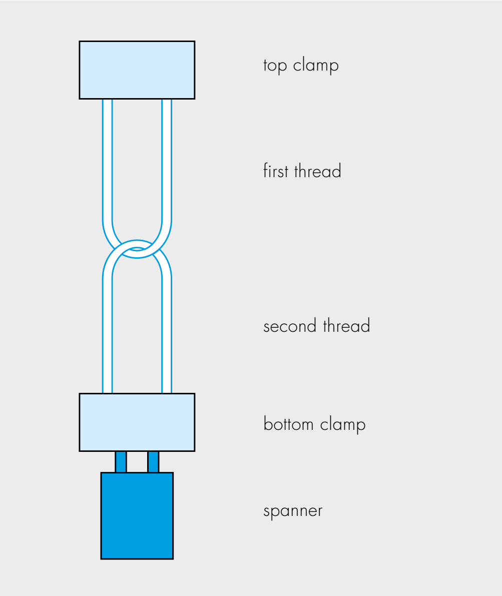
This testing method is closely related to the actual stress experienced by the sewing thread in stitch formation looping, much more so than by testing the linear breaking strength with the simple tensile test.

In this loop strength test, the sewing threads are simultaneously stressed in different ways:

- tensioned in a lengthwise direction
- pressure is applied crosswise
- bent around a very small radius

Sewing threads usually break at the point of looping because the transverse strengths of the fibres are lower than their linear strengths due to the lengthwise direction of the fibre molecules.

The relative loop strength is expressed in the relation between the maximum loop strength and the maximum tensile strength rated in percentage. Depending on their construction, conventional sewing threads have a relative loop strength of 60 to 75%.



Test setup in the tension testing machine

Spun threads usually have the highest relative loop strength, while continuous filament threads have the lowest. Para-aramide threads have an extremely low loop strength of only about 40%. Thus, a large share of the very high linear strength exerts no effect in seams. This must be taken into consideration when calculating seam strength.

Example:
Saba 120 has a maximum tensile strength of 1,200 cN and a relative loop strength of approx. 70%.

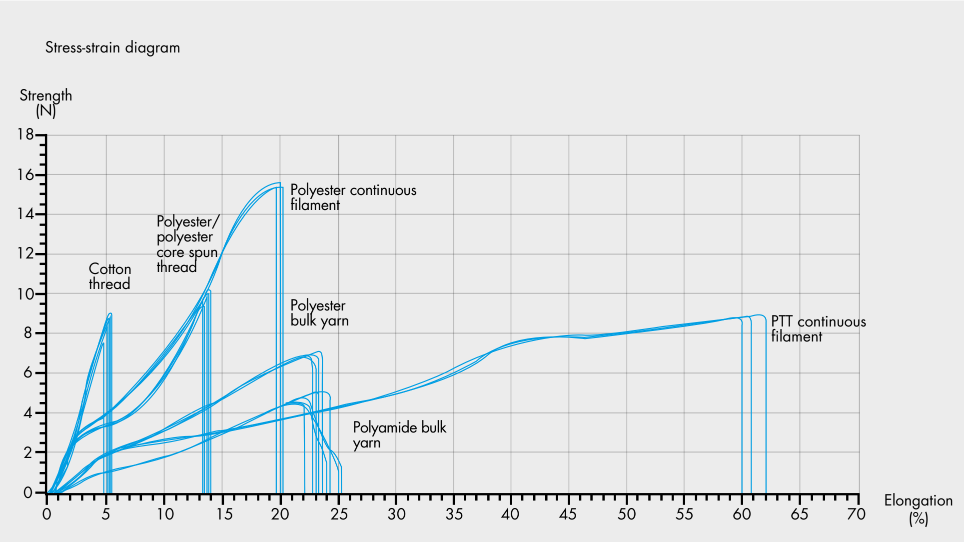
ELONGATION AND ELASTICITY

The elongation of sewing threads has a direct effect on sewability and seam elasticity. Therefore, this quality feature is often in focus of attention. It is important to understand the correct use of the different terms for this physical property.

Basically, the elongation is divided into an elastic (reversible) and a plastic (permanent) part, whereas the transition between both is flowing and overlapping. The elastic elongation is the part that completely restores itself upon relief. The plastic elongation does not restore itself. In the current nomenclature, the former is referred to as elasticity, whereas the latter is called elongation.

At AMANN, elongation is tested together with the maximum tensile strength in accordance with ISO 2062 and is expressed as maximum tensile elongation in percentage on the product data sheet. The standard describes the maximum tensile elongation as the change in length of a sewing thread until it breaks or tears, which is caused by the tensile strength lengthwise (in relation to its original length).

The entire elongation behaviour is illustrated by the stress-strain curve. Different sewing threads display different elongation behaviours, which can be effectively compared using the stress-strain curves.



Elongation behaviour of different sewing thread types

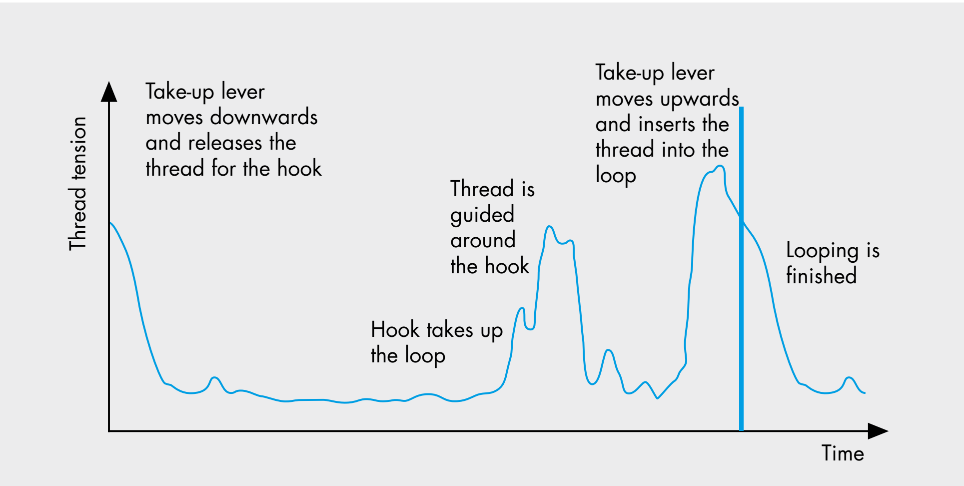
The elongation behaviour of sewing threads is determined based on the selection of the raw material, the construction, and the production method. Cotton threads such as MercifilGD have a low elongation of approx. 5 to 10%.

Sabaflex, AMANN's highly elastic sewing thread, has an elongation of approx. 60% due to its innovative raw material PTT. It is therefore ideal for elastic seams. Standard sewing threads feature an elongation of approx. 10 to 30% and are universally applicable. Through an optimal combination of the sewing parameters (stitch type, stitch density, thread tension, etc.) they are also suitable for elastic seams.

The two most important raw materials, polyester and polyamide, also have different elongation behaviours. Polyamide sewing threads are well known for their high elongation behaviour. Polyamide continuous filament threads, such as Onyx, have a maximum tensile elongation of approx. 20 to 25%. In comparison, polyester threads have a lower elongation behaviour, depending on the sewing thread construction.

Product	Maximum tensile elongation (%)
Polyester spun thread	approx. 12 to 15
Polyester/polyester core spun thread	approx. 15 to 25
Polyester/cotton core spun thread	approx. 15 to 25
Polyester continuous filament	approx. 20 to 30

Different forces (tensile strengths) affect the sewing thread during the sewing operation. By the time the sewing thread is sewn and worked into the seam via lockstitch, it is periodically exposed to this tensile stress up to 80 times depending on the stitch density (see following chart). Using this effect principle, one arrives at two requirements for the sewing thread's elongation properties. On the one hand, sewing threads require a specific elasticity in order to bear the rapidly changing tensile stresses. On the other hand, backlash and thus tension puckering shall be relatively low.



Thread tension during sewing operations

ABRASION RESISTANCE

The abrasion resistance refers to the sewing or embroidery thread's resistance to abrasion assessed based on the visible changes in the appearance of the sewing thread up to the point where it is completely destroyed. The abrasion resistance is measured through abrasive rubs that are necessary to destroy the thread.

The resistance to abrasion is one of the most important characteristics when evaluating the performance behaviour of the sewing thread in the seam. This becomes clear when one considers, for example, the abrasive stress on decorative seams on upholstery, or topstitch seams on shoes. Embroideries on workwear and children's shoes, for example, can also be exposed to extreme abrasive stress. At the same time, the resistance to abrasion influences a thread's sewing performance. The abrasion, which develops during the sewing operation, should not impair the sewing or embroidery thread in order to ensure the seam strength.

There are no DIN or ISO standards for the abrasion test of sewing and embroidery threads. Internationally accredited abrasion tests exist for fabric surfaces only. Therefore, AMANN has developed its own testing methods that come as close as possible to the abrasion stresses in practical use.

Martindale abrasion tester

Modelled after DIN EN ISO 12947-2, the thread abrasion test in the seam is conducted with the Martindale abrasion tester.

The results are visually assessed with a microscope at specified intervals. The intervals are determined by the expected number of abrasive rubs before destruction. In contrast to the testing of the sewing thread strength or elongation, the abrasion resistance test is not part of the standard quality control. However, the abrasion tests serve to gain detailed information on this quality feature, which is necessary for giving competent sewing advice.

Depending on their raw materials and their construction, sewing threads may have very different abrasion resistances. A comparison of different sewing thread types of the same strength – tested in accordance with the AMANN test specification – provides the following results:

Product	Number of abrasive rubs before destruction
Cotton thread	4,800
Polyester spun thread	7,600
Polyester/polyester core spun thread	17,000
Polyester/cotton core spun thread	17,000
Polyester continuous filament	24,000
Polyamide continuous filament	130,000

The abrasion resistance of sewing threads is primarily determined by the raw materials, which means it can be classified into different quality levels. The results confirm polyamide's superiority over polyester, and the advantages of synthetic sewing threads over cotton threads. Furthermore, the sewing thread construction has a strong influence on abrasion resistance. It is interesting to note that there is a clear difference when comparing core spun and spun threads.

A coarser sewing thread does not necessarily lead to a better abrasion resistance. Depending on the sewn material, it can be more prominent on the material, and is therefore exposed to a higher abrasion stress than a finer sewing thread.

The sewing parameters and the material (the fabric used for the abrasion test) have a special influence on the abrasion resistance of threads in seams. The sewing parameters – selected stitch type, stitch density, thread tension – determine the stitch formation and thus the degree of stress. The material used also determines the thread's position on the material. When processing voluminous, fleecy materials, the sewing thread sinks into the fabric and is thus protected from abrasive rubbing stress. Firm, dense materials hinder a deep stitch intake; the sewing thread lies prominently on the material, and is thus exposed to a high degree of abrasive rubbing stress.

GLIDING PERFORMANCE

A trouble-free sewing operation (without faulty stitches or thread breakage) and a perfect stitch formation, require a good gliding performance. It should be possible to process sewing and embroidery threads under conditions where friction is as constant and as low as possible. This quality feature is not only influenced by the thread's construction, and thus by the different surface properties, but also by the applied lubrication.

AMANN monitors the gliding performance, and thus the lubrication application as a quality feature, by means of a friction meter. With this test, one tries to imitate the stress imposed by the thread tension of the sewing machine. The sewing thread is guided through a tension disk under constant stress and at a constant speed; the friction meter records the forces created. Progression graphs indicating the thread tension display the results.

Slight fluctuations in the graph indicate an optimal application of lubrication and guarantee an excellent sewability. In contrast, great fluctuations are not favourable.

THREAD CONSISTENCY

Thread consistency is understood as diameter deviations from the average linear density of sewing and embroidery threads. Hereby, the number of faults in a pre-defined length of thread is recorded. The thread consistency has a direct influence on the sewing performance. It is necessary to differentiate between disturbing, i.e. hindering the sewing operation, and non-disturbing faults. The thread consistency is particularly important for the qualitative evaluation of spun threads and core spun threads, since they tend to show sporadic irregularities and thick places even under perfect production conditions, due to their constructions.

A trouble-free production process, from the spinning mill to the finished thread, is indispensible for an optimal thread consistency. AMANN checks the consistency of the used yarns as well as the finished threads. This quality feature is tested and monitored in the laboratory, and in production.

For the laboratory test an elcometer is used, which mechanically scans the threads using a scan head and finds the faults (deviations from the standard diameters). Faults are cut out and recorded on fault cards.

The faults are categorised in fault classes. These are related to the different causes for the thick and thin places. Faults can develop during the piecing up in the spinning mill or in the twisting department, from naps, impurities, fibre fly, loops, knots, or bad splices.

The testing of the thread consistency in the production process is done with the help of optical sensors on the winding machines. In contrast to the laboratory test, the faults are not cut out here but merely recorded in the course of the quality control process. Products with a high number of faults can then be detected and separated.

SHRINKAGE

The shrinkage refers to changes in the dimension of the thread due to thermal or hydrothermal influences. The usually negative length change is expressed in percentage of the initial length. This quality feature is of special importance for the subsequent product quality. Cleaning and finishing processes such as washing, dry-cleaning, steaming and ironing should not cause a shrinkage of the sewing or embroidery threads.

The following are factors which influence the shrinkage of sewing threads:

The sewing thread itself
- raw material
- construction
- production process (drawing, thermal setting, dyeing)

Thermal or hydrothermal treatment
- treatment temperature
- exposure time
- type of medium (water, steam, hot air, etc.)
- state of tension

AMANN conducts the shrinkage test in accordance with DIN 53 866. The length is measured prior and after treatment with the relevant medium using a simple hanging and measuring device. The test is carried out using a so-called strand measuring process with a strength-related pre-tension force. AMANN tests both the thermal and boil shrinkage with the following parameters:

Thermal shrinkage: 180°C, 15 min, in a thermo cabinet
Boil shrinkage: 95°C, 30 min, in boiling water

A finishing treatment is simulated through the thermal shrinkage, while the boil shrinkage imitates the stress during the washing process. The results help to determine the respective thermal and mechanical parameters when producing sewing threads. Thereby, AMANN guarantees the least possible shrinkage values.

SEWABILITY

The sewability describes the sewing thread's performance in the sewing operation. A prerequisite for good sewability is that the sewing thread should not be processed under favourable conditions only, but that it should also run trouble-free under difficult sewing conditions. Good sewing properties guarantee trouble-free stitch formation and also prevent thread breakage and missing stitches. Thus, the sewability is of great importance for the production efficiency as well as for seam quality.

The perfect sewability is the result of a variety of the quality features mentioned in this chapter. Because there are no DIN or ISO standards, AMANN tests the sewability according to specially developed specifications in its own sewing and embroidery laboratories. Depending on thread type and strength, the following sewability tests are performed:

- reverse sewing
- zigzag sewing
- multidirectional sewing
- buttonholes in underwear
- thermal sewing
- sewing at high speeds
- test embroidery
- WR-test
- serging seams
- crimp test
- fibre abrasion
- abrasion test
- tendency towards a build-up of static electricity
- unwinding test
- fraying test

AMANN Sewing Technology Center

These sewing operations show the various properties of a sewing thread. The sewing of underwe-ar buttonholes, for example, places a high demand on abrasion resistance due to the short stitch lengths. In reverse and zigzag sewing as well as in multidirectional sewing operations, the thread compactness or thread splitting possibility is tested. This enables an assessment of the twist level and a possible bonding.

Metallic threads are notable for their distinctive look and have a very specific structure due to their metallic surface. This has an adverse effect on their sewing and embroidering charac-teristics. In practice, especially at high sewing speeds, disturbances may arise. Various tips in sewing technique may help secure a trouble-free processing. You may obtain information about this from the AMANN Sewing Technology Center via stc@amann.com.

The sewability is influenced by numerous factors. There are three more significant quality features besides the ones already mentioned in this chapter:

TWIST

Threads with a low twist level have an "open" character, which can cause the hook to pick up a single yarn during the stitch forming process, resulting in thread breakage. Sewing threads with too much twist tend to crimp. Knots and loops can develop leading to disturbances in the sewing operation. At the same time, the relationship of the yarn twist to the thread twist is important for obtaining a compact, well-balanced thread (see chapter Sewing Thread Construction/Twist).

SURFACE STRUCTURE

The surface structure is primarily determined by the yarn or thread construction and influences the sewability. Due to their textile, fibrous surface, spun threads and core spun threads behave differently on the sewing machine, for example, than continuous filament threads. The sewing properties of bulk yarns differ from conventional sewing threads and cannot be used in every material or operation due to their voluminous character. Monofilament threads are stiff with a smooth surface, which makes it difficult to guarantee a perfect loop formation on seam ends (see chapter Sewing Thread Construction/Construction type).

LUBRICATION

The lubricating agent is basically comprised of silicone, paraffin, wax and static inhibitors. It is applied onto the sewing thread in order to guarantee perfect sewing performances (see chapter Production/Lubricating (Finishing)). Both a suitable lubrication formula and a controlled application are important.

The lubrication of sewing threads improves their sewability for a number of reasons:

IMPROVING THE GLIDING PERFORMANCE

Sewing threads are to run through the thread guiding and tensioning components of sewing machines as smooth as possible to provide processing with the least possible tension fluctuations.

IMPROVING THE ABRASION RESISTANCE

The lubrication virtually acts as a protective cover against abrasion during sewing operations. However, the abrasion resistance is primarily determined by the raw material and the thread construction.

NEEDLE COOLING

High-speed sewing as well as processing many layers and hard fabrics cause the needle to become hot, which is problematic for synthetic sewing threads. The lubrication is responsible for cooling the needle during the sewing process, and helps reduce the melting of synthetic sewing threads in demanding sewing operations.

MINIMISING THE TENDENCY TOWARDS A CHARGE OF STATIC ELECTRICITY

The friction of the mainly synthetic sewing threads on the different thread guiding elements of the sewing machine often leads to a charge of static electricity in the sewing threads, which adversely effects the stitch formation. The lubrication positively influences this behaviour. Simultaneously, the anti-static components of the lubricating agent prevent the thread from ballooning during off-winding.

If too much of the lubricating agent is applied, it rubs off on the sewing machine. This clogs the thread guiding elements with lubrication particles, thus disturbing the sewing process. If too little lubrication is applied, or applied unevenly, the result is an unstable gliding performance which can also disturb the sewing operation.

too much lubrication — irregular lubrication — perfect lubrication

STORAGE

AMANN uses a variety of raw materials for producing its products. These raw materials are processed and treated in different ways, depending on the final product. Due to the material variety and the different production and processing methods, there is no general statement on the optimal storage of AMANN's sewing and embroidery threads.

However, poor storage conditions (temperature, air humidity, UV light exposure, etc.) should be avoided since a combination of these factors can adversely affect the quality of the sewing and embroidery threads. Normal storing conditions do not affect the quality of AMANN's sewing and embroidery threads.

In order to ensure the high quality of our sewing and embroidery threads, we recommend
a cool, dry and dark storage

- in the original sales box,
- well protected against dirt,
- protected against direct UV light exposure,
- protected from high humidity,
- shielded from chemicals such as oils, gas, etc.,
- an ambient temperature not higher than 25°C,
- efficient stock rotation (in order to avoid long storage times)

COLOUR

The colour, determined by different colour properties, is a complex quality feature for sewing and embroidery threads. This feature is primarily determined by the shade, colour consistency from batch to batch and the colour fastness. Especially important – and easily verifiable by every observer – is matching the colour scheme of sewing material and the sewing and embroidery threads. The prerequisite is a large range of colours adapted to the requirements of the relevant industries, and the colour consistency of the qualities of different batches. Colour deviations are instantly recognisable, and they impair the product quality of the finished piece of garment or other textile product. The colour is defined by the three components shade, brightness and saturation.

COLOUR MATCHING

Colour matching can basically be done in two different ways. On the one hand, there is the visual and thus the subjective way of colour matching. On the other hand, we can use an instrumental colour matching with the aid of highly technical colour metering instruments. To guarantee perfect dyeing results, AMANN uses both assessment options.

Independent from the assessment type, the colour impression that an object transmits is decisively influenced by various factors. Primarily, these are:

The source of light

Depending on the source of light – such as sunlight, neon light, light bulbs, or candle-light – there may be serious differences in the colour impression conveyed. Two material samples, for example, may seem to have the same colour in a room with neon light. In daylight, however, there can be a clear difference in colour. This phenomenon of light source related colour deviation is called metamerism. The reason for this lies mainly in the raw materials used in the thread and the respective colouring pigments. AMANN exclusively uses dye formulas which hinder a metameric colour change, or at least keep it as slight as possible.

The background

The exactly same colour may look clearer and brighter against a dark background than against a light background. The most suitable neutral background for colour matching is a medium grey.

The size of the object

As a rule, colours applied on large areas look brighter and more intense than on smaller areas.

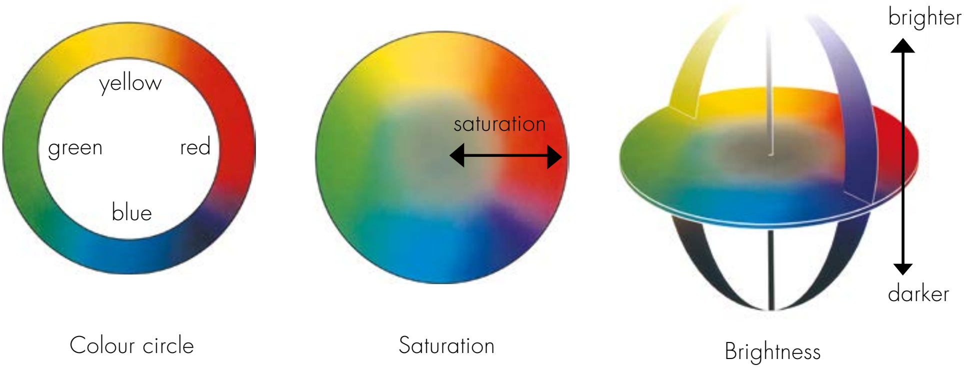
The angle of observation and light incidence

These factors are especially decisive for the colour impression of glossy or metallic colour surfaces.

Therefore, AMANN always conducts colour matching under standardised conditions which, in case of the instrumental test, fulfils international standards.

SUBJECTIVE OR VISUAL COLOUR MATCHING

The human eye is almost unbeatable when detecting colour differences. However, the colours one sees are subjectively assessed and influenced by personal feelings and experiences. Usually, one first observes the deviation in shade, then the differences in the saturation, and finally the difference in the brightness. Despite the awareness of this fact you cannot do without the trained and experienced eye of the dyers who are employed in colour development as well as colour testing within AMANN's quality control.



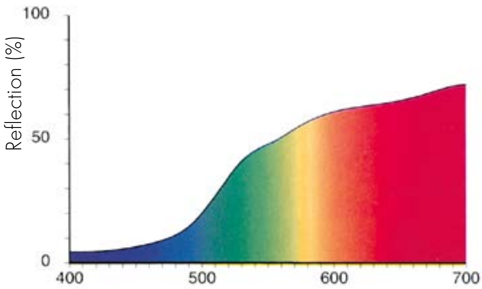
Three-dimensional colour system

OBJECTIVE OR INSTRUMENTAL COLOUR MATCHING

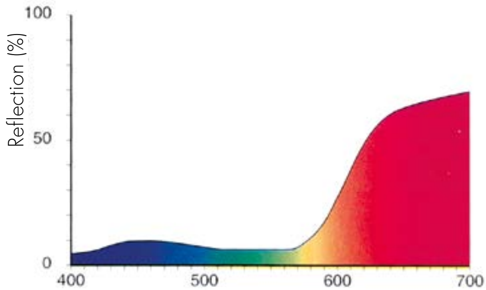
The basis for every objective colour evaluation is the standardisation of the conditions for assessment. For a universally reproducible colour matching, the International Commission on Illumination CIE (Commission Internationale de l'Eclairage) has worked out different test parameters (four standard types of illumination A, C, D and F). The most important types for colour evaluation are D65 (spectral range of daylight) and F11 (lighting conditions of a shopping mall, also known as TL84).

The instrumental colour matching is done with special software used in a spectrophotometer, which defines the measured colour shade precisely using the reflectance curve. The relevant curve is also called the colorimetric fingerprint of a colour, and it makes it unique.

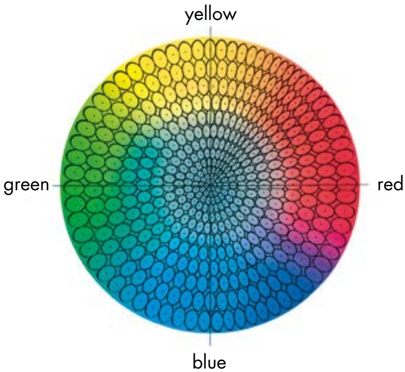
AMANN uses instrumental colour matching worldwide in the quality control of different dye batches by means of modern colorimeters. For every colour in the colour range, a prototype is created in the dye house laboratory and then archived as an exactly defined colour standard with its own colour number. This fixed standard serves as the basis for all the subsequent dyeing processes. During quality controls in the dyeing process, single values of the dyeing are identified and compared with the values of the prototype. By means of the CMC system, ellipse shaped tolerance rooms are generated for every colour standard, which must not be exceeded by an acceptable copy of the prototype (see following chart). These tolerance rooms vary in size depending on the position within the colour space and are inspired by the human eye's ability to perceive deviations in colour. In the green area, the ellipse's form is for example larger and more circular than it is in the orange area.



Reflectance Curve of a Yellow Tone



Reflectance Curve of a Red Tone



COLOUR FASTNESS

The colour fastness indicates the resistance of colours to the effects of use and care treatments. In the following, the most important fastness values for sewing threads are summarised:

- light fastness
- fastness to perspiration
- wash fastness
- water fastness
- rub fastness, dry
- rub fastness, wet
- fastness to dry cleaning

The single fastness values are important quality features for sewing and embroidery threads since they should neither fade (change in colour shade) nor stain the surrounding fabric. Examples are:

- light fastness in outdoor textiles, convertible soft tops, decorative seams and embroideries on car upholstery,
- wash, water, and rub fastness of colourful embroidery on apparel.

Special requirements can sometimes be fulfilled only when special dyestuffs or different non-standard dyeing methods are used. In these cases, the achieved fastness values are determined by special supply specifications.

Light fastness (blue scale)
1 = very low
2 = low
3 = moderate
4 = quite good
5 = good
6 = very good
7 = excellent
8 = outstanding

The fastness is rated by the numbers or grades of a fastness scale. Internationally accepted grey or blue scales are used for assessment. As a rule, all tests must be conducted under standardised illumination and vision related conditions to achieve a reproducible result. The blue scale for assessing light fastness shows eight standard blue tones with different colour gradings, and thus serves as the basis for comparison and assessment.

The grey scale for assessing changes of colour shows ten pairs of grey areas, which determine different contrast steps or possible brightness differences. The change in colour of a treated test sample is assessed in relation to the prototype.

A similar assessment principle is applied with the grey scale for assessing staining, which is also compromised of ten, white colour pairs. Here, the colour change of an accompanying fabric is assessed after a joint treatment with the original fabric. AMANN regularly checks the colour fastness of all articles in accordance with international standards, and states the values on product data sheets.

All other fastnesses (grey scale):
1 = low
2 = moderate
3 = quite good
4 = good
5 = very good

CARE

40
100% Baumwolle / COTTON /
COTONE / KATOEN /
BAWEŁNA / BAVLNA /
BUMBAC

CHAPTER OVERVIEW

CARE PROPERTIES OF SEWING THREADS

With regard to laundering and aftercare of sewing threads, the chosen thread should be compatible with the fabric used, and suitable for the planned application. The outer fabric, the sewing threads, and any other trimmings must have compatible characteristics when laundered.

In many countries, textile fabric labels are legally binding, yet the care labels are voluntary. Nonetheless, the care labels on most textiles indicate, how they must be treated during washing, drying, etc. Based on the first attempts by GINETEX (international organisation for textile care labelling, headquartered in Switzerland) in the 1950s, a new ISO 3758 was established in 1994. It has been revised several times (current status is the version of April 2012) and is now accepted by most countries. Exceptions are the US, Canada, Australia and South Korea (effective 03/2019). However, even in some of these countries, there are plans to adopt ISO 3758.

In this standard, the procedures regarding washing, bleaching, drying, ironing or professional textile care are specified with the respective care symbols and related explanations. The depiction of the symbols are shown in chronological order (first washing, possibly bleaching, then drying and ironing, afterwards possibly professional care).

Manufacturers should permanently attach a care label, in keeping with the international care labelling standards. The information on the care symbols define, which requirements the entire textile, as well as all single components used must fulfill. By providing the correct information, the textile manufacturer ensures that no permanent damage will result if the recommendations on the label are followed. The basis are the standards ISO 3758 “Care labelling code using symbols” and ISO 6330 “Domestic washing and drying procedures for textile testing”.

The single care symbols and their meaning are listed in the following table. Each of the symbols is connected with an international standard testing.

CARE LABELS

Washing

95 Normal process	60 Normal process	60 Mild process
40 Normal process	40 Mild process	40 Very mild process
30 Normal process	30 Mild process	30 Very mild process
Wash by hand maximum temperature of 40°C	Do not wash	The numbers in the washing tub specifiy the maximum temperature.

Bleaching

Any bleaching agent allowed	Only oxygen/non-chlorine bleach allowed	Do not bleach

Drying

Tumble drying possible normal temperature 80°C normal drying process	Tumble drying possible lower temperature 60°C normal drying process	Do not tumble dry
Line drying	Drip line drying	Flat drying
Drip flat drying	Line drying in the shade	Drip line drying in the shade
Flat drying in the shade	Drip flat drying in the shade	The lines indicate type and position of the natural drying process.

Ironing

Iron at maximum sole plate temperature of 200°C	Iron at maximum sole plate temperature of 150°C	The number of dots indicates the severity of the temperature of the hand iron.
Iron at maximum sole plate temperature of 110°C *	Do not iron	* ironing without steam

Professional care

P Professional dry cleaning normal process	P Professional dry cleaning mild process	F Professional dry cleaning normal process
F Professional dry cleaning mild process	Do not dry clean	The encircled letters indicates the chemicals used. P = perchloroethylene and hydrocarbons, F = hydrocarbons
W Professional wet cleaning normal process	W Professional wet cleaning mild process	The bar under the care symbols indicates a mild process (e.g. for easy care articles). The double bar symbolizes a very mild process.
W Professional wet cleaning very mild process	Do not wet clean	

SYMBOLS FOR THE CARE TREATMENT OF TEXTILES AND THEIR MEANING

Washing

- Household linen, hand wash or no linen allowed
- The figures in the washing tub = max. washing temperature measured in Celsius (°C)
- One or two bars below the washing tub = mild or very mild treatment with reduced amount of washing items and low speed during spinning
- Testing according to international colour fastness standard ISO 105-C06 or ISO 105-C08
- Assessment of the colour change according to DIN EN 20105-A02, and of the bleeding according to DIN EN 20105-A03

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Normal process	30°C	normal	"Coloured laundry", e.g. dark coloured products made from cotton, polyester, blended fabrics etc.
	Mild process	30°C	mild	"Easy-care", e.g. products made from modal, viscose or synthetic fibres (polyacrylics, polyester and polyamide). Reduce amount of laundry (half fill the drum). No spinning or only short spin due to the likelihood of creasing.
	Very mild process	30°C	very mild	"Delicate laundry/wool laundry", e.g. wool that can be washed in the washing machine. Significantly reduce amount of laundry (drum only 1/3 full).
	Normal process	40°C	normal	"Coloured laundry", e.g. dark coloured products made from cotton, polyester, blended fabrics etc.
	Mild process	40°C	mild	"Easy-care", e.g. products made from modal, viscose or synthetic fibres (polyacrylics, polyester and polyamide). Reduce amount of laundry (half fill the drum). No spinning or only short spinning due to the likelihood of creasing.
	Very mild process	40°C	very mild	"Delicate laundry/wool laundry", e.g. wool that can be washed in the washing machine. Significantly reduce amount of laundry (drum only 1/3 full).
	Normal process	60°C	normal	"Coloured laundry", not boil-proof coloured laundry made from e.g. cotton, modal, polyester and blended fabrics.

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Mild process	60°C	mild	"Easy-care", reduce amount of laundry (half fill the drum). No spinning or only short spinning due to the likelihood of creasing.
	Normal process	95°C	normal	"Boil wash", Laundry e.g. made from cotton or linen, white, boil-proof, colou-red or imprinted. Fill drum completely.
	Wash by hand	40°C	mild	Select hand wash mode on washing machine, or manual hand washing (dis-solve mild detergent/wool detergent in plenty of water, add the laundry piece into the solution, agitate carefully, no rubbing, no tugging, or wringing, then rinse laundry piece properly, squeeze gently and re-shape whilst damp).
	Do not wash	not relevant	not relevant	Object is sensitive to wet treatment or unsuitable for the treatment in a common household washing machine, due to its size.

Bleaching

- Bleach allowed or not
- Use of active chlorine (e.g. Javelle water) or chlorine-free active oxygen (e.g. heavy-duty detergent) to increase whiteness, or assist in stain/grime removal
- Testing among others according to colour fastness standard ISO 105-N01 (determination of the hypochlorite bleach fastness), ISO 105-N02 (peroxide bleach)
- Assessment of the colour change according to DIN EN 20105-A02, and of the bleeding according to DIN EN 20105-A03

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Any bleaching agent allowed	not relevant	not relevant	Chlorine or oxygen bleach
	Only oxygen/ non-chlorine bleach allowed	not relevant	not relevant	Oxygen bleach is contained in several universal or heavy-duty detergents
	Do not bleach	not relevant	not relevant	Use only bleach-free detergents (e.g. colour detergents). If stain removal products are used, they should be tested in a concealed positon.

Drying

- Drying in the dryer allowed or not = squared circle and dot
- Amount of dots = intensity of the dryer setting
- Natural drying = squared horizontal or vertical dashes
- Diagonal dash = must not be exposed to direct sunlight
- Drying method and testing according to ISO 6330
- Assessment of the colour change according to DIN EN 20105-A02, and of the bleeding according to DIN EN 20105-A03

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Tumble drying possible	80°C	normal	not relevant
	Tumble drying possible	60°C	mild	not relevant
	Do not tumble dry	not relevant	not relevant	not relevant
	Line drying	not relevant	not relevant	not relevant
	Line drying in the shade	not relevant	not relevant	not relevant

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Drip line drying	not relevant	not relevant	not relevant
	Drip line drying in the shade	not relevant	not relevant	not relevant
	Flat drying	not relevant	not relevant	not relevant
	Flat drying in the shade	not relevant	not relevant	not relevant
	Drip flat drying	not relevant	not relevant	not relevant
	Drip flat drying in the shade	not relevant	not relevant	not relevant

Ironing

- Dots = temperature range of the iron (regulator iron, steam iron, travel iron or pressing machines)
- Temperature is measured at the sole plate!
- With some iron devices, partly certain raw materials are assigned to these setting ranges
- Testing according to colour fastness standard ISO 105-X11
- Assessment of the colour change according to DIN EN 20105-A02, and of the bleeding according to DIN EN 20105-A03

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Iron at maximum sole plate; steam my cause damage	110°C	not relevant	= "Polyacrylics, polyamide (nylon), acetate". If necessary, iron delicate products that are by using a dry pressing cloth, or on the reverse side. Do not iron with steam. Do not distort.
	Iron at maximum sole plate	150°C	not relevant	= "Wool/silk/polyester/viscose". Iron using damp pressing cloth. Steam iron can be used. Avoid heavy pressing. Do not distort.
	Iron at maximum sole plate	200°C	not relevant	= "Cotton/linen". Iron-dry treatment, possibly moisten. Iron delicate products with a dry pressing cloth, or on the backside. Steam iron can be used.
	Do not iron	not relevant	not relevant	not relevant

Professional textile care

- Professional textile care, wet or dry cleaning allowed or not, incl. declaration of the particular chemicals
- Basic testing standard ISO 3175, and ISO 105-D01 (dry cleaning fastness with PER)
- Assessment of the colour change according to DIN EN 20105-A02, and of the bleeding according to DIN EN 20105-A03
- For any dry cleaning processes, a test on a concealed part of the article is advisable beforehand

Symbol	Shortcut	Max. temperature	Mechanical load	Explanation
	Professional dry cleaning normal process	not relevant	normal	Tetrachloroethene (also known as Perchloroethyelene) and all solvents listed under symbol F.
	Professional dry cleaning mild process	not relevant	mild	
	Professional dry cleaning normal process	not relevant	normal	Hydrocarbons (heavy benzines)
	Professional dry cleaning mild process	not relevant	mild	
	Do not dry clean	not relevant	not relevant	Do not treat with solvents or solvent-based stain removals.
	Professional wet cleaning normal process	not relevant	normal	not relevant
	Professional wet cleaning mild process	not relevant	mild	For delicate textiles.
	Professional wet cleaning very mild process	not relevant	very mild	For very delicate textiles.
	Do not wet clean	not relevant	not relevant	not relevant

Sewing threads are tested and assessed according to the respective international standards. The sewing thread properties are guided by the particular market requirements. Furthermore, the **colour fastnesses** are ascertained and published on the product data sheet after the conduct of the different care treatments (for this, see also chapter Colour fastness). Changes of the sewing thread colour or bleeding of the colour on the surrounding fabric are typical consequences of an unsuitable care treatment.

Due to its role in joining fabrics, the **dimensional stability** is another important care property for sewing threads. If the sewing thread shrinks e.g. during the washing procedure or during ironing, the seams will contract and become puckered. An embroidery thread that shrinks too much would make the entire embroidery shrink and become unattractive. If, on the other hand, the fabric shrinks more than the sewing thread, it affects the seam appearance negatively. Hence, in this case it is important to match similar (or low) shrinkage values.

CARE RECOMMENDATIONS FOR AMANN PRODUCTS

The care recommendations for the entire AMANN product range is specified on the particular colour cards and product data sheets. One important point: Whereas the care labelling in clothing states the permitted washing temperature, the washing temperature that is stated on the AMANN products relates to the adherence of colour fastness. They meet the markets requirements and can be ideally maintained by following the declared washing temperature. Depending on the raw material, in many cases it is even possible to wash with higher temperatures (above 60°C), which applies to high-quality sewing and embroidery threads, such as the most AMANN products.

FEATURES

In the fashion sector, the importance of industrially pre-washed and specially treated washing products has significantly increased. With this, the aim is to achieve a certain feel or a certain appearance (look). To avoid damage on seams or embroideries, it is very important to consider the effects of **special washing procedures and special finishes.**

Special colouring (Dip-Dye method)

Special wash treatment on jeans (partial sanding, brushing and spraying)

Where **contrasting colours** are concerned and under extreme care conditions, e.g. with **hospital laundry or workwear,** the requirements are particularly high. For such cases it is recommended to conduct individual tests with the seams regarding care durability. Correspon-ding care properties should be considered during product development.

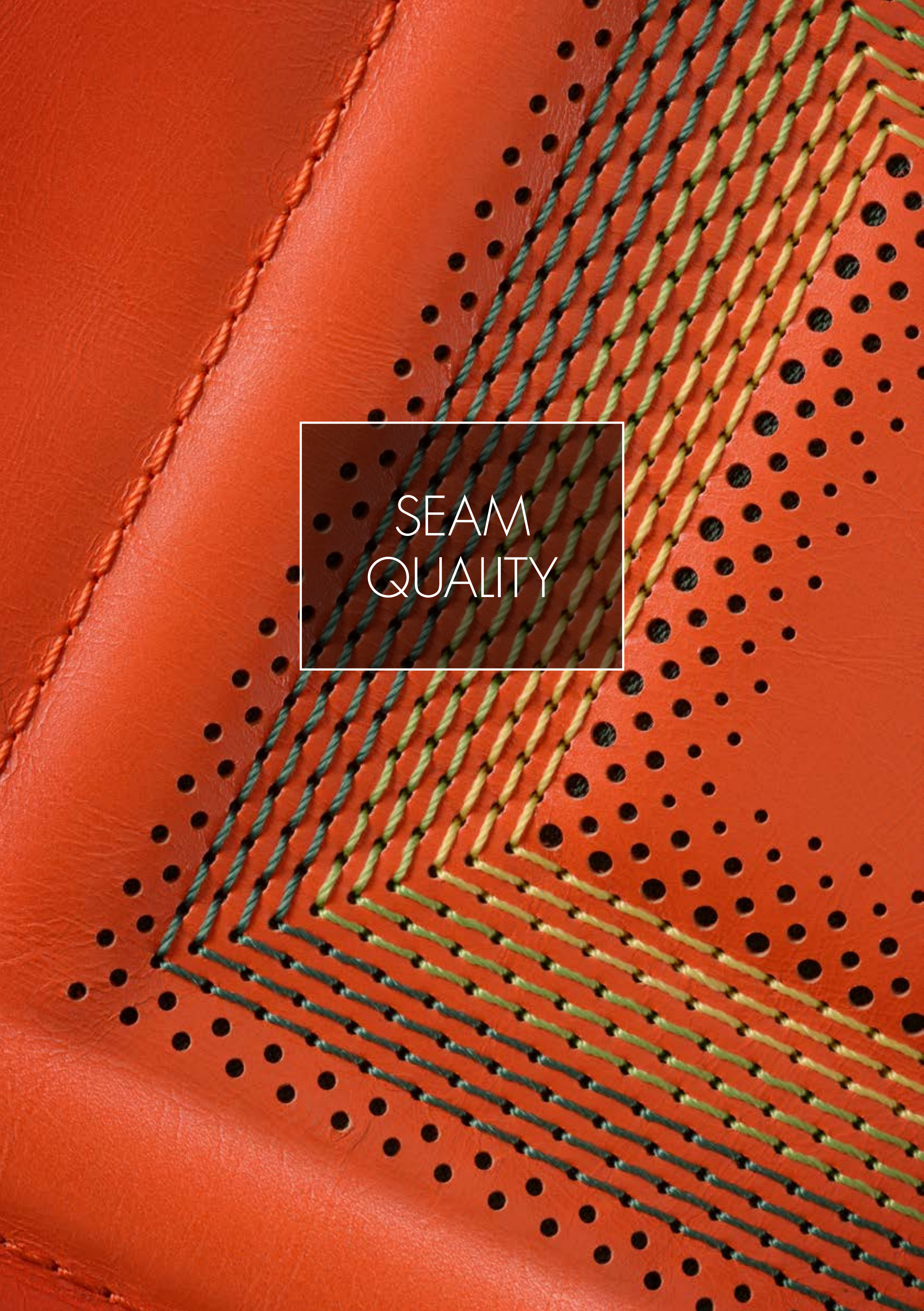
Workwear, leasingwear and corporate wear are used intensively and hence, they are often industrially washed and dried. Even after wearing these clothes very often, they are supposed to become clean. Moreover, they shall retain their colour and dimension stability on a long term. Consequently, the requirements for workwear concerning industrial washings are extremely complex. "PRO-care", the care label which has been specially developed for professional industrial washing ensures that the garments can be treated optimally.

Hohenstein Laboratories have examined those AMANN products that are relevant for workwear and leasingwear concerning the industrial wash resistance after care treatments according to DIN EN ISO 15797 for workwear. These products have received the PRO-care certification according to DIN EN ISO 30023. The following articles are certified for the most common industrial washing procedures 2 and 8, as well as for the two drying procedures tumble drying and tunnel/cabinet finishing according to DIN EN ISO 15797: Saba, Sabatex, Sabaflex, Serafil, Serafil fine, Isacord, N-tech and N-tech CS.

Workwear

The production of AMANN's sewing threads is subject to high quality standards. Since the conditions of use and care may differ, it is recommended to conduct individual tests to examine the colour fastness under the given conditions.

SEAM QUALITY



CHAPTER OVERVIEW

The term quality indicates the extent to which a product corresponds to its specifically determined requirements. According to the general quality understanding of the sewing industry, the seam quality is usually crucial to the product quality.

Considering the variety of sewn products and their application fields, it is clear that there are different requirements set on seams. For example, the seat seams of denim trousers must have a different level of stability than the seams of an airbag.

The requirements profile for the respective seams needs to be developed based on application and function. The following chart shows the most important features and gives examples for individual quality criteria.

CRITERIA OF SEAM QUALITY

Seam elongation

Seam stability

- Seam breaking strength (crosswise)
- Seam slippage

Seam haptic

- Grip
- Softness

Individual product-related criteria

- Refractory
- Weatherproof
- Chemical-resistant
- Conductive
- Waterproof
- Dyeable

Abrasion resistance

- Special look (e.g. Jeans)
- Strain because of usage (e.g. furniture)

Care properties

- Compatibility of care properties
- Reliability at high care stress (e.g. leasing textiles)

Seam appearance

- Smooth
- Purposely puckered
- Hardly visible
- Coarse and striking
- Stitch type (e.g. zigzag)

Criteria of seam quality

SEAM STABILITY

To assess the seam stability, it is necessary to examine the **seam slippage** and the **seam breaking strength**.

Seam slippage relates to the tendency of warp threads and weft threads of a fabric to shift in crosswise direction to the seam, while being influenced by traction forces. A lesser resistance to seam slippage leads to an opening of the fabric in the seam area.

Poor seam strength as a result of slippage

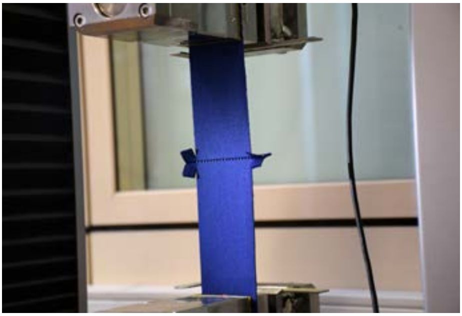
Seam slippage is dependent on the fabric. Hence, changing the sewing conditions will have minimal effect. The following methods can have conditional positive influence: Additional topstitching of stressed seam positions; selection of other seam types (e.g. use of felled seams or safety seams); a preferably high stitch density; a preferably broad seam allowance; taping of the fabric in the seam area with a heat-bonded tape; additional trimming of the particular layers of fabric. The sewing thread use has no influence on seam slippage. Usually, the manufacturers of the fabric are required to optimise seam slippage. For further information, please also see chapter Seam slippage.

Seam breaking strength describes the resistance of seams towards a tensile load in crosswise direction to the seam. If the seam strength is not sufficient, the seams will break during future use. Broken seat seams are a well-known practical example for an insufficient seam breaking strength.

The seam breaking strength is determined by the fabric, the sewing thread and the sewing parameters. The basic level of seam stability first determines the fabric's tensile strength. Besides, the choice of the sewing thread primarily decides about the attainable seam breaking strength. Raw material, construction and strength determine the strength level of the sewing thread (maximum tensile force), and thus, also the strength of the seam. For instance, a coarse polyester continuous filament thread features a much higher tensile strength than a fine cotton spun. To receive a first evaluation, it is helpful to check the declaration of the maximum tensile force on the product data sheets.

When choosing the sewing parameters, the stitch density, stitch type, and the thread balance within the seam have a huge impact on the breaking strength of the seam. For instance, referring to double chainstitch, while using Saba 120, increasing the stitch density from 4 to 5 stitches/cm leads to an improvement of the seam breaking strength of approx. 25 %. When comparing the most important stitch types for joint seams, lockstitch and double chainstitch, the double chainstitch will achieve far greater seam breaking strength, due to its higher seam elasticity. The ideal thread balance for lockstitch is given, when both needle thread and bobbin thread, have the same length. Based on its huge influence on seam stability and seam elasticity, the thread balance will be explained in more detail in chapter Stitch types & sewing thread requirement.

To ascertain the adequate sewing thread/sewing parameters, the seam breaking strength can be examined on request at AMANN's Sewing Technology Center, following DIN EN ISO 13935-1.



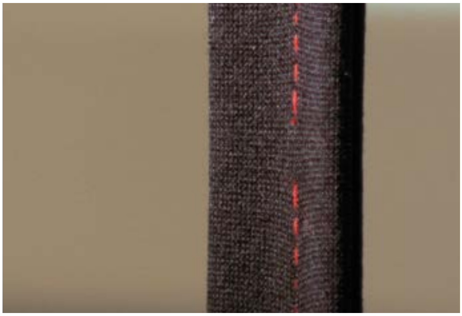
Examination of seam breaking strength

Test object with broken seam

SEAM ELONGATION

Seam elongation describes the stretch properties of a seam under tensile stress in lengthwise direction. Seam elongation is primarily determined by the thread stock in the seam. The thread stock depends on the choice of the stitch type, stitch density and stitch balance. The trend to wear more body-hugging and comfortable clothes requires a high level of manufacturing expertise concerning flexible materials in general, and elastic seams in particular. Therefore, AMANN has developed Sabaflex, the highly elastic sewing thread. In chapter Elastic & soft seams, influencing factors and important processing advice for elastic materials will be specified. Seam elasticity can be examined based on DIN EN ISO 13934-1 (simple strip method).

Examination of seam elongation



Test object with torn seam

SEAM HAPTIC

Haptic describes the perception by touching something. Often it is just called “touch”. There are objective measuring methods to evaluate textile surfaces, but not for seams. Seams solely receive a subjective evaluation, to wit, via manual examinations or via wearability tests.

For clothes that are worn tightly, soft seams and a soft touch are very important. For manufactures of lingerie and sportswear, this is especially important to achieve a quality garment. On leather products it is common to use heavy sewing threads in order to achieve striking feature seams to complement the material.

The seam haptic is influenced by the fabric, stitch type and sewing thread:

- Depending on the texture of the fabric, the seam sinks into the sewing material. Accordingly, the seam is more or less noticeable.
- The choice of the stitch type determines the thread amount on the top or bottom side of the fabric (e.g. higher presence of the seam with multi-needle cover chainstitch/flatlock in comparison to single needle lockstitch). The type and the position of the stitch formation in the fabric affect the softness of the seam. Compared to lockstitch, whose stitch formation lays centered in the fabric, the double chainstitch on the bottom of the fabric feels more coarse, because of the looper thread chain.
- The sewing thread has an enormous impact on the seam haptic. The touch can be altered through the variation of ticket number and construction. Fine tickets (such as Serafil fine 300 (200/2)) feel far softer than coarse tickets (such as Serafil 10). Texturised microfilaments (such as Sabasoft), with their voluminous, soft character allow a different “seam feeling” to Serabraid, the braided continuous filament thread.

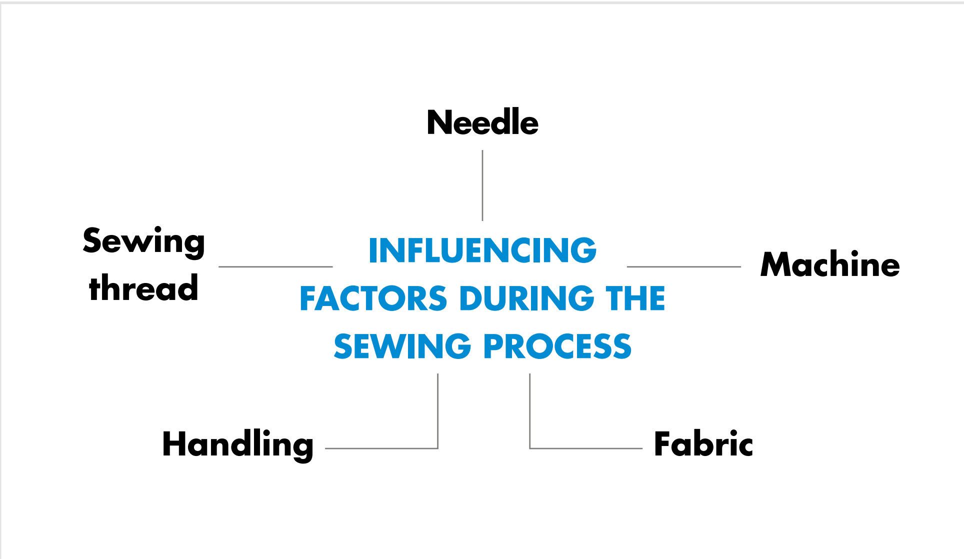
With regard to the previously mentioned influencing factors, sewing tests are recommended prior to production, so that a good seam haptic (e.g. a soft seam) is achieved.

SEAM ABRASION RESISTANCE

The seam abrasion resistance characterises the thread's resistance to abrasion stress in the seam. Its evaluation is based on the visible alteration of the appearance of the sewing thread until a complete destruction of the thread is reached. AMANN has developed an own test method for evaluating the seam abrasion resistance that optimally reflects the abrasion stress of seams according to their future use. It is based on the well-known abrasion testing procedure with the Martindale tester for textile surfaces. Further information is provided in chapter Abrasion resistance.

SEAM APPEARANCE

The seam appearance is a special quality attribute, because it can be evaluated subjectively. Often, a seam only attracts attention, when it is not well processed. The possible reasons for this are diverse. Beside the right choice of sewing thread, needle and fabric, also the correct handling and the use of appropriate machines determine the final seam quality.



Influencing factors during the sewing process

SEAM PUCKERING

A visible, undulated appearance, either on one or both sides of the seam is seldom desirable. Seam puckering is one of the most common processing problems. It can occur directly after sewing, during ironing or pressing, or after a short break along the seam, or in specific sections of the seam. In practice, they are usually assessed visually and evaluated on the basis of a photo criterion (see also chapter Prevention of seam pucker).

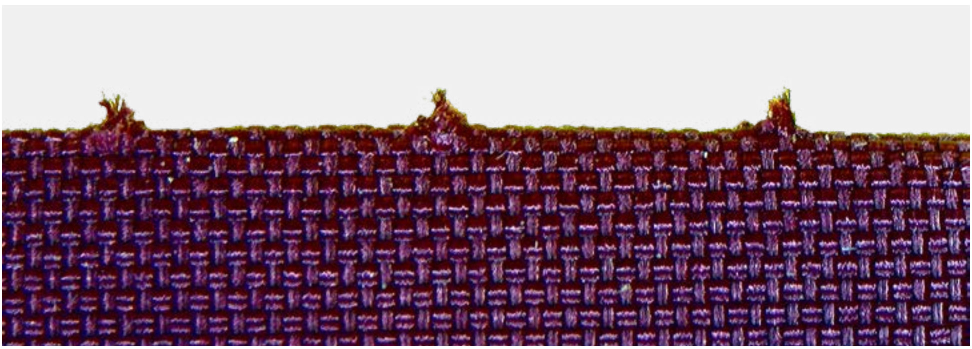
Seam puckering

SEAM MARKS

Imprints in the seam area that are visible on the outside are a well-known processing problem with fine fabrics. They may occur in the ironing process, when seam allowance and/or sewing thread press down the closing and serging seams.

POOR COORDINATION OF SEWING THREAD AND FABRIC

Sometimes, the construction and ticket number of the thread can adversely affect the fabric. If sewing thread, needle size and fabric are not well-matched, material damage can occur, for example, because needles are used that are too coarse. Usually, material damage only becomes visible after the first washing, when the fabric threads are getting brushed along the seam.



Damage of the fabric

INCORRECT THREAD BALANCE

Once the thread balance differs from the ideal, an irregular seam pattern arises, which is usually not acceptable where threads are visible. The following image shows the look of poor thread balance on a lockstitch seam.

Seams with poor thread balance

POOR COLOUR MATCHING

It is easy to identify undesired colour differences with tone-in-tone stitching. Where seams are sewn in contrasting colours, this is less of a problem.

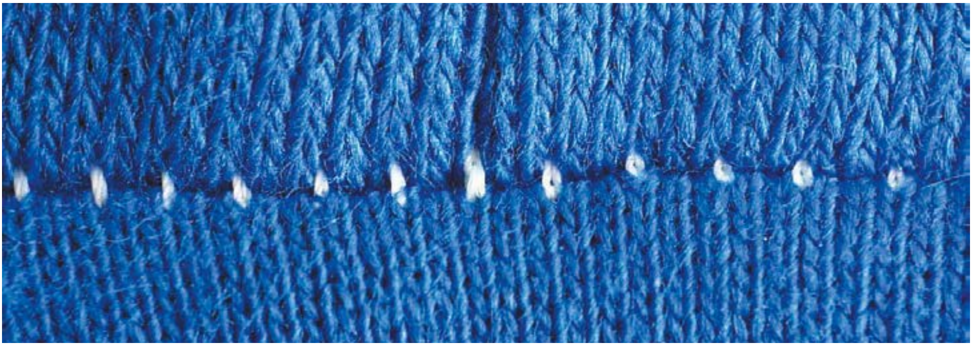
Poor colour matching

The following points are important for an ideal colour matching between sewing thread and sewing material:

- Colour matching considering the metamerism effect (see also chapter Colour)
- Alignment of colour fastness between fabric, sewing thread and further ingredients other components (see also chapter Colour)
- Assignment of trained personnel with good colour perception (see also chapter Service)

SEAM GRINNING

You do not need to be an expert to notice that grinning or loose seams are a sign of production errors. Mostly, this occurs on joining seams that are exposed to intense stress during use, e.g. on seat seams. If seams diverge, the stitch formation becomes visible between the edges of the seam. Under tensile stress in crosswise direction to the seam, the sewing threads appear in the shape of a ladder. Potential causes may be: the thread balance is poor, the thread tension is too loose, or the stitch density is too low.



Seam grinning

CARE PROPERTIES

It is quite easy to define the quality requirements for the care properties of sewing threads: The sewing thread must fulfill the care requirements of the fabric. The outer fabric and the sewing thread must be well-matched.

The high quality sewing threads by AMANN usually fulfill this demand for harmonic care for all kinds of fabrics – whether it is washing, bleaching, tumble drying, ironing, or professional dry cleaning. Often, the care reliability of the fabrics is much lower than the care reliability of the sewing threads. There are only few restraints, mostly during ironing, because of the raw-material-dependent temperature resistance. The specific care labellings of all AMANN products are specified on the particular colour cards and product data sheets.

With contrast processings and extreme care conditions (e.g. hospital laundry or workwear), the care reliability of the seams needs to be examined individually. In chapter Care, you may find further details.

INDIVIDUAL, PRODUCT-RELATED QUALITY CRITERIA

Beside the standard quality criteria, there are numerous product-related requirements. This applies especially to the production of technical textiles. According to the demanded functionality, there are further highly diverse requirements for sewing threads. The following examples illustrate the wide range:

- Heat-resistant seams for heat-protective clothing
- Weatherproof seams for outdoor textiles
- Chemical-resistant seams for chemical-protective clothing
- Conductive seams for conductive textiles
- Waterproof seams for rainproof clothing
- Dyeable seams for Garment Dyeing

A concrete requirements profile facilitates the selection of the most suitable sewing thread to achieve impeccable seam quality

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

APPLICATIONS & PRODUCTS

CHAPTER OVERVIEW

APPAREL

Ladieswear, menswear, sportswear & outdoor, denim, underwear & lingerie, leatherwear, workwear, garment dyeing

AUTOMOTIVE

Airbags, trim/interior, steering wheels, seatbelts, shading systems

SHOES & ACCESSORIES

Shoes, bags, suitcases,
belts and small leather goods

EMBROIDERY

Brilliant & fashionable, metallic, glow-in-the-dark, bobbin thread, matt, filigree & monograms, coarse decorative embroidery, dyeable, technical & functional, flame-retardant

HOME INTERIOR

Upholstery, mattresses, pillows & inner covers, bed linen, curtains, table linen, bathroom textiles

TECHTEX

Protective clothing, outdoor textiles, smart textiles, lifting and restraint systems, composites, filtration, medtech


saba
Polyester/Polyester core spun


sabaTEX
Polyester continuous filament, texturised


sabaFLEX
PTT (Polytrimethylene terephthalate) continuous filament


sabaSOFT
Polyester continuous microfilament, texturised


Serafil fine
Polyester continuous filament


Serafil
Polyester continuous filament


STRONGFIL
AMANN
Polyamide 6.6
continuous filament


Oxcel
Polyamide 6.6
continuous filament,
bonded


Serabraid
Polyester
continuous filament,
braided
AMANN
Serabraid


ONYX
Polyamide 6.6
continuous filament
ONYX


Rasant
Oxella
Polyester/cotton
core spun, glacé


Serabond
Polyester
continuous filament,
bonded


STRONGBOND
AMANN
Polyamide 6.6
continuous filament,
bonded


GORE® TENARA®
ePTFE (expanded
polytetrafluorethylene)
tape


META
Polyester/polyester
wrapped yarn,
metallised


Silver-tech
Silver coated
polyamide/polyester
hybrid thread


ISACORD
Polyester continuous
filament, trilobal


ISAMET
Polyester/polyamide
wrapped yarn


ISA
TEXLIGHT
PBT (polybutylene terephthalate)/
PP (polypropylene),
continuous filament


ISA ISABOB
Polyester
bobbin threads
for embroidery


Rasant
Polyester/cotton
core spun


MercifilGD
Cotton spun,
mercerised


STRONGfix
Polyester/polyamide
continuous filament


Topfil
AMANN
Polyester continuous
filament


TEXTURAN
Polyester continuous filament, texturised


N-tech
Nomex® DuPont™ meta-aramide, schappe spun


N-tech CS
Nomex® DuPont™ meta-aramide, cut staple spun (N-tech CS)


A-tech CS
NEWSTAR® Yantai meta-aramide, cut staple spun


Nc-tech
Nomex® DuPont™ meta-aramide, continuous filament


K-tech
Kevlar® DuPont™ para-aramide, schappe spun


Kc-tech
Kevlar® DuPont™
para-aramide,
continuous filament,
bonded


C-tech
Belltron® B31/
Polyester
hybrid thread


D-tech
Dolanit® Dolan
polyacrylic,
cut staple spun


I-tech
Bekinox® stainless steel-
polyester/polyamide
hybrid thread


PP-tech
Polypropylene
continuous
filament


XTREME-tech
with Dyneema®
Dyneema® by DSM,
HPPE (High Performance
Polyethylene)
continuous
filament,
bonded


ZYEX®
PEEK
(Polyetheretherketone)
continuous
filament


Rasant IR
Polyester/cotton
core spun, infrared-
absorbent (IR)


AMANN
GROUP

CHAPTER OVERVIEW

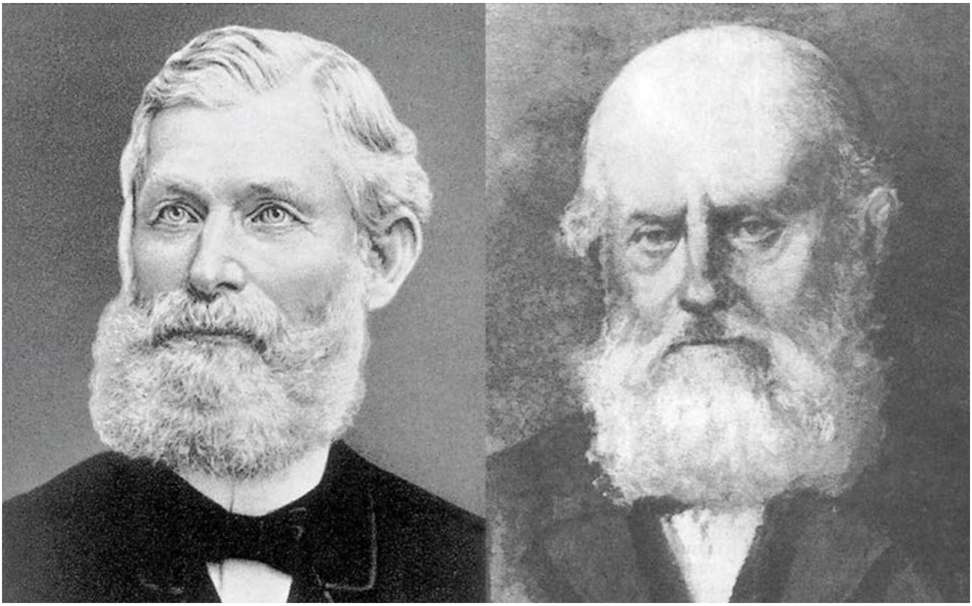
CORPORATE HISTORY

1854: A NEW ERA BEGINS – THE BÖNNIGHEIM SEWING THREAD FACTORY OPENS ITS DOORS

Bönnigheim, 1854: Alois Amann and Immanuel Böhringer founded the Amann & Böhringer company “for the purpose of manufacturing twined and dyed silks”.

Silk in the 19th century was a precious material and difficult to obtain. Professionally processing it into silk threads was considered a supreme discipline.

Amann and Böhringer were pioneers in Europe of an exacting art that had few imitators at the time.



Alois Amann & Imanuel Böhringer

1854 – 1880: BETWEEN SWEAT AND GROWTH – THE FOUNDING YEARS

In 1879, the young company celebrated its 25th anniversary. It had now become established as “the leading company among the German silk thread-makers”. But it had been a long journey. In the beginning, Amann & Böhringer employed 12 women thread-makers, two wheel movers, and several donkeys and oxen to power the machines. Despite this extremely laborious and strenuous work, the company soon started to flourish.

1880 – 1900: A NAME GOES DOWN IN HISTORY

After Imanuel Böhringer left the company in 1882, Alois Amann brought in his two sons Emil and Alfred as partners, and renamed the company Amann & Söhne. Until his death in 1892, founder Alois Amann remained the sole owner.

1900 – 1920: A NEW FACTORY FOR A NEW CENTURY

At the beginning of the 20th century, Amann & Söhne made a new start too: the old factory building was demolished in 1902 to make way for a new factory on the same site. The red-brick building still serves as the company's headquarters today.

Changes were underway inside the building as well: Emil and Alfred Amann were jointly running the company, and realised early on that market demands were changing. In response, they began to produce artificial silk. In 1917, Emil Amann retired from the company.

1920 – 1940: NEW PRODUCTION METHODS

In 1919, in a characteristic and defining move, Amann & Söhne started to manufacture schappe silk. In 1923, production was expanded to include mercerised cotton. Both remain typical manufacturing methods in sewing thread production to this day.

Amann & Söhne Headquarter (around 1954)

1940 – 1954: PHOENIX FROM THE ASHES – RECONSTRUCTION AFTER FATEFUL YEARS

Alfred Amann, the esteemed managing director and driving force behind the company, died in 1942 aged 78. His son-in-law Alfred Pielenz took over management of the company. Despite massive import and logistics problems, Pielenz succeeded in bringing the business and its production levels back to normal just a short time after the end of World War II.

Alfred Amann

1954: 100 YEARS OF AMANN

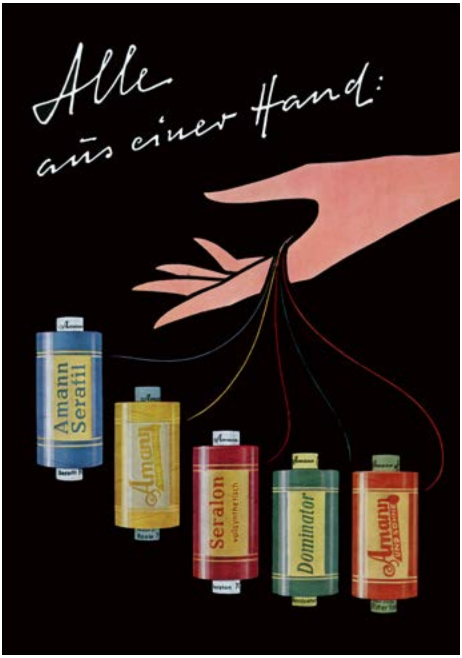
The company celebrated its centenary in 1954.

1955: PIONEERING WORK IN SYNTHETIC THREADS

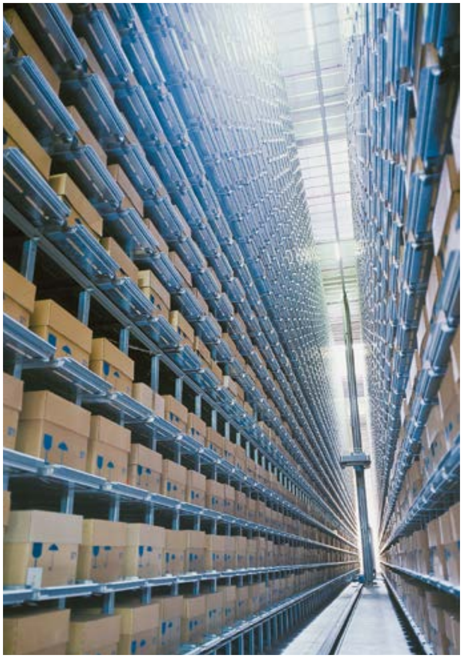
As a trailblazer in a leading position, AMANN perfected the development and production of continuous filament synthetic sewing threads. The Serafil brand was born. To this day, its name represents unique quality.

1955 – 1968: MARKET LAUNCH OF SABA

A new era in synthetic sewing threads begins: thanks to intense research and development work, the 1950s and 1960s were a defining period that culminated with the launch of Saba in 1968. With its characteristic and innovative three-cylinder construction, the age of innovative synthetic sewing threads had begun.



AMANN advertising poster (around 1960)


AMANN high-bay warehouse in Erligheim

1968 – 1980: RAPID GROWTH AND INVENTIVE SPIRIT

The successful development of Rasant began in 1974 with the first polyester/cotton core-spun thread of its kind.

The innovative spirit continued, as once again AMANN broke new ground in sewing thread technology. saba[c] is the brand name of the polyester/polyester core-spun thread that has become established in the market since 1980 as "the all-rounder among all sewing threads".

1980 – 2000: PREPARING FOR THE NEW MILLENNIUM

Success must continue – into the new millennium, too. AMANN set the course at the end of the 20th century by acquiring the long-established Augsburg company Ackermann-Göggingen AG, together with its state-of-the-art dyehouse. AMANN therefore gained additional expertise in embroidery threads.

In 1996, all logistics processes were professionalised with the inauguration of the fully automated industrial central warehouse at Erligheim, close to Bönnigheim. This confirmed AMANN's status as one of the world's biggest sewing thread manufacturers.

2000 – 2004: INTERNATIONALISATION AND TECHNOLOGISATION

In 2001 and 2002, AMANN acquired the long-established British firm Donisthorpe, and the French sewing thread manufacturer Cousin Filterie.

techX Performance Threads, a new speciality range for technical textiles, was successfully launched a short time later, in 2002. It creates a whole new spectrum of possibilities for many different industries. New standards in underwear, sportswear and swimwear have been set since 2003 with the market launch of Sabaflex, an extremely elastic sewing thread.

2004 – PRESENT: AMANN, THE INNOVATIVE GLOBAL PLAYER

In 2006, a new production facility opened near the Romanian town of Brasov. Launched that same year, the new braided thread line Serabraid promises new dimensions in expressive design. AMANN continues to develop its expertise in the automotive field, and has increased its impact in the international sector with the acquisition of long-established British firm Oxley Thread Ltd., one of the best-known sewing thread manufacturers in Europe.

Expansion in the Asian market: with the opening in 2009 of its first production site in Asia, in the Chinese city of Yancheng, AMANN has improved product availability and customer service in the Asian region.

AMANN Produktionsstätte in Yancheng (China)

In 2013, AMANN expanded into Bangladesh. A new state-of-the-art production facility was inaugurated near the capital city, Dhaka.

In 2014, AMANN launches Sabasoft, an extremely soft sewing thread that combines performance and softness for the first time. To develop innovative solutions and concepts for sewing threads, embroidery threads and smart yarns is the goal of the AMANN Innovation Lab, which opened in 2017. This textile development hotbed at the Augsburg site carries out intensive research and development activities.

In 2018, AMANN starts with the construction of a new production site in the Vietnamese coastal city of Đà Nẵng, which got inaugurated in 2019. Moreover in 2019, AMANN begins with the construction of another new production site in the Indian state Tamil Nadu.

AMANN TODAY

Today, more than 2,300 employees in more than 100 countries contribute to AMANN's success. The management consists of Bodo Th. Bölzle (CEO), Wolfgang Findeis (CFO) and Peter Morgalla (COO). The company headquarters are still based in Bönnigheim, where the company was founded in 1854. Since 1996, there is a central industrial warehouse in Erligheim, from where AMANN delivers threads to the entire world. Nationally, as well as internationally, AMANN exclusively produces at its own production plants. These are located in Augsburg (Germany), Manchester (United Kingdom), Chribska (Czech Republic), Brasov (Romania), Yancheng (China), Mawna (Bangladesh) and Đà Nẵng (Vietnam).

RESPONSIBILITY

The acceptance of social and environmental responsibility is an essential part of AMANN Group's corporate philosophy. The main focus of this philosophy is responsible interaction with employees, vendors, customers and partners, and with the environment and its resources.

SOCIAL

The charitable Hanns A. Pielenz Foundation was established by its eponym Hanns A. Pielenz in 2005. Through the transfer of his shares to the foundation, Hanns A. Pielenz ensured the continuation of the traditional family business and a long-term support of regional cultural and charitable institutions in the fields of arts and culture, science and research, and education.

ENVIRONMENTAL

- sustainable production and dyeing processes and continuous reduction of the use of harmful substances
- similarly high safety, production and sustainability standards at all AMANN production plants worldwide and ongoing observation of the standards
- reduction of waste and promotion of recycling
- responsible utilisation of resources through water and energy management

CERTIFICATION & SAFETY

At AMANN, customer expectations regarding performance, reliability and technical expertise, as well as the quality and environmental compatibility of the products are an obligation and a motivation at the same time. Continuous compliance with the high-quality standards at AMANN Group is ascertained by the certification for quality management according to DIN EN ISO 9001.

ENVIRONMENTAL MANAGEMENT

AMANN's resource-friendly approach and its strive to keep the environmental impact as low as possible is documented by the certification of the sites Bönnigheim and Augsburg in accordance with the DIN EN ISO 14001 environmental management system.

ENERGY MANAGEMENT

The reasonable use of energy is an important factor in AMANN's sustainability program. The DIN EN ISO 50001 certification states that the production site at Augsburg has developed a sustainable energy management system and has a very high degree of energy efficiency and environmental compatibility.

QUALITY COMMITMENT

The fulfilment of the process-oriented quality commitment for a safe production environment is proven by the certification of the offices Bönnigheim, Augsburg, Brasov, Manchester and Yancheng under the strict IATF 16949 standards.

PRODUCT CERTIFICATIONS

The compliance with REACH and certification under STANDARD 100 by OEKO-TEX® guarantee that AMANN's products are not harmful. Moreover, AMANN participates in Greenpeace Detox Campaign. Almost all products are even certified in accordance with the strict criteria of the OEKO-TEX® testing catalogue according to appendix 6. The AMANN products Saba, Sabatex, Sabaflex, Isacord, Serafil, N-tech and N-tech CS have been examined concerning the industrial wash resistance according to DIN EN ISO 15797, and have received the PRO-Label certification according to DIN EN ISO 30023.

TÜVRheinland® ZERTIFIZIERT
Management System
ISO 9001:2015
ISO 14001:2015
ISO 50001:2011
www.tuv.com
ID 1104000462

TÜVRheinland® ZERTIFIZIERT
Management System
IATF 16949:2016
www.tuv.com
ID 1104000462

SERVICE

From development to production and everyday customer support, quality, precision and a great deal of creativity and passion characterise AMANN's performance.

RELIABILITY

Based on its vast expertise in the production of sewing and embroidery threads, AMANN has been serving the global textile industry for decades. AMANN is a reliable partner for all industries and offers professional product solutions, from fashionable to technical applications.

INTERNATIONAL SALES TEAM

Direct points of contact all over the world facilitate a more personal communication and have comprehensive understanding for the procedures within the sewing and embroidery industry.

COLOUR COMPETENCE

Colour is a crucial topic within the textile industry. The AMANN colour competence center utilises state-of-the-art technologies and employs experienced experts. A huge colour range that is available worldwide covers the most diverse requirements of all industries: from fashion to shoes & leather, from automotive industry to technical applications.

LOGISTICS AND WAREHOUSING

As an internationally leading producer of high-quality sewing and embroidery threads, shipping and warehousing are a part of AMANN's daily business. Just-in-time-delivery, flexibility in meeting customer requirements and efficient logistics management – this is what AMANN stands for.

AMANN SEWING TECHNOLOGY CENTER

Excellent technical sewing and embroidery consulting is one of AMANN's big strengths. For this purpose, AMANN has created a state-of-the-art sewing-technical lab with its new Sewing Technology Center (STC).

Among others, the services of the AMANN Sewing Technology Center comprise the following:

- Technical sewing and embroidery consulting worldwide
- Individual customer workshops, technical seminars and lectures
- Sewing tests and analyses
- Calculation of sewing thread requirement and recommendations for increase in productivity
- Technical elaborations for specific topics
- Processing tests

The AMANN STC team has decades-long, application-oriented know-how and enables customers to receive the best possible consulting and support.

INNOVATION

LAB

CONDUCTIVE SENSORY COMPOSITES

THINKING SOLUTIONS

AMANN INNOVATION LAB – THINKING SOLUTIONS!

AMANN Innovation Lab is the innovation pool at AMANN. Our textile think-tank develops intelligent products, individual solutions and innovative concepts for textile issues, not only for sewing and embroidery threads but also for textile surfaces. The spectrum includes conductive threads and yarns, hybrid threads for composites, sensor yarns, threads with indicator function as well as a multitude of functional yarns and technical threads. The AMANN Innovation Lab develops different smart yarns that offer technical solutions for the following fields:

- Conductive
- Sensory
- Composite

Research and innovation are an integral part of our processes. In close cooperation with our customers, our interdisciplinary team develops solutions ranging from special smart yarns for technical textiles to individual product designs for the automotive sector. As the interface between market and customer, we translate your requirements and ideas into textile concepts.

INTELLIGENTLY EMBROIDERED AND SMARTLY SEWN: AMANN YARNS FOR SMART TEXTILES

At a time when technology is becoming increasingly important in our lives, AMANN develops intelligent yarns that precisely fit the application in question. The conductive and sensory fields in particular play a major role in our work in the Innovation Lab. Our innovative smart yarns are already used in a wide variety of industries today.

Typical applications for conductive threads include

- Medical
- Work clothing/Personal Protective Equipment (PPE)
- Sportswear
- Automotive

Sensor yarns are used in the following industries, among others:

- Healthcare
- Construction
- Logistics
- Agriculture

CONDUCTIVE

The topic conductivity is becoming increasingly important for many industries. Due to its properties, a conductive smart yarn offers itself for a variety of different applications such as conductance of electricity or data transfer.

SENSORY

Smart yarns with sensor technology transfer information and have a variety of different applications. These so-called sensor yarns are thread-like textile constructions that measure e.g. humidity.

COMPOSITES

The Comphil finish, specially developed by AMANN for composites, offers optimised sewing performance without adhesion-inhibiting properties towards the composite matrix. Thus, it is optimally synchronised with the further processes (for example resin infusion) and end use applications.

Are you facing a new challenge or do you have a specific task? We are happy to support you with all questions to do with our smart yarns or with a specific project. We look forward to hearing from you at innovation-lab@amann.com.

STITCH TYPES & SEWING THREAD REQUIREMENT

CHAPTER OVERVIEW

Stitch types are the main processing element of the clothing industry. They describe the processing and are used as a "language code" for all processing descriptions. However, not everyone is familiar with the terms and numerations according to ISO 4915 and DIN 61400, the seam appearanceand the correct stitch formation. Subsequently, the most important stitch types are specified including graphics and pictures of thecorresponding seam appearance. The overview also contains industry standard data concerning seam width and stitch density per stitch type as well as therespective thread requirement.

DETERMINATION OF THE SEWING THREAD REQUIREMENT

Knowing the thread requirement is essential for work preparation, calculation and disposition. The basis for determining the sewing thread requirement is the stitch type. Therefore, the following overview lists the thread requirement figures based on the industrial standard parameters: stitch density, sewing material thickness, seam width and seam length per stitch type.

The indicated thread requirement relates to the respective thread system (needle thread + bobbin or looper thread + cover thread) and is also listed in the overview as an overall amount. Thus, it is possible to determine the consumption for single seam positions of a garment by multiplying seam length and thread requirement.

Furthermore, the table shows the percentage distribution of the sewing thread requirement per thread system (needle thread, bobbin or looper thread and cover thread).

It is important to consider that the sewing material thickness may influence the percentage distribution (see section sewing material thickness).

FACTORS THAT MAINLY INFLUENCE THE SEWING THREAD REQUIREMENT

STITCH DENSITY

The stitch density has huge influence on the sewing thread requirement, in particular for stitch types with cross-directional threads (overlock, cover chain or zig-zag stitches). An increase of the stitch density from 4 to 6 stitches/cm at the lockstitch (stitch type 301) leads, for example, to a sewing thread requirement increase of approx. 15%. With the 2-needle cover chainstitch (stitch type 602), the sewing thread requirement even increases by approx. 30% with the same increase in stitch density. This must be considered during calculation to avoid shortage in quantities and therefore costly subsequent deliveries.

SEWING MATERIAL THICKNESS

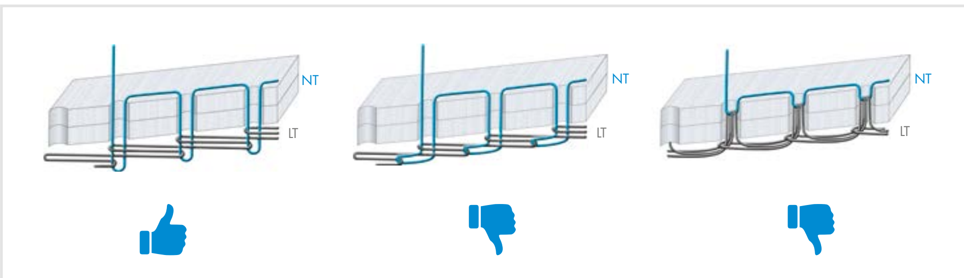
A change in the sewing material thickness has also big impact on the sewing thread requirement. Besides a change in the overall thread requirement, it is possible that the ratio between the thread systems could shift. An increase of the sewing material thickness leads to a change in the relation between needle and looper thread for all stitch types, whose interlooping does not take place within, but outside the fabric. The double chainstitch is an example for this. In this case, an increase of the sewing material thickness leads to an increase of the needle thread requirement, whereas the looper thread requirement remains constant.

THREAD TENSION AND THREAD BALANCE

The following overview shows stitch appearances with an optimal thread balance. If the interloopingor interlacing does not take place on the ideal position, there is an incorrect thread balance. This does not only affect the thread requirement, but also the seam strength and the seam elasticity. Therefore, it is crucial to always aim for an optimal thread balance. The cause of an incorrect thread balance can tremendously influence unbalanced thread tension setting of the sewing machine. This changes the ratio between needle thread, bobbin or looper thread and, if applicable, cover thread and can influence the overall thread requirement, especially with stitch types of categories 500 and 600.

THE OPTIMAL THREAD BALANCE IN THE SEAM

Lockstitch



Double chainstitch

NT = needle thread | BT = bobbin thread | LT = looper thread

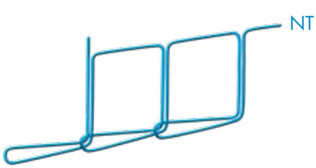
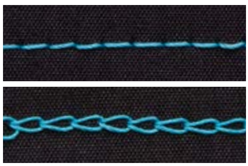
ADDITIONAL THREAD REQUIREMENT

The thread requirement figures listed in the overview are so-called “net values”. This means that they chapter to a seam of one meter. In practice, there is a supplement of approx. 10 – 15 % calculatedon top of the net amount to ensure a sufficient thread supply during model calculation. This supplement considers the following procedures:

- Securing of seam beginning and seam end with lockstitch seams, e.g. by bar tacking
- Sewing seam ends of chainstitches
- Change of colour
- Remaining meters in case of spool or cone change
- Variability in sizes
- Model- or production-related changes

The mentioned relations should be considered during model calculation. If the parameters, such as stitch density, sewing materialthickness, thread tension, seam width etc. of the of the calculated piece do not match the information in this chapter, it is possible to easily identify the missing sewing thread requirement figures through unpicking and measuring a seam.

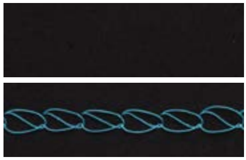
Single thread chainstitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
101			–

Stitch density per cm	Thread requirement* in m per 1 m seam				Thread requirement* in % per 1 m seam			
	NT*	BT/LT*	CT*	Total	NT*	BT/LT*	CT*	Total
2	3.57	–	–	3.57	100	–	–	100
3	3.85	–	–	3.85	100	–	–	100

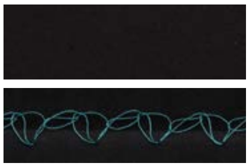
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

Blindstitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
103			–

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
2	4.57	–	–	4.57	100	–	–	100
3	4.85	–	–	4.85	100	–	–	100

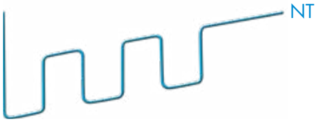
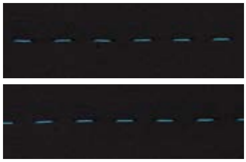
Blindstitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
105			–

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
2	3.93	–	–	3.93	100	–	–	100
3	4.39	–	–	4.39	100	–	–	100

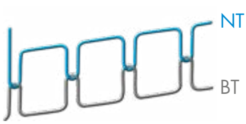
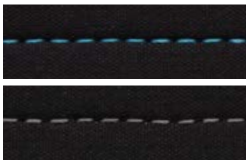
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

Single thread lockstitch (hand stitch)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
209			–

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.8	–	–	1.8	100	–	–	100
6	2.2	–	–	2.2	100	–	–	100

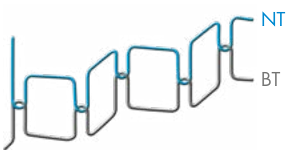
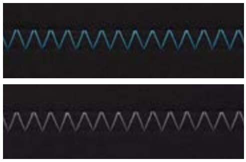
Lockstitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
301			–

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.31	1.31	–	2.62	50	50	–	100
6	1.49	1.49	–	2.98	50	50	–	100

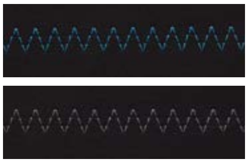
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

Lockstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
304			3

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.84	1.84	–	3.68	50	50	–	100
6	2.5	2.5	–	5	50	50	–	100

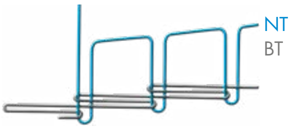
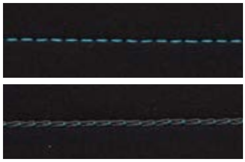
Lockstitch (multiple zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
321			6

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.58	1.58	–	3.16	50	50	–	100
6	2.02	2.02	–	4.04	50	50	–	100

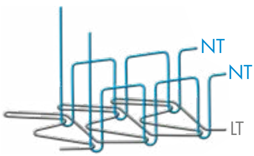
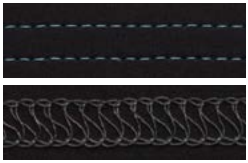
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

Double chainstitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
401			–

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.61	3.53	–	5.14	31	69	–	100
6	2.01	3.80	–	5.81	35	65	–	100

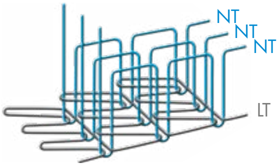
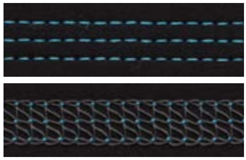
2-needle cover chain stitch (without cover thread)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
406			5

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	3.22	9.63	–	12.85	25	75	–	100
6	4.03	12.25	–	16.28	25	75	–	100

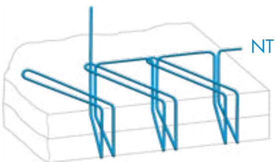
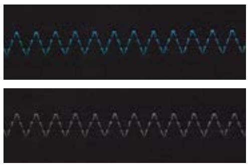
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

3-needle cover chain stitch (without cover thread)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
407			6

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	4.83	12.11	–	16.94	28	72	–	100
6	6.04	15.10	–	21.15	29	71	–	100

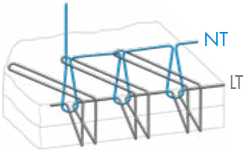
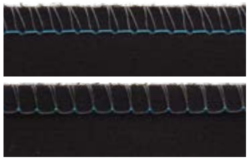
1-thread overlock stitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
501			5

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	11.40	–	–	11.40	100	–	–	100
6	16.22	–	–	16.22	100	–	–	100

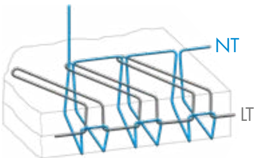
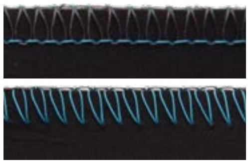
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

2-thread overlock stitch (interlaced at needle hole)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
502			5

Stitch density per cm	Thread requirement* in m per 1 m seam				Thread requirement* in % per 1 m seam			
	NT*	BT/LT*	CT*	Total	NT*	BT/LT*	CT*	Total
4	1.61	10.60	–	12.21	13	87	–	100
6	2.01	15.02	–	17.03	12	88	–	100

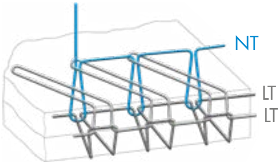
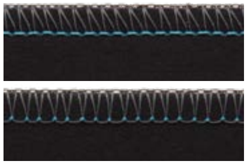
2-thread overlock stitch (interlaced on edge)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
503			5

Stitch density per cm	Thread requirement* in m per 1 m seam				Thread requirement* in % per 1 m seam			
	NT*	BT/LT*	CT*	Total	NT*	BT/LT*	CT*	Total
4	6.51	5.79	–	12.30	53	47	–	100
6	9.12	8.20	–	17.31	53	47	–	100

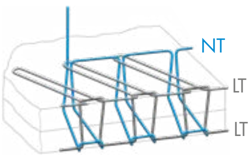
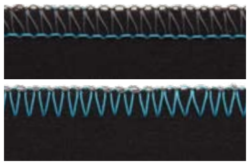
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

3-thread overlock stitch (interlaced at needle hole)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
504			5

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	1.61	12.02	–	13.63	12	88	–	100
6	2.01	16.73	–	18.75	11	89	–	100

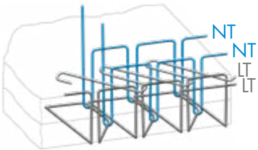
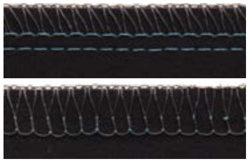
3-thread overlock stitch (interlaced on edge)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
505			5

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	6.27	7.46	–	13.73	46	54	–	100
6	8.76	10.19	–	18.95	46	54	–	100

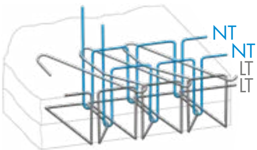
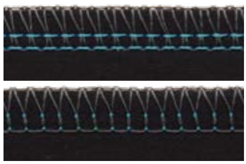
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

4-thread overlock stitch (imitated safety stitch)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
512			7

Stitch density per cm	Thread requirement* in m per 1 m seam				Thread requirement* in % per 1 m seam			
	NT*	BT/LT*	CT*	Total	NT*	BT/LT*	CT*	Total
4	3.22	13.36	–	16.58	19	81	–	100
6	4.03	18.58	–	22.61	18	82	–	100

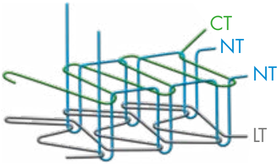
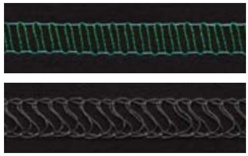
4-thread overlock stitch

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
514			7

Stitch density per cm	Thread requirement* in m per 1 m seam				Thread requirement* in % per 1 m seam			
	NT*	BT/LT*	CT*	Total	NT*	BT/LT*	CT*	Total
4	3.22	15.65	–	18.87	17	83	–	100
6	4.03	22.10	–	26.13	15	85	–	100

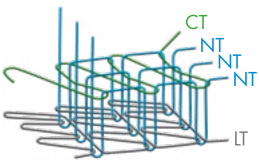
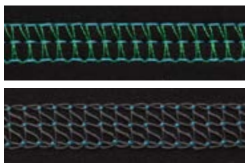
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

2-needle cover chain stitch (with cover thread)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
602			4

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	3.30	8.08	4.15	15.52	21	52	27	100
6	4.15	10.28	5.99	20.42	20	50	30	100

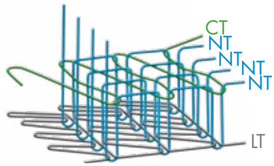
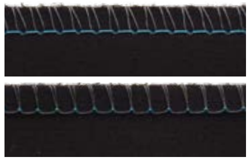
3-needle cover chain stitch (with cover thread)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
605			6

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	4.95	10.91	5.66	21.52	23	51	26	100
6	6.22	13.80	8.32	28.34	22	49	29	100

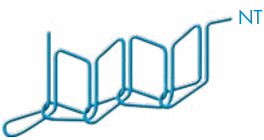
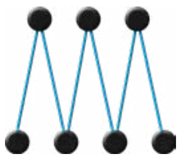
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

4-needle cover chain stitch (with cover thread)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Seam width in mm
607			7

Stitch density per cm	Thread requirement* in m per 1 m seam NT*	BT/LT*	CT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	CT*	Total
4	6.60	14.15	6.43	27.18	24	52	24	100
6	8.30	17.84	9.51	35.64	23	50	27	100

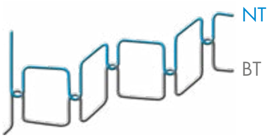
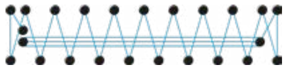
Spot tacking single thread chainstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
107			25

No. of stitches	Implementation in mm	Thread requirement* in m per 1 m seam NT*	BT/LT*	Total	Thread requirement* in % per 1 m seam NT*	BT/LT*	Total
7	2	0.06	–	0.06	100	–	100

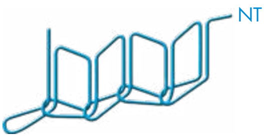
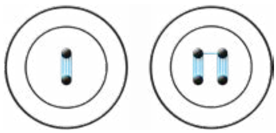
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

Bar tack lockstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
304			35

No. of stitches	Implementation in mm	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
42	12	0.14	0.10	0.24	100	–	100

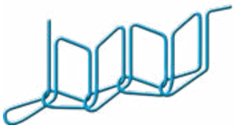
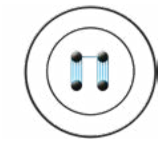
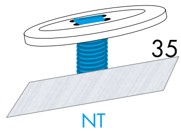
Set/attach button single thread chainstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
107			30

No. of stitches	Implementation	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
10	2-Loch	0.13	–	0.13	100	–	100
20	4-Loch	0.25	–	0.25	100	–	100

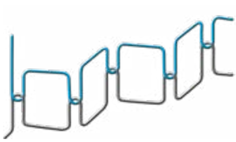
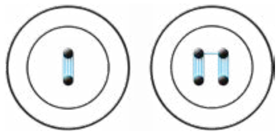
* Thread requirement: Net value for sewing material thickness of 1 mm (double layer of sewing material)

Spot tacking single thread chainstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
107		 	35

No. of stitches	Implementation	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
25	4-Loch	0.37	–	0.37	100	–	100

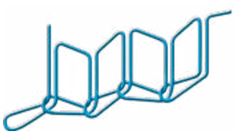
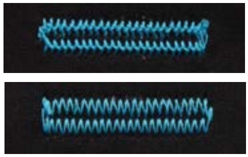
Set/attach button lockstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
304			25

No. of stitches	Implementation	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
10	2-Loch	0.06	0.06	0.12	50	50	100
20	4-Loch	0.12	0.10	0.22	53	47	100

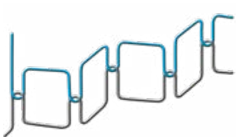
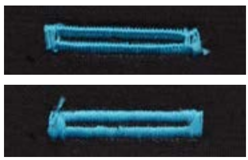
NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

Shirt buttonhole single thread chainstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
107			30

No. of stitches	Implemen-tation in mm	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
90	16	0.70	–	0.70	100	–	100

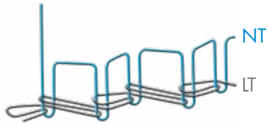
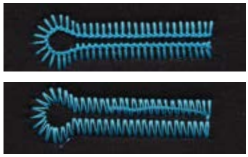
Shirt buttonhole lockstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
304			30

No. of stitches	Implemen-tation in mm	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
160	18	0.11	0.87	0.98	11	89	100

* Thread requirement: Net value for sewing material thickness of 1 mm
(double layer of sewing material)

Eyelet buttonhole without bar tack double chainstitch (zig-zag)

ISO 4915	Stitch appearance	Seam appearance top/bottom	Stitches per cm
404			30

No. of stitches	Implementation in mm	Thread requirement* in m per 1 m seam			Thread requirement* in % per 1 m seam		
		NT*	BT/LT*	Total	NT*	BT/LT*	Total
96	30	0.33	0.62	0.95	35	65	100

NT = needle thread | BT = bobbin thread
LT = looper thread | CT = cover thread

* Thread requirement: Net value for sewing material thickness of 1 mm
(double layer of sewing material)

EMPIRICAL DATA FOR THE THREAD REQUIREMENT

It is important to know the amount of thread required for each piece. This is the precondition for ordering the right quantities, reducing stock and optimising costs. The following tables serve as a guidance. The figures contained are based on fashionable and qualitative characteristics of the garments. The supplements for seam beginning and seam end and colour change are considered in the following.

LADIESWEAR

Article	Range of variation (m)	Orientation value (m)	Orientation value includes (m)		
			Closing seam	Serging seam	Decorative seam
Trousers	180 – 350	265	40	172	53
Skirts	100–200	150	20	100	30
Blouses	80–200	140	21	91	28
Dresses (classic, with lining)	200–300	250	25	200	25
Dresses (sporting, without lining)	300–500	400	60	260	80
Blazers (classic, with lining)	100–400	250	212	0	38
Blazers (sporty, without lining)	300–500	400	140	200	60
Winter jackets (with lining)	150–500	325	225	0	100
Summer jackets (without lining)	150–700	425	85	300	40
Coats	200–1000	600	180	210	210

MENSWEAR

Article	Range of variation (m)	Orientation value (m)	Orientation value includes (m)		
			Closing seam	Serging seam	Decorative seam
Classic trousers	200–300	250	75	163	12
5-pocket trousers	180–300	240	72	84	84
Blazers	100–260	180	162	0	18
Coats/jackets	250–350	300	240	0	60
Shirts (short-sleeve)	70–100	85	75	0	10
Shirts (long-sleeve)	100–130	115	104	0	11

UNDERWEAR

Article	Range of variation (m)	Orientation value (m)	Orientation value includes (m)		
			Closing seam	Serging seam	Decorative seam
Vests/t-shirts	70–150	110	27	77	6
Underpants Ladies/Men	20–100	60	3	9	48
Bras	20–80	50	10	20	20
Homewear	170–250	210	53	105	52
Nightgowns	130–190	160	40	104	16

SHOES

Article	Range of variation (m)	Orientation value (m)	Orientation value includes (m)		
			Closing seam	Serging seam	Decorative seam
Sports shoes	20–80	50	5	0	45
Men's shoes	15–30	23	5	0	18
Women's shoes	20–30	25	5	0	20
Women's boots	25–45	35	7	0	28

To achieve the best possible sewing result, it is recommended to conduct individual tests (e.g. regarding the matching stitch type, the right thread balance, or the required thread amount) first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

PREVENTION OF SEAM PUCKER

CHAPTER OVERVIEW

Seam pucker is one of the most common processing problems within the sewing industry. During, or directly after sewing, unwanted waves appear alongside the seam. Ironing or pressing can only eliminate these so-called seam puckers for a short time, and after laundering they will reappear.

Generally, the following three types of pucker can be distinguished:

- tension pucker
- feed pucker
- displacement pucker

Depending on the structure of the material, one or more pucker types can occur. Further causes of pucker can be e.g. pattern-making attributes or incorrect processing parameters.

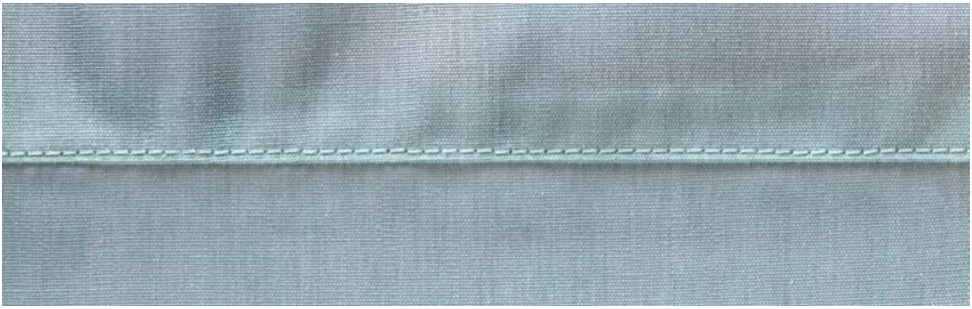
Smooth fabrics are prone to feed pucker, tightly woven fabrics are prone to displacement pucker and very fine and light fabrics are usually prone to tension pucker along the seams. Seam pucker can be also increased by creative combinations, such as coarse decorative seams on thin materials.

Nowadays, the classic combination of filigree seams on fine fabrics is rather less important. To prevent seam pucker, or to improve the seam appearance, we first need to analyse the type of pucker, in order to determine the underlying cause. According to the type of pucker, different approaches for improvement are necessary.

FEED PUCKER

IDENTIFICATION FEATURE

Puckers occur asymmetrical to the seam (puckers are present only on one layer of the fabric)



Feed pucker

PROBLEM

Sewing two equal pieces of fabric, which appear different in length after sewing.

EXPLANATION

While sewing, the bottom layer of the fabric is pushed further through the common drop feed transport. The presser foot simultaneously presses on the material and generates adhesion that carries along the bottom layer. With smooth fabrics especially, this can lead to feed pucker. If the presser foot pressure is increased, this effect becomes worse.

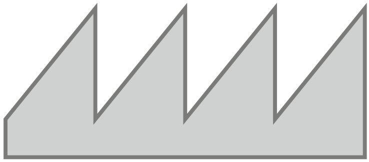
SOLUTION

- Adjust presser foot pressure as low as possible (consistent transport of the material must just beguaranteed)
- Selection of feed type according to application (e.g. needle feed, puller feed, top feed, gripper top feed, differential bottom feed)
- Selection of feed dog teeth according to upper material (e.g. fine teeth for fine materials, coarse teeth for heavy fabrics)

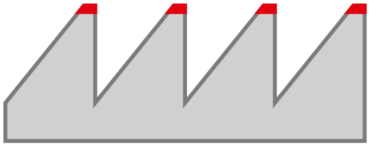
Fine feed dog teeth

Coarse feed dog teeth

- Adjust the lift of the feed dog so that the teeth protrude only about 1mm above the stitch plate
- Exchange of worn feed dogs (rounded teeth)



Functioning feed dog



Worn feed dog

- Plastic roller presser foot (gummed, smooth feed surface) for challenging materials

Plastic roller presser foot

- Use of teflon presser foot
- In case of seam constructions with several seams, the sewing direction should be kept the same (if feasible)
- Reduction of the sewing speed
- Use of hinged presser foot (only the presser foot must be moved in the rhythm of the feed lift, not the entire presser foot system)

TENSION PUCKER

IDENTIFICATION FEATURE

Puckers to the left and the right of the seam that disappear after cutting (unpicking) the stitches.

Tension pucker

There are two potential causes: thread balance and thread amount.

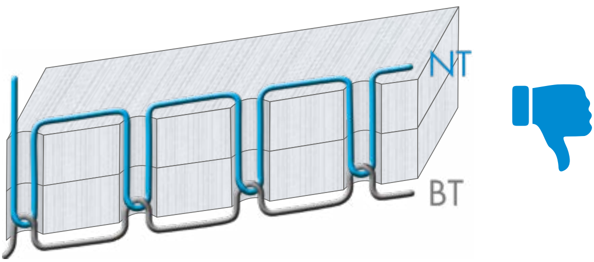
PROBLEM

Incorrect balance between needle thread and bobbin thread at lockstich

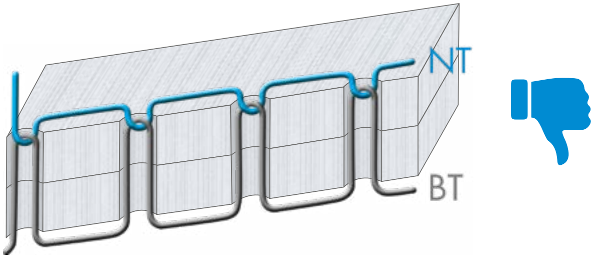
EXPLANATION AND SOLUTION

If one of the two threads (needle or bobbin thread) is significantly shorter than the other one, the stitch formation will be incorrect. Depending on the material characteristics, the seam gets clinched and puckers can emerge. The thread quantity must be allocated correctly.

Incorrect thread balance:

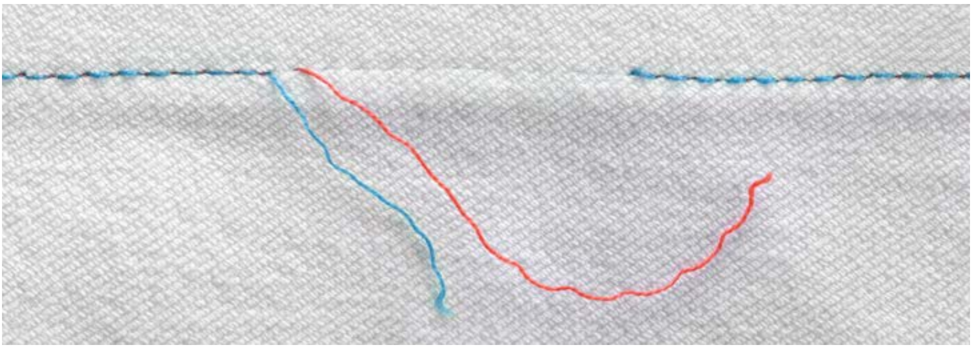


Needle thread tension (NT) too loose or Bobbin thread tension (BT) too tight



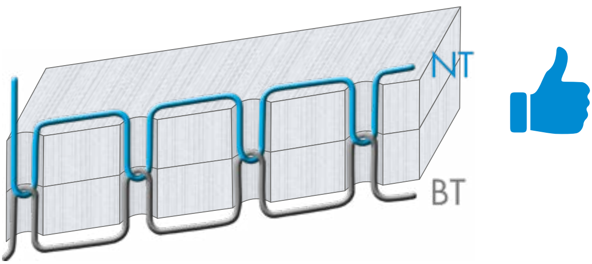
Needle thread tension (NT) too tight or Bobbin thread tension (BT) too loose

To check the thread balance, it is helpful to unpick one seam section. In case of an incorrect thread balance, one thread is considerably shorter than the other one.

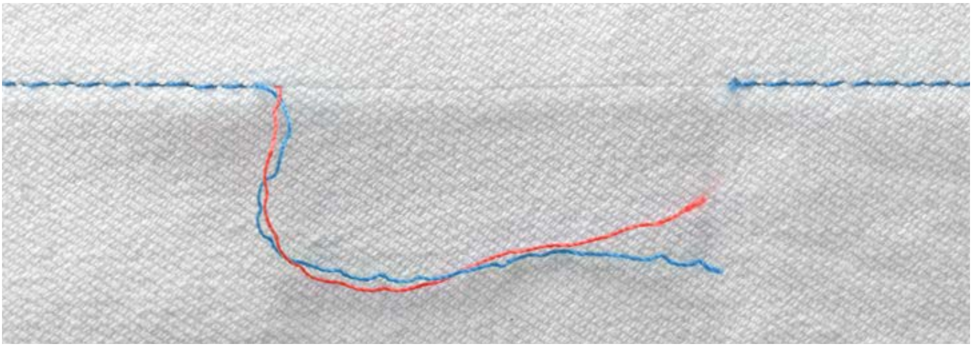


Thread balance after unpicking the seam – bobbin thread is too short

Correct thread balance:



Looping of needle thread and bobbin thread (NT or BT) in the centre of the material



Thread balance after unpicking the seam – both threads are equally long

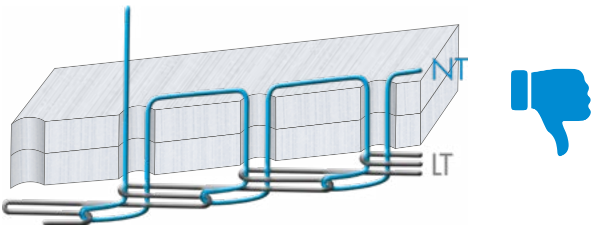
PROBLEM

Unfavourable needle and thread balance with double chainstitch

EXPLANATION AND SOLUTION

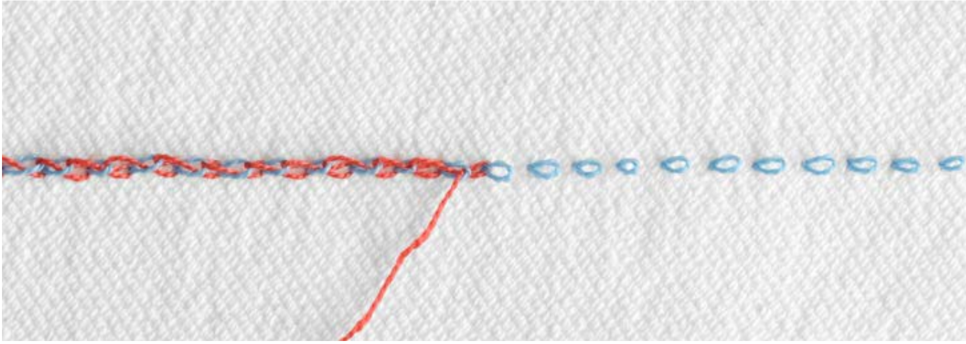
As soon as one of the thread systems is significantly shortened, there is no optimal stitch formation. Depending on the material characteristics, the seam gets clinched and puckers can emerge. The thread quantity must be allocated correctly.

Incorrect thread balance:

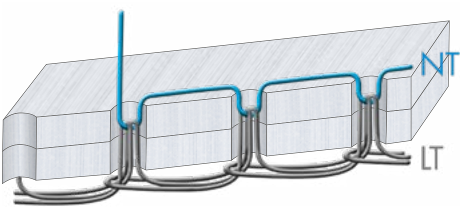


Needle thread tension (NT) too loose or Looper thread tension (LT) too tight

To control the thread balance, it is helpful to unpick one seam section. Where the needle thread is too tight, needle thread loops are clearly visible on the bottom side of the seam. Long loops are visible after unpicking the seam.

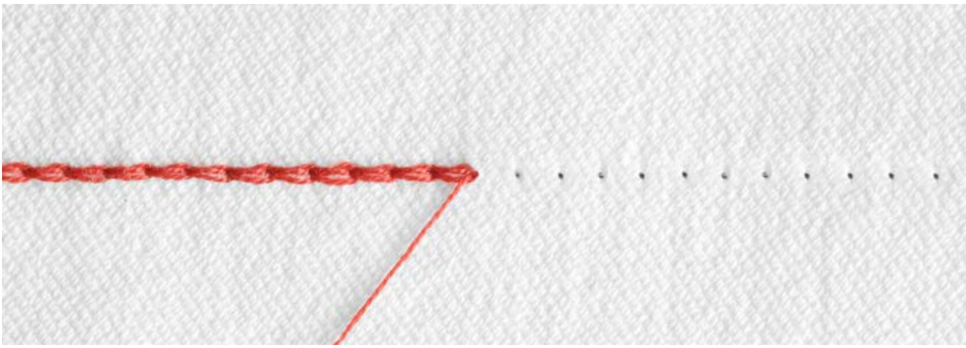


Thread balance after unpicking the seam – needle thread tension is too loose



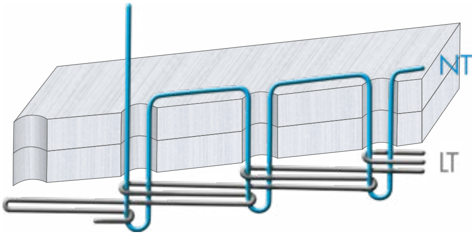
Needle thread tension (NT) too tight or Looper thread tension (LT) too loose

In case of a too tight needle thread tension, the needle thread loops disappear in the material after unpicking the seam, and are not visible anymore on the bottom side of the seam.



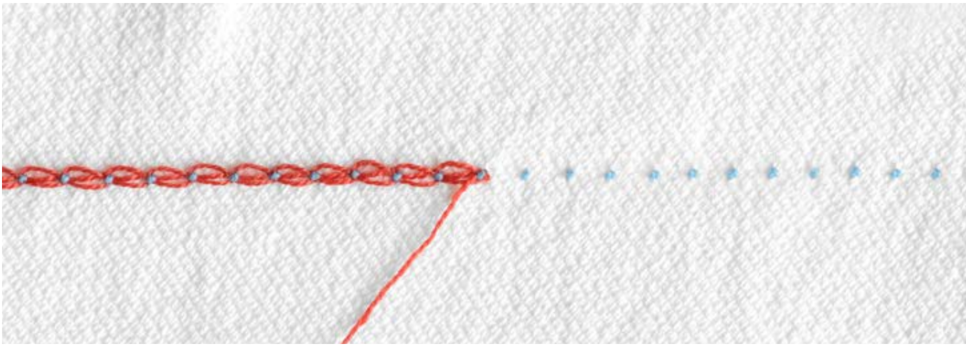
Thread balance after unpicking the seam – needle thread tension is too tight

Correct thread balance:



Needle thread forms a dot-like loop on the bottom side of the material through which the looper thread get easily pulled through when unpicking

In case of an optimal thread balance, the needle thread loops are visible as small dots (approx. 1-1.5 mm) after unpicking the seam.



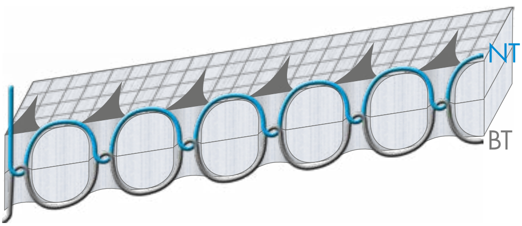
Ideal thread balance – thread loops are visible as small dots

PROBLEM

Amount of thread in the seam is not sufficient

EXPLANATION

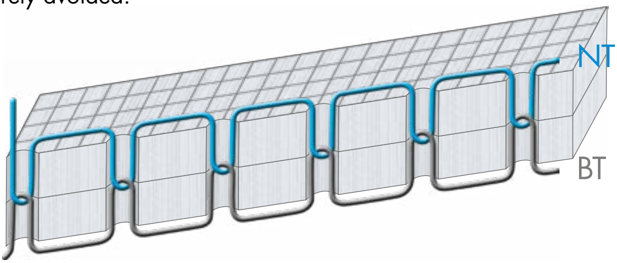
By overtightening the thread tension, the needle thread and/or underthread lie(s) too tightly within the seam. The total thread quantity is too little in relation to the seam section. This causes the puckers of the material.



Total thread amount is too low

SOLUTION

General rule: **"As little as possible, as much as necessary"**. To guarantee sufficient threadquantity in the seam, the thread tension of the needle thread and under thread needs to be set as low as possible. However, a certain minimum thread tension is necessary for a controlled thread guide. With extremely thin and delicate fabrics, often small waves cannot be entirely avoided.



Ideal thread position

For lockstitch machines, the following applies:

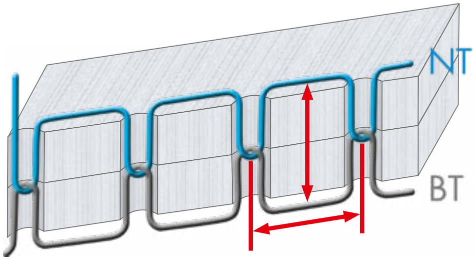
- Even winding of the bobbin thread spool with preferably low tension
- Adjust bobbin thread tension as low as possible (yoyo effect)
- Adjust needle thread tension accordingly
- It is recommended to regularly check the thread tension values. For this, simple and cheap spring scales (e.g. www.pesola.com) or specially developed thread balance measuring devices (e.g. www.hans-schmidt.com/EN/home) are suitable. The ascertained thread tension values depend on type, condition, maintenance and care of the machine.

PESOLA tension measuring device

Schmidt tension measuring device

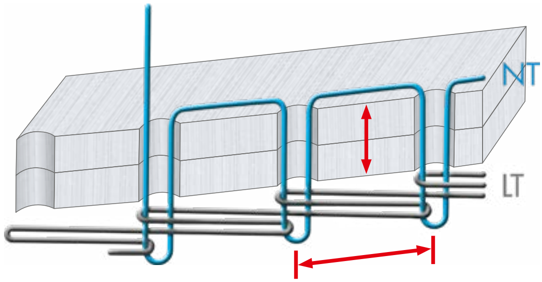
- To get an idea of the optimal thread quantity in the seam, the theoretical thread requirement per stitch can be calculated with the help of the following formulae. The results need to be consideredas approximate values.

FORMULA FOR LOCKSTITCH (301)



1 stitch = 2x length of the stitch + 2x thickness of the material + thread quantity for interlooping*

FORMULA FOR DOUBLE CHAINSTITCH (401)



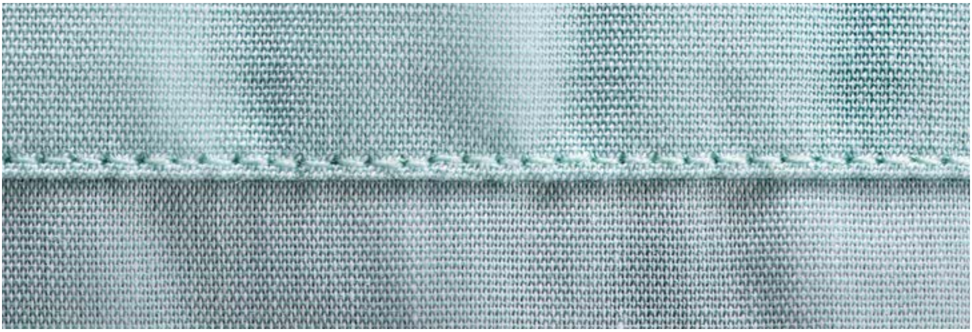
1 stitch = 4x length of the stitch + 2x thickness of the material + thread quantity for interlooping*

*variable, depending on the different parameters (e.g. sewing thread ticket, thread tension)

DISPLACEMENT PUCKER

DISTINGUISHING FEATURE

Puckers at the left and the right of the seam that do not disappear after cutting (unpicking) the stitches.



Displacement pucker

PROBLEM

Displacement of single warp threads and weft threads due to the needle penetration (without sewing thread). When using a sewing thread, this effect worsens.

Displacement pucker stitch holes

EXPLANATION

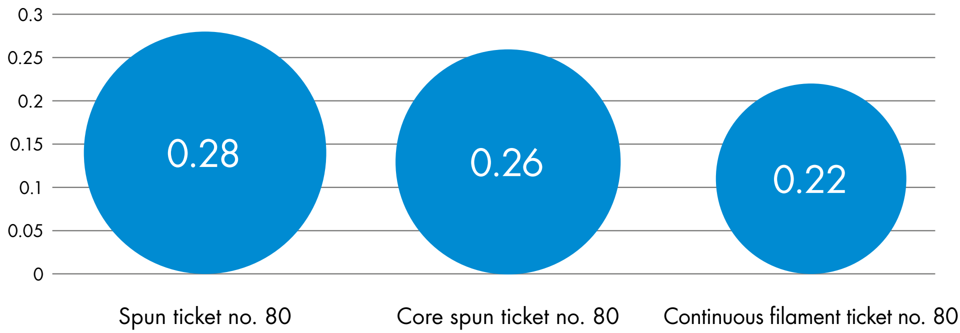
The extent of displacement depends on several factors:

- type of weave binding (due to their structure, plain weave fabrics are more prone to pucker than fabrics in satin (atlas) weave and twill weave)
- density of the fabric (the denser it is woven, the more susceptible it is for puckers)
- density of the stitches (the more stitches there are, the more visible is the pucker)
- needle size and thread strength (the thicker, the more visible is the pucker)
- fabric fi nishing (high-end processed fabrics, e.g. easy-care finish, allow only minimal movement of warp and weft threads)

While processing, displacement puckers usually cannot be completely avoided. Potentially, the optical interference can be reduced slightly with the following proposed solutions.

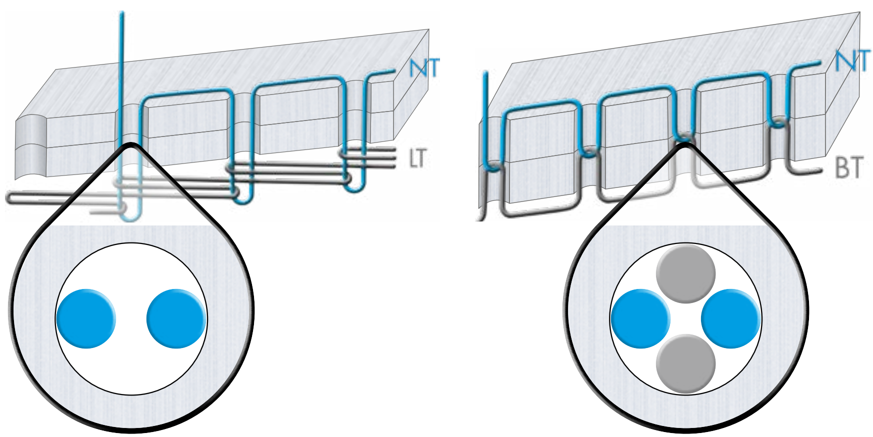
SOLUTION

- Thread strength as fine as possible, but suitable for application (usage of core spuns or continuous fi laments is better than the usage of spuns, because of the lower optical diameter, while showing a comparable breaking strength)



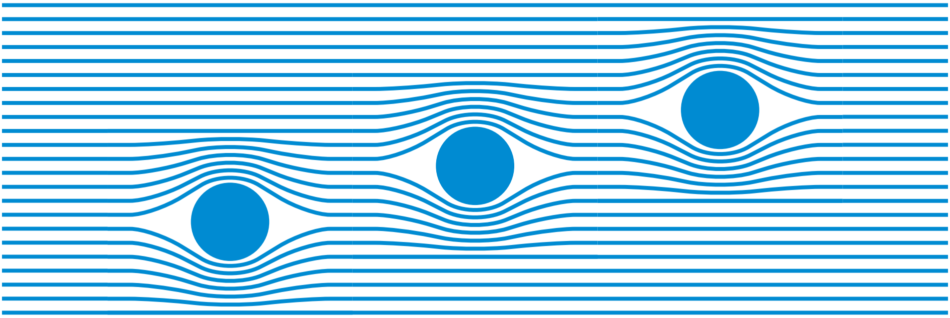
Comparison of the optical diameter with different construction types

- Selection of possibly fi ne needles according to the thread strength (by reducing the needle size by Nm 5, a visible improvement is already possible)
- Usage of suitable needle tips and blade types (possibly conduction of own needle tests, in regard of the different behaviours of the fabric)
- With regard to double chainstitch (stitch type 401), less warp and weft threads are displaced, because of the construction of the seam (looping of the thread on the bottom side of the fabric)



Stitch types (401 + 301) as a factor of influence

- Balanced stitch length (the fewer the needle holes, the lesser the displacement; but: consider the seam strength!)
- Turn of the seam line by approx. 5° off the grain so that the fabric displacement splits up to several warp and weft threads)



Displacement pucker – crooked seam line

- Rotation of the pattern by 90°, so that the straight grain proceeds in weft direction (the fabric density in weft direction is usually lower, thus, the seam line maybe contains less puckers in this direction)

FURTHER CAUSES OF PUCKER

Besides the most important types of pucker, which were explained in detail on the previous pages, various processing parameters may have negative influence on the appearance of the seam. A selection of these potential influencing factors is listed below:

HANDLING

- An uneven feed during sewing can lead to the appearance of undesired puckers along the seam. Manual processes are subjective and therefore not reproducible. It may be helpful to use mechanical supplementary equipment, which can be provided according to the machine type and machine class of the machine manufacturer.
- Compared to the permanent mode of the sewing machine, the seam pattern can be different during “sewing on”. Hence, it is recommended to maintain a possibly even sewing speed. On the other, stop-and-go-sewing should be avoided.

MACHINE SETTING

Another aspect to be focused is the adjustment between machine and material. A slightly puckered seam may occur, if the top puller feed is either set too slow or set to fast. Also during piping or the sewing in of zippers, it gets obvious, if the piping tension was set too tight. See also following picture.

Machine setting – piping is too tight

PROCESSING PARAMETERS

Certain fabrics that are prone to pucker cannot tolerate multiply topstitched seams. In this case, the factors tension pucker and displacement pucker influence each other, and thus, they increase. The only chance to achieve a calm seam appearance is to not stitch any topstitch seams. See also following pictures.

Processing parameters – multiply topstitched seam

PATTERN-MAKING

- With incongruent seam lines, such as the princess seam or the seam of a sleeve insert, it is technically impossible to achieve pucker-free topstitch seams. In this case it makes most sense to spare the topstitch seams. Wherever they are still desired, it is recommended to place the topstitching as close as possible to the closing seam, where the additional width of the fabrics is still possibly low.

Incongruent seam line sleeve setting seam

- The same applies with hems on curved cut edges (e.g. curved hems etc.). In such a case, it can be an option to join the edges with a matching, to achieve pucker-free seams.

Diagonal pull at rounded hem

MATERIAL CHARACTERISTICS

If seams puckers occur due to the properties of the upper fabric, such as density, weave, raw material or fi nish, it is strongly recommended to conduct sewing tests prior to production. This is the only way to determine, if this respective material can be processed according to the desi-red appearance.

Material characteristics with Taffeta

Material characteristics with with wool fabric

To achieve the best possible sewing result, it is recommended to conduct individual tests (e.g. regarding the correctly chosen thread tension and thread balance) first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.


NEEDLE
THREAD
TENSION

CHAPTER OVERVIEW

MEASURING OF NEEDLE THREAD TENSION

In the previous chapters, the thread balance of the most important stitch types was discussed. First it was shown, how a poor thread balance can be detected by opening (unpicking) a seam. By adjusting the thread tension, the thread balance was able to be corrected. Now, it is necessary to make the ideal thread tension measurable by concretely determining it with a thread tension measuring device on the sewing machine.

There are two common measuring devices (www.hans-schmidt.com; www.pesola.com), although the PESOLA thread tension measuring device is more handy and much cheaper. In the following, the correct application of the PESOLA device is shown.

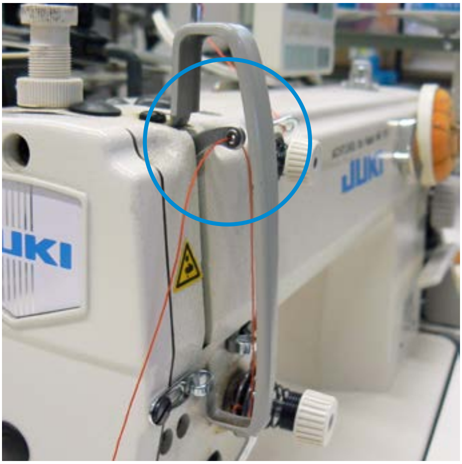
PESOLA tension measuring device

PREPARATION

The sewing machine must be threaded correctly.

The cones/spools must be correctly placed on the spool stand, possibly with spool plate.

The spool stand must be adjusted correctly. This means that the first thread guide of the spool should be exactly placed above the center of the spools.



The take-up lever must be at the upper turning point.

With machines with a thread trimmer, the take-up lever usually automatically remains at the upper turning point after the trimming process.

With machines without positioning and thread trimmer, the take-up lever must be brought to the upper turning point via the hand wheel.

The thread needs to be slightly struck off over the thread guiding in the take-up lever and needs to be fixed in the thread clamp of the tension measuring device.

The thread must fit tightly in the thread clip and must not slip if the thread is pulled through afterwards.

A knot or a loop can possibly help with “fixing” the thread.

CONDUCTION

Now, at the position of the take-up lever, the tension measuring device is evenly pulled in horizontal direction to the left (away from the take-up lever).

The tension measuring device must be held as shown on the picture.

During this movement, the current thread tension (in cN) can be read off.

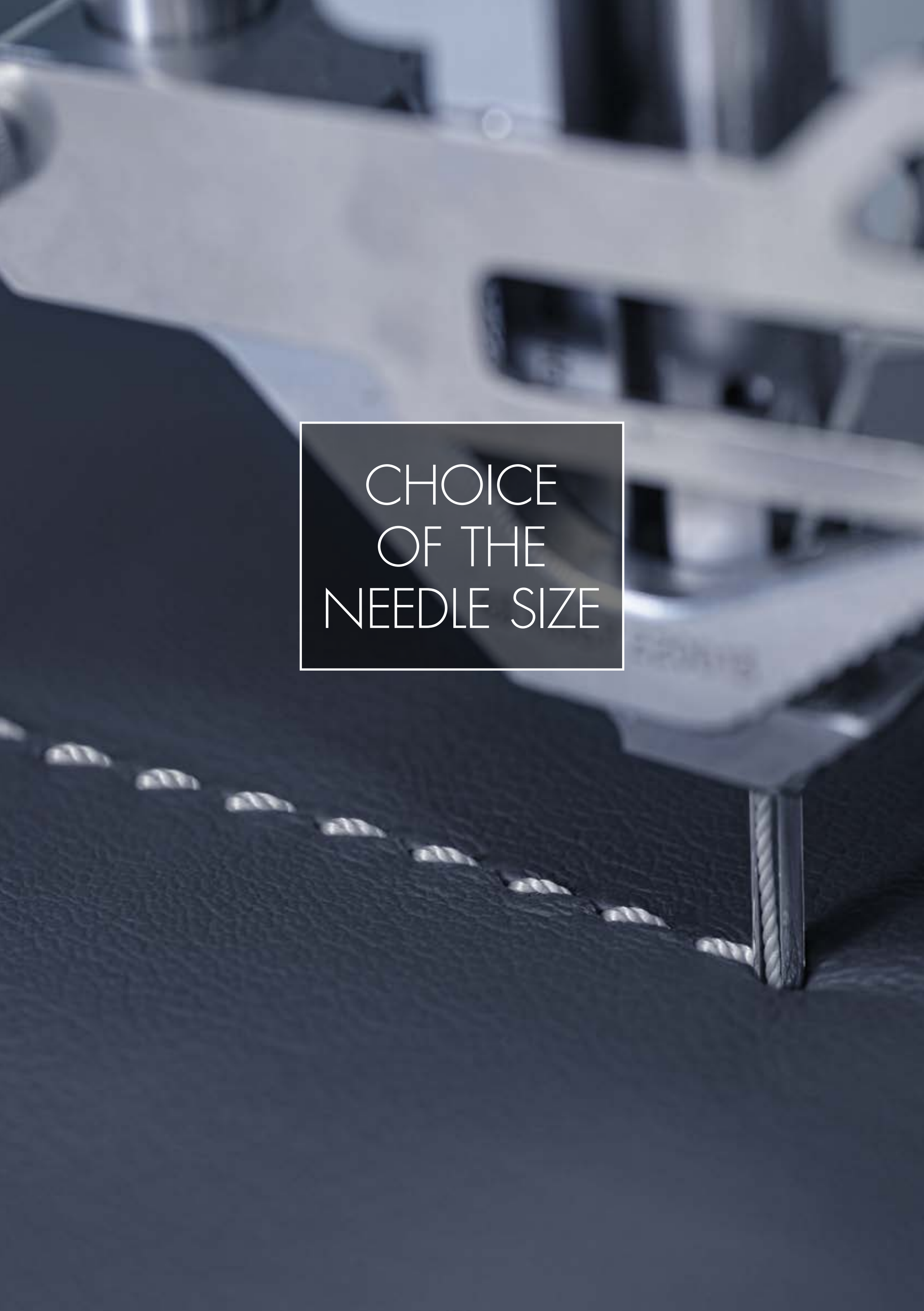
REMARKS

According to the machine, sewing material, layer height, and needle size, different thread tension settings can be required. Different ticket sizes require different thread tension settings (this means, the thread tension for Saba 80 differs from the tension figure of Saba 30).

The determined thread tension figures can only be transferred between the same machines (manufacturer and class/type). The ideal thread tension of a seam depends on the requirements of the seam (e.g. optics, strength, etc.) and is always an interaction between needle thread tension and lower thread tension.

With sewing threads that have a textile character (e.g. Saba), the indication of the thread measuring device usually fluctuates, because of the structure of the surface.

With sewing threads that have a very smooth surface (e.g. Serafil), the fluctuation on the display is very low.



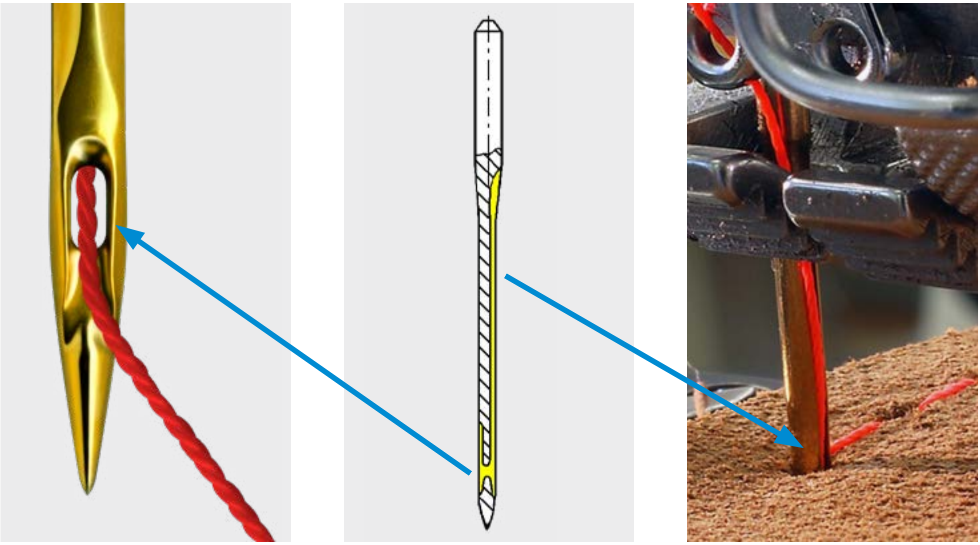
CHOICE OF THE NEEDLE SIZE

CHAPTER OVERVIEW

Beautiful seams are not achieved by chance. They are the result of correctly chosen sewing parameters. Choosing the correct needle size, corresponding with the thread, will result in a beautiful seam with correct thread balance. There are technical parameters that need to be known before the needle size is chosen.

THE NEEDLE

The parts of the needle which have to match the sewing thread thickness are:
- the needle eye (the thread must fit through the needle eye)
- the long groove (the thread must fit into the long groove, since it protects the thread during the recurring motion while sewing)



Needle eye | Blade | Long groove

BASIC RULE FOR NEEDLE SIZE – SEWING THREAD RATIO

In Europe, the needle size Nm is common and gives the diameter of the needle in 1/100 millimeters. This means, a needle with size Nm 100 has a diameter of 1 mm at the blade.

INFLUENCE ON THE SEWING PERFORMANCE

With standard needles, the diameter of the needle eye/long groove is about 40% of the blade diameter. This means that the thickness of the thread should be less than 40% of the blade diameter in order to not damage the sewing thread while it moves through eye and material. In this manner, **a good sewing performance** will result.

INFLUENCE ON STITCH FORMATION AND THREAD TENSION SETTING

Beside the sewing performance, the stitch pattern and the thread tension setting are also affected by the needle size. The needle creates space for the stich to interlock within the material, especially with hard materials, such as leather, thick fabrics, fine knitted and woven fabrics, or materials with surface finishing (e.g. imprinted surfaces). Unfortunately, these materials often show a high tendency to material damage (e.g. fabric damage, material damage), because of the needle penetration. To avoid or reduce such damages, it is required to use preferably small needles. However, they must match the desired thread sizes.

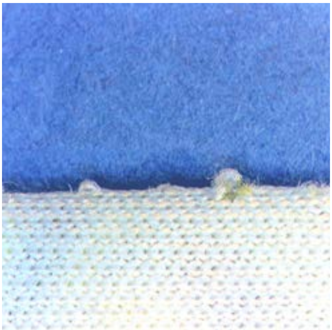
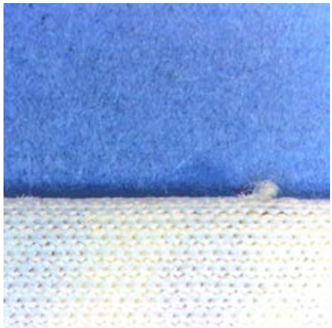
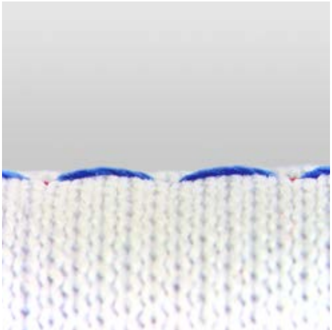
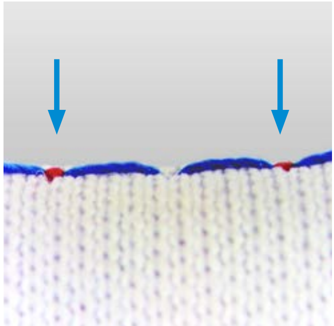
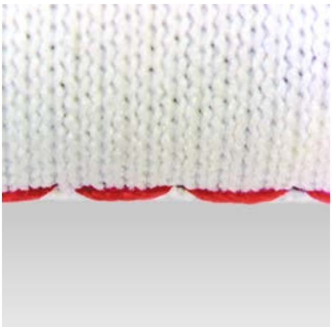
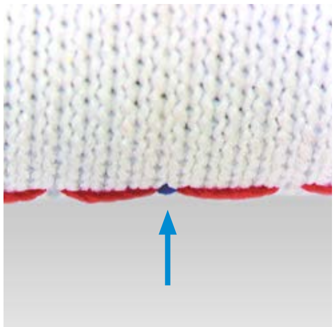
What happens, if a very small needle is chosen to avoid material damages and therefore, the desired sewing thread does not match the needle size anymore?

EXAMPLE

Outer fabric:	finely woven knitwear
Stitch type:	lockstitch (stitch type 301)
Sewing thread:	Saba 80 (thread diameter: approx. 0.26 mm)
Matching needle size:	Nm 90–100 / Size 14–16
Used needle size:	Nm 70 / Size 10 (needle diameter at blade: 0.7 mm)

PROBLEM

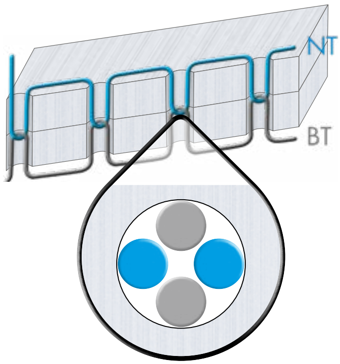
For visual reasons, Saba 80 has been chosen and needle size Nm 90–100 is necessary. However this needle has been found to cause material damage, so a smaller needle has been used, but the result is an irregular stitch pattern.

	Nm 80 (size 12) SES	Nm 70 (size 10) SES
Material damage in lateral view of the seam		
Upper view of the seam		
Bottom view of the seam		

EXPLANATION

- Dense materials yield only slightly in the stitch hole area, thus, there is very little space for the stich to interlock within the material.
- The needle only creates a small stitch hole with a diameter of 0.7 mm.

- The stitch interlocking of needle thread and bobbin thread with lockstitch means: Sewing thread diameter × 4, i. e. stitch interlocking diameter of 1.04 mm.

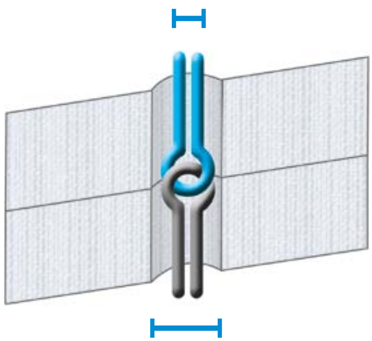


Horizontal
cross section

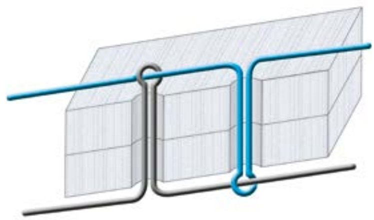
Cross section of stitch interlocking with lockstitch

- The stitch interlocking is thicker (1.04 mm) than the diameter of the stitch hole (0.7 mm).

Stitch hole created by the needle:
Ø 0.70 mm



Diameter of stitch interlocking of 1.04 mm –
due to sewing thread diameter of 0.26 mm



Stitch interlocking with lockstitch (stitch type 301)

Insufficient thread formation

FOLLOWING THE PREVIOUS POINTS:

- A very high thread tension is required, to pull the stitch interlocking into the small stitch hole of the needle.
- This leads to an irregular stitch pattern/stitch formation, because either the knot gets stuck on the bottom side of the material, or, due to the high thread tension, it slips through to the upper side of the material. It will rarely be possible to place the knot in the centre of the material.
- The seam may pucker due to the high thread tension.
- In extreme cases, thread breakage and/or skip stitches may occur.
- The unequal stitch formation can affect the seam elasticity and seam strength negatively.

SUMMARY

If needle size Nm 80 is used, material damages will occur with almost every stitch. However, the stitch pattern is equal and the stitch interlocking happens in the centre of the outer fabric. If the finer needle size Nm 70 is used, damage can be significantly decreased. Certainly, it leads to an uneven stitch pattern, because the stitch hole of the Nm 70 needle is not big enough and the knots lay both on the upper side and also on the underside of the outer fabric. A central placement of the stich interlocking is only possible with an increased thread tension, which can hardly be achieved in practice. If the coarse sewing thread must be used, there is no solution to this problem with very difficult or delicate materials. Hence, there is the choice between:

Small needle and no damage – but an uneven stitch pattern!	or	Bigger needle and material damage – but an even stitch pattern!

Only choosing a finer sewing thread can help to avoid material damage and to achieve an even stitch pattern.

CONCLUSION

It is recommended to check the outer fabrics regarding material damage before the production begins. For example, it is possible to sew with different needle sizes over two layers of the outer fabric and to subsequently check and assess the stitch holes that are caused by the penetration of the needle with the help of a magnifying glass for damages. As soon as it is clear, which needle size can be processed damage-free, a sewing thread that matches the needle size needs to be selected. As mentioned earlier, it is not useful to use rather coarse sewing threads in combination with fine needles.

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.


SEAM
SLIPPAGE

CHAPTER OVERVIEW

Seams sometimes give way completely, even though the stitching remains intact, and a hole in the seam results. If an undesired opening suddenly occurs under tensile load in the seam area of the fabric, the problem is "seam slippage", which can be seen on the following pictures.

Seam slippage

CAUSES FOR SEAM SLIPPAGE

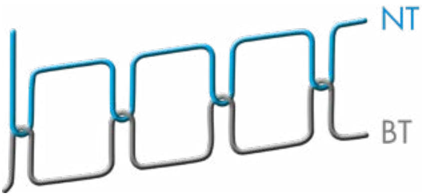
The cause for this occurrence is not, as often assumed, the seam or the sewing thread, but the fabric itself that shows poor seam slippage behavior. This means that the warp and weft threads of the fabric only have little adhesion towards each other and thus, shift each other. The cause for this can either be the fabric finishing (e.g. special anti-slippage finishing), or the construction of the fabric (e.g. linen weave, twill weave, satin weave). These parameters can only be optimised by the fabric manufacturer.

Poor fabric slip-resistance

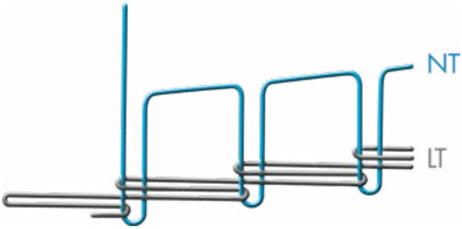
POSSIBLE SOLUTIONS

Within the context of a testing procedure that was specially developed by AMANN, different processing parameters were tested and compared with fabrics that tend to seam slippage regarding their effect on seam slippage. The seam strength recommendations of Euratex TCG (Technical Clothing Group) and DTB Produktinfo (Dialog Textil Bekleidung) served as the basis for this testing procedure. In none of the cases, the desired level of strength could be achieved. With the following measures, seam slippage may be minimised.

1. Use of a suitable stitch type:

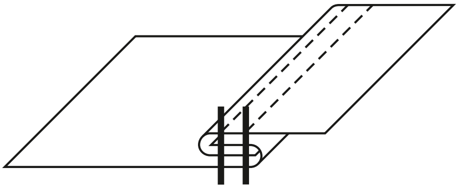


Stitch type 301

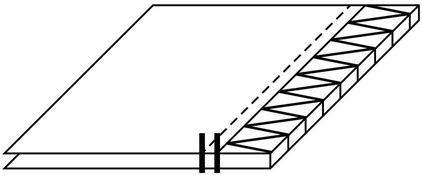


Stitch type 401

2. Use of a suitable seam type:

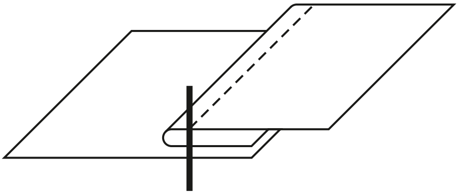


Double felled seam

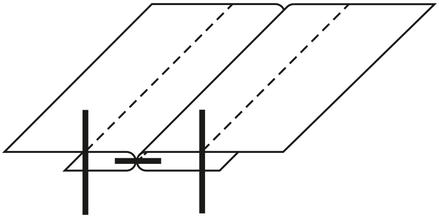


Safety seam (Stitch type 401+504)

3. Secure closing seams by additional topstitching or, e.g.:



Folded seam allowance on one side
and topstitch



Unfold seam allowances and
topstitch on both sides

4. Before sewing, bonding of the seam line with an inlay

Bonding of the seam line with an inlay

- **Seam allowance** of at least 1 cm width
- **Stitch density** of at least 4 stitches/cm / 10 stitches/inch
- Possibly additional **serging** of the individual layers as a protection for the seam edges

These measures my affect the feel of the seams, their appearance, and lead to increased production costs.

SUMMARY

The cause of seam slippage is usually in the fabric and can be only corrected in collaboration with the fabric manufacturer. With further working steps and ideal processing parameters, the seam grinning can be maybe slightly improved, but not fully eliminated. Moreover, it needs to be considered that any additional production efforts also lead to higher production costs at the same.

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

OVEREDGING

CHAPTER OVERVIEW

In practice, overedging is given little attention, but it does serve an important function and determines the appearance of the inside of the garment.

There is barely any textile that does not require overedging. Apparel, home textiles or even some technical textiles require overedging to prevent the edges of the sewing material from fraying. Finest silk fabrics, coarse denims, tight sportswear or technical filters – as different as the material and the products are, as different are also the requirements for perfect overedging. The choice of a matching sewing thread is also important as it has a bearing on the final appearance.

CHOICE OF THE PROCESSING PARAMETERS

STITCH TYPES

For classic overedging, this means the protection of the edges of the sewing material from overedging, the following stitch types are suitable:

2-thread overedging:

2-thread overlock stitch interlooped at needle hole
(stitch type 502)

2-thread overlock stitch interlooped on edge
(stitch type 503)

3-thread overedging:

3-thread overlock stitch interlooped at needle hole
(stitch type 504)

3-thread overlock stitch interlooped on edge
(stitch type 505)

In practice, mostly the stitch types are used that are interlooped at the needle hole (stitch type 502 and 504). The penetration of the needle thread loop directly at the stitch hole brings along advantages for the correct thread balance and smooth processing of the edge of the sewing material without the edges rolling in. Most common is 3-thread overedging (stitch type 504). The stitch formation with three threads offers best conditions for a perfect stitch pattern, even with difficult thread qualities. 2-thread overedging is often used on the assumption that it reduced the meterage of thread required, however, the difference is actually minimal: provided that stitch density and seam width are similar, stitch type 502 requires only approx. 10% less sewing thread than stitch type 504 (see also chapter Stitch types & sewing thread requirement).

Overedging is usually done as single process along with the manufacture of the joining seam. For this, the 4-thread overlock stitches, stitch type 512 and 514, or the classic safety seam (stitch type 401 and 504) are possible options (see the following images). In these cases, the durability and the seam strength of the closing seam must be primarily guaranteed. This usually means an increase of the stitch density by at least 4 to 6 stitches per cm (depending on application).

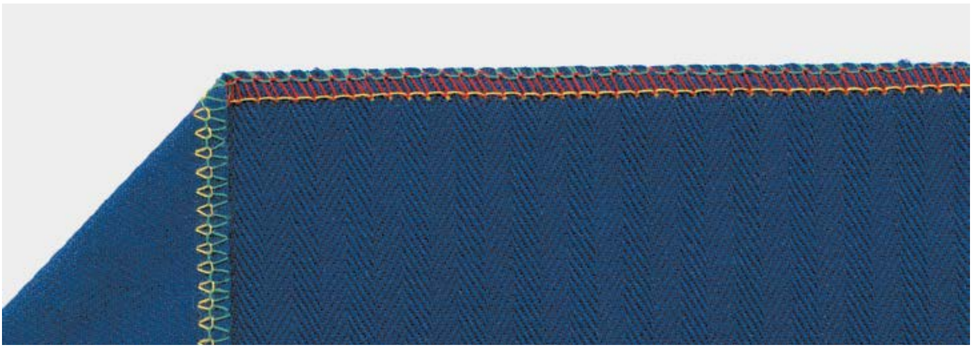
4-thread overlock stitch (imitated safety stitch)
(stitch type 512)

4-thread overlock stitch
(stitch type 514)

For all previously mentioned stitch types that are suitable for overedging, the following sewing parameters can be chosen individually.

THREAD BALANCE

The correct thread balance of needle and bobbin thread is important to achieve a good over-edging appearance. In practice however, the serging seams neither feature interlooping at the needle hole nor on the edge, but something "in between". Thus, the seam seems untidy. Moreover, this may promote that the seams get pushed through during ironing.



Poor thread balance with stitch type 504

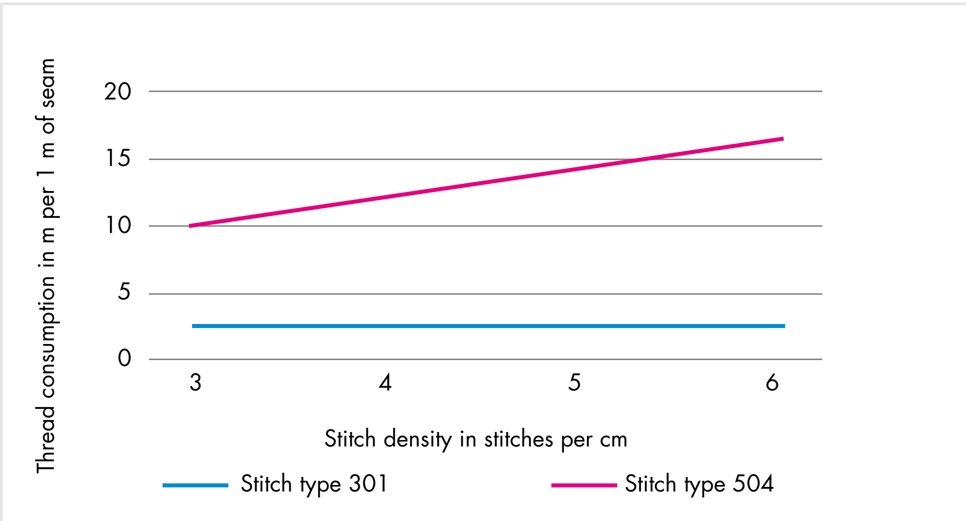
STITCH DENSITY

The stitch density determines the degree of coverage of the raw edge. Within the apparel sector, a stitch density of 4 stitches/cm is standard. Fabrics that tend to fray a lot, often require an improved cover and consequently a higher stitch density. The same can also apply for garments that undergo an intensive industrial washing after production. In this case, field trials are required to give indication of the required edge protection. Unproblematic fabrics can also be overedged with a lower stitch density.

Upholstery fabrics are often overedged with a stitch density of 2.5 – 3 stitches/cm. For fine curtains however, a stitch density of 4 stitches/cm is customary in practice. For technical textiles, there is no universal standard due to the huge variety of products and materials.

The stitch density affects the thread consumption and thus also the sewing thread costs. A change of the stitch density from 3 to 4 stitches/cm increases the thread requirement by approx. 20%. Here, among others, it is required to balance the quality requirements (e.g. ideal covering effect) with the financial guideline.

The following graph shows the influence of the stitch density on the thread consumption with the common serging stitch type 504 in comparison with stitch type 301 that is used for closing seams.



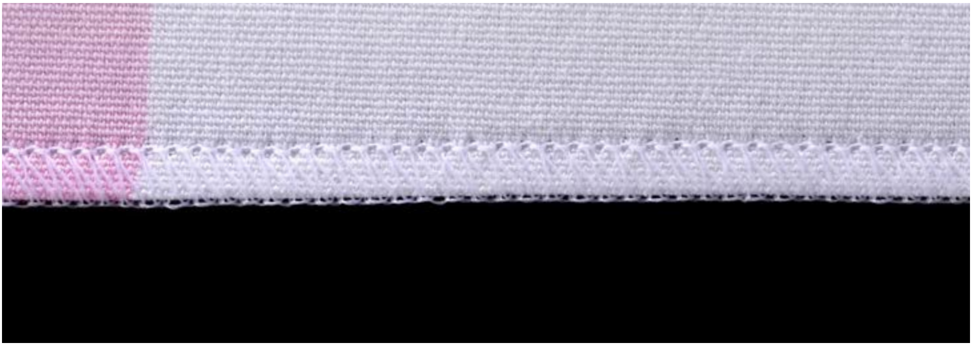
Influence of the stitch density on the thread consumption

Samples on garments often show varying stitch densities with the different seam positions. Beside the unattractive appearance, the exact sewing thread disposition gets more complicated.

SEAM WIDTH

The seam width is determined by the machine model. 5 mm are a common standard. According to the rule of thumb "As wide as necessary, as tight as possible", this measure has become established for all overlock stitch machines. The seam must be wide enough to guarantee safe edge covering without fraying. On the other hand, the seam must be tight enough, to keep seam presence and thread consumption as low as possible.

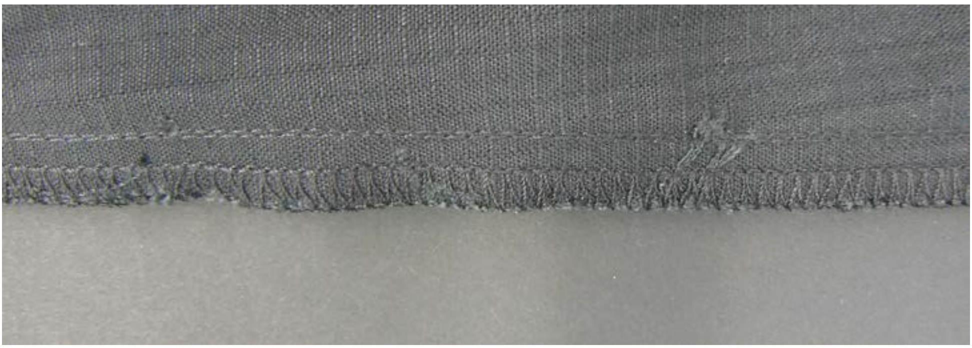
There is no rule without an exception: with a rolled hem (with stitch type 504), the seam width usually contains only 2 mm.



Rolled hem

KNIFE

Fabrics that are very solid, but also materials that tend to fray a lot require a sharp knife on the overlock stitch machine otherwise the result is very unattractive. Consequently, it is important to ensure proper and sharp knives.



Uneven seam allowance through blunt knife

CHOICE OF THE SEWING THREAD

There is more than just one good choice. But how can the respectively best result be achieved? The following criteria serve as a guideline for the choice of the correct sewing thread:

APPEARANCE

The interior appearance is determined by the sewing thread size and construction. Fine continuous filaments create almost invisible filigree seams, which is especially desired with fine fabrics. Whereas, texturised continuous filaments and microfilaments ideally cover the seam edge due to their voluminous character. With fraying materials especially, this is very useful. Core spuns can be used for closing and topstitch seams, as well as for overedging and thus, offer the advantage of being universally applicable – cue: one thread concept.

SEAM HAPTIC

With sportswear and other fitted articles, it is mostly the seam softness requirement that determines the sewing thread concept for overedging. Because of the individual material properties, there is no universal recommendation for “soft seams”. In this case, only seam comparisons can help to find the best solution. In doing so, all potential sewing thread concepts and sewing parameters should be tested. More information regarding the topic “soft seams” can be found in chapter Elastic & soft seams.

BEHAVIOUR DURING PROCESSING

Not all sewing thread types are equally suitable for all overlock stitch machines, and not all sewing thread types are equally suitable as needle and bobbin thread. This has consequences on the sewability and the sewing safety. Texturised continuous filaments (also called bulk yarns) are more open, their surface is less compact due to their open construction. Regarding the stresses during sewing, especially for the sewing thread, this can have negative effect. Therefore, in practice, bulk yarns are often used as bobbin threads in combination with core spuns as needle threads.

Furthermore, the properties of the chosen sewing thread have influence on the transport of goods in production. Due to their open structure, texturised continuous filaments are more prone to get stuck (e. g. on rough surfaces). These individual filaments that are pulled out of the thread are called pulled threads and should be considered when the sewing thread concept is chosen.

Pulled threads

Beyond, overedging must not create issues during ironing. Delicate, fine fabrics can be affected by ironing marks. The seam presence and consequently the propensity towards ironing marks depend on the sewing thread type, sewing thread size, as well as on the fabric and the processing parameters. With critical fabrics, it is recommended to conduct tests to figure the best sewing thread choice prior to production.

During processing, articles that can be washed put high requirements on the function. In this case, the overedging must not be damaged during the (industrial) washing process (e. g. for leasing articles) which involves high mechanical stresses during laundry.

FUNCTIONALITY DURING USAGE

Overedging fulfills the function to protect the edges of the sewing material against fraying. Following the rule of thumb "the greater the covering effect, the higher the protection", it gets clear, that this task cannot be fulfilled equally well by all sewing thread types. Voluminous bulk yarns inevitably cause a better covering effect than filigree continuous filaments or core spuns. Depending on the quality of the fabric, this means based on the propensity for fraying, this criterion has different importance. With fraying products, this criterion itself can determine the choice. With fabrics that hardly tend to fray, this criterion has no meaning.

The already mentioned propensity towards ironing marks of serging seams also matter in regard of the future use.

COSTS

Besides seam haptic, appearance and function, the different sewing thread concepts for overedging also differ in terms of costs. Bulk yarns are naturally cheaper than twisted threads, due to their simple manufacturing process. Because of their high thread consumption, the serging seams make up the largest part of the total thread consumption. Therefore, the influence of the costs for serging seams on the total sewing thread costs are accordingly high. However, in comparison to the remaining costs of a garment, the sewing thread costs only form a small part of the entire costs. Hence, a change to high-quality overedging usually only leads to a minimum increase of costs.

Beside the procurement costs, the production performance must be considered for a correct cost estimation. Here, the sewability and the cost of any re-work required is of great importance and has crucial influence on the productivity.

The limitation of the sewing thread colours for serging seams, e.g. to four basic colours, can have cost-saving effect. Less colours mean less disposal effort, lower stocks, higher productivity through rarer colour changes on the sewing machine, and possibly lower procurement costs through larger order quantities. However, in such a case, a poorer colour matching of the serging on the sewing material must be accepted. For some producers, this is unimaginable, whereas for others, this is acceptable or even a desired design aspect.

If the amount of colours shall be restricted, serging with fine continuous filaments, such as Serafil fine 300 (200/2), offers advantages: the so-called semi-transparency of this sewing thread size ensures the best possible colour matching of the serging on the sewing material. This capability is often aptly described as chameleon effect. Because of this, minimising the colour range in the production plants is possible, especially with serging seams. With a colour range of four to five colours, most colourful fabrics can be processed.

The Serafil colour card contains several colours that are especially geared to cover a large range of colours.

Colour no.	Colour		Colour of the outer fabric
1000	Natural white		all white shades, light pastel, very bright colours, uni or patterned (e.g. bright beige, grey, green, blue)
326	Light beige		light through to medium colours, uni or patterned (e.g. light beige, grey, blue)
329	Dark beige		stronger, darker colours, uni or patterned (e.g. strong grey, brown, blue)
4000	Black		all dark colours

For very brilliant and plain fabrics, such as bright red, lemon yellow, brilliant blue, pink, neon orange, etc. A matching colour should be selected according to the respective requirements and standards. Example on a patterned fabric: Due to its delicacy, the sewing thread (Serafil fine 300 (200/2), colour 326) seemingly takes on the colour of the surrounding material. The reflective characteristic of the sewing thread perfectly adapts itself to the transparent, shimmering look of the fabric.

"Chameleon" effect

SEWING THREAD CONCEPTS FOR OVEREDGING

The following table gives an overview on the sewing thread concepts, as well as a description of their properties.

Construction and raw material of the sewing thread	AMANN article	Characteristics
Polyester/polyester core spun	Saba 150 Saba 120 Saba 100 Saba 80	• very good sewability with highest sewing safety • accurate seam appearance • robust, "resilient" (advantageous for washable articles) • usable as needle and bobbin thread • potential for 1-thread concept (closing and serging seams with the same thread)
Polyester continuous filament	Serafil fine 180 (120/2) Serafil fine 300 (200/2) Serafil fine 420 (300/2)	• filigree, fine • ideal for finest fabrics • chameleon effect • less seam presence • usable as needle and bobbin thread
Polyester continuous filament texturised	Sabatex 100 Sabatex 120 Sabatex 250	• soft, voluminous, covers well • economic procurement • mostly usable as bobbin thread, as a needle thread of limited suitability
Polyester microfilament texturised	Sabasoft 120	• extremely soft • voluminous, covers well • usable as bobbin and needle thread

Further details regarding the mentioned sewing thread types, constructions, raw materials and quality features can be found in chapter Sewing thread construction.

Different appearances of different sewing thread concepts

APPLICATION EXAMPLES

There is no perfect way to achieve good overedging. Often, different sewing thread concepts are functionally suitable. Serging with texturised threads or continuous filament threads is very different, nonetheless, both options may be the correct solution for the same task. In this case, the determining factors for the choice are the desired appearance, the application field and the costs. Typical solutions and established concepts are shown in the following table:

Application	Main focus	Stitch density	Needle thread	Bobbin thread
Lingerie	Covering	5 stitches/cm	Sabatex 120	Sabatex 120
	Soft	5 stitches/cm	Sabasoft 120	Sabasoft 120
Jeans	Robust	4 stitches/cm	Saba 80	Saba 80
Classic HAKA trousers	Filigree	4 stitches/cm	Serafil fine 180 (120/2)	Serafil fine 180 (120/2)
Silk blouse	Fine & noble	4 stitches/cm	Serafil fine 300 (200/2)	Serafil fine 300 (200/2)
Mattress plates	Economic, efficient	3.5 stitches/cm	Topfil 80	Texturan 120

SUMMARY

There is barely any seam that offers as many possibilities for the sewing thread selection, as overedging. The serging should individually match the material, model, application field, as well as the desired appearance and function. Thus, overedging provides the interior with an attractive appearance and is an indicator of quality of manufacturing. It makes sense to look at all the available options for overedging.

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

For overedging, the following products from the AMANN range are recommended: Serafil, Serafil fine, Saba, Sabatex, Sabasoft, Texturan, Topfil

EMBROIDERY BASIC KNOWLEDGE

CHAPTER OVERVIEW

Embroidery can make all the difference – enhancing a product and giving it a personal touch. The threads used are not just a means to an end – depending on their quality, they can be an important design element. Diverse, high-precision embroidery techniques are also becoming increasingly important in technical areas, where they fulfil numerous functions. As extensive the range of applications, as high the demands on the colour and quality of the threads. Creativity and productivity are given free rein with our range of AMANN embroidery threads.

In this chapter, the most essential components to achieve a successful embroidery are introduced: stitch types, digitizer, embroidery machine, backing and needle.

STITCH TYPES

Embroidery machines generally work with lockstitch (stitch type class 301). In this case, there are three different **stitch types**:

RUNNING STITCHES

Running stitches proceed linear, one after the other – just like a conventionally sewn seam. They may become shorter or longer and their thickness can be emphasised by multiple overstitching.

SATIN STITCHES

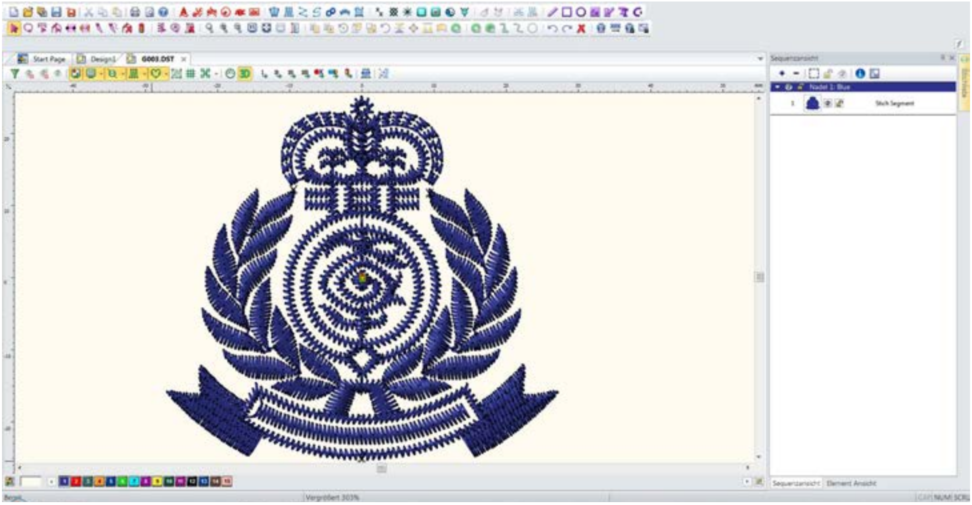
Satin stitches are closely spaced zig-zag stitches, and both their width and density can be altered to create the desired effect. This makes the satin stitch the most versatile of all embroidery stitches. The use of large underlay stitches can create texture and relief.

FILL STITCHES

Fill stitches fill surfaces. Depending on the stitch rhythm and frequency, the surface can have an increased or decreased glance and show relief-like structures. Selecting the correct stitch length can help to reduce the number of stitches required, thus reducing production time.

THE DIGITIZER

To visualise an embroidery, the digitizer needs to set the desired object into a digital format. It arranges the embroidery pattern from the above described three stitch types and sets it up. It is important to know the embroidery materials and customer wishes to use in order to set the correct parameters. The skills of the digitizer are crucial to the quality of the embroidery. For example, stitches that appear to be different shades can be created by varying the stitch length or direction.



Digitizing programme by Zündt®

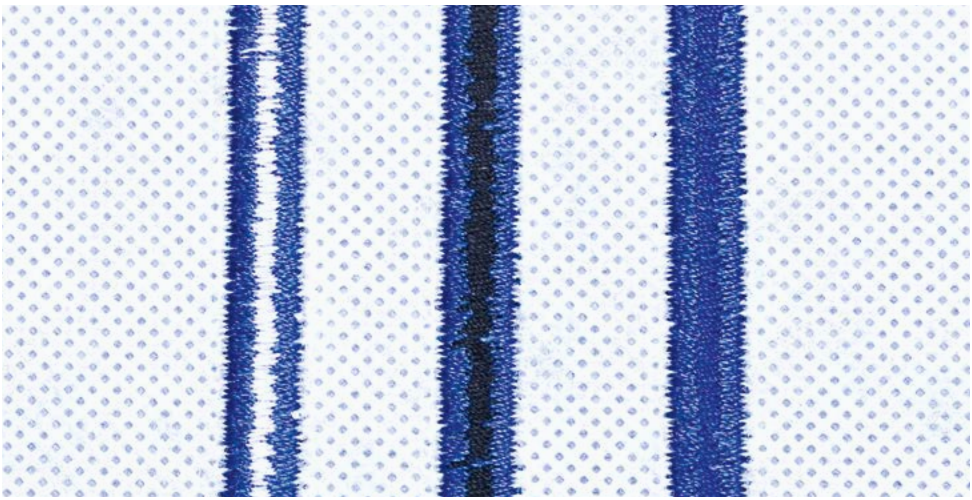
THE EMBROIDERY MACHINE

The data created by the digitizer is converted from the embroidery machine in conjunction with the yarn, embroidery base and backing to the final embroidery. One distinguishes between:

- Number of heads: per head, one embroidery pattern can be completed at the same time. Common machine sizes vary from 1 to 72 heads.
- Number of needles per head: the needle number gives the maximum number of colours that can be threaded in a single pattern without having an intermediate changeover. Needle numbers between 1 and 18 are common, although the focus is on approx. 12 needles.
- The work area and frame size dictates the maximum size of the embroidery.

Embroidery machine

The stitch speed (currently, around 200–1,800 stitches per minute is feasible) and additional equipment like tools for sequins, drills or cord embroidery are further important features of the embroidery machine. Embroidery machines generally require a finely adjustable and accurate thread tension setting. The thread tension should always be set as low as possible. It is usually correct, if on the backside of the running stitch, 1/3 of the surface is formed by the bobbin thread.If a high-quality embroidery thread is used, such as Isacord with its low and very consistent coefficients of sliding friction across all colours, it should not be necessary to readjust the thread tension between colour changes.



Correct thread tension while embroidering (Bobbin thread is 1/3 of the surface)

THE BACKING

A backing material is used in order to achieve a distortion-free, sharp-contoured embroidery. It is used on the bottom side of the outer fabric and gives the embroidery base the necessary dimensional stability in conjunction with the underlay stitches. Depending on the type or the properties, it may be removed after the embroidery process by tearing, cutting or dissolving. For materials with nap, the backing can be supported with a soluble foil on the upper side of the embroidered material. The stitches are prevented from sinking into the nap by a water- or heat-soluble backing or a respective foil.

Embroidery and fabric put into the frame

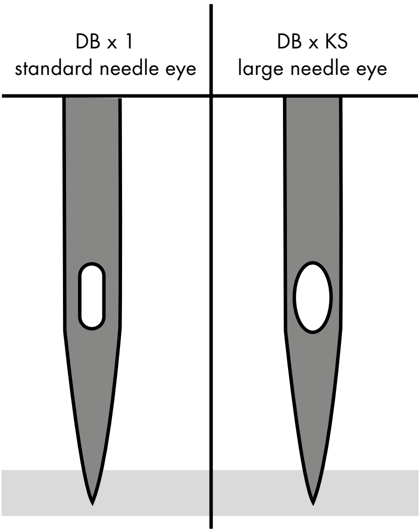
The following table offers general guidelines for the selection of the correct backing fabric, but these can be varied

Material	Backing
Fine knitwear, very fine woven fabrics	Cut away backing, in order to avoid material damages while tearing away the backing
Woven fabric, stable knitwear	Tear away backing
Transparent materials, embroideries which are visible as well from the reverse side	Water- or heat soluble backing for the purpose of complete removal
Terry cloth, velvet, velours, fleece	Tear or cut away backing + water-soluble film on the top

THE NEEDLE

The DB x K5 needle system is established worldwide for machine embroidery. Machines by the brand Fortron® constitute an exception. With the DB x K5 system, the needle eye is 1–2 needle sizes larger than usual. Thus, a size 70 needle has the needle eye of a size 80 or size 90 needle, which brings along several advantages:

- better protection of the material
- a smaller needle diameter can be selected
- better protection of the embroidery thread, due to more space in the needle eye
- simplified threading of the needle



Needle eye sizes in comparison, source: Groz-Beckert

In Europe, the most common needle size description is the diameter of the needle blade, divided by 100. Therefore, a size 70 needle has as diameter of 0.7 mm. On conventional embroidery machines, needle sizes between 55 and around 120 can be used. The needle point is selected according to the required embroidery application. The small ball point may be used as a starting point. For machine embroidering, the cutting points can usually be avoided to preclude the perforation of the material.

The following table offers general guidelines for the selection of needle point and needle size, but these can be varied.

	Needle size			Needle brand		
Material	Nm	Size	Needle point	Groz-Beckert	Organ	Schmetz
Knitwear						
Knitwear & jersey	65-80	9-12	medium or small ball point	FFG/RG	J/Q	SES
Finely knitted fabric	60-75	8-11	medium or small ball point	FFG/RG	J/Q	SES
Woven fabric						
Fabrics for shirts/blouses	55-70	7-10	sharp or small ball point	R/RG	R/Q	R
Denim	70-110	10-18	sharp or small ball point	R/RG	R/Q	R
Terry cloth	65-90	9-14	sharp or small ball point	R/RG	R/Q	R
Mircro-fibre	60-90	8-14	sharp or small ball point	R/RG	R/Q	R
Silk	60-80	8-12	sharp or small ball point	R/RG	R/Q	R
Leather goods						
Leather	70-110	10-18	sharp ball point	R	R	R
Synthetic leather	65-90	9-14	sharp ball point	R	R	R
Coated materials	65-100	9-16	sharp or small ball point	R/RG	R/Q	R

The most important component for a perfect embroidery is an embroidery thread that matches the respective application. Along with the appearance, the reliability and productivity are also very important features.

Isacord, the embroidery yarn made from trilobal polyester continuous filaments combines best processing features with extreme durability. The standard embroidery thread size 40 is available in a comprehensive colour range of single and multicolour colours.

Embroidery with Isacord

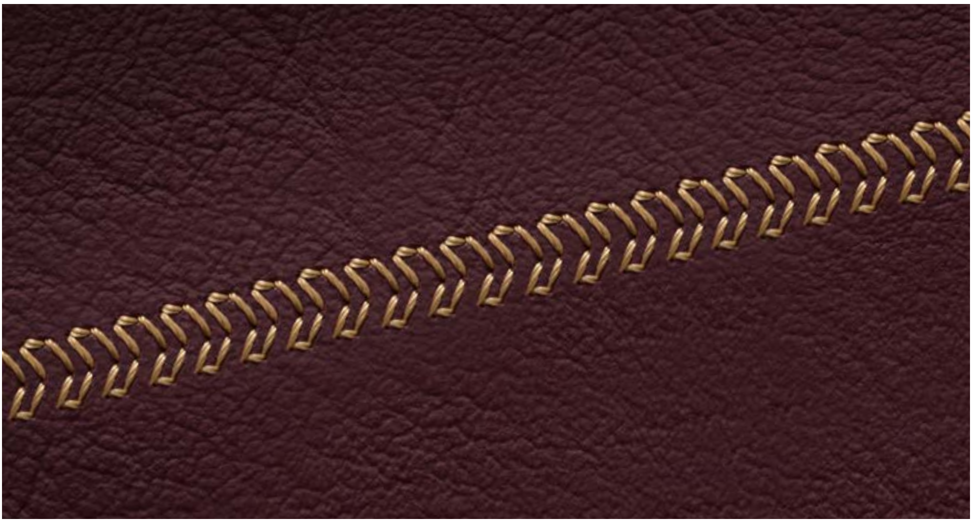
Wherever metallic appearance is desired, metallic wrapped yarns, such as Isamet are used. Isamet's colour card ranges from different gold and colours shades through to pastel shades and multicolour shades.

Metallic embroidery with Isamet

Serafil fine, the polyester continuous filament in fine tickets is the best choice for all **detailed and filigree applications**. For the finest ticket 420 (300/2), which corresponds to embroidery thread size 100, a size 55 needle can be used.

Filigree embroidery with Serafil fine

Serafil also offers plenty of opportunities for rather coarse applications, e.g. Serafil in coarse tickets enables great embroidery results for crank and hook embroideries.



Coarse embroidery with Serafil

For **matt embroideries,** polyester/polyester core spuns (e.g. Saba) or polyester/cotton core spuns, such as Rasant are suitable. AMANN offers a huge variety of sizes and colours covering embroidery thread sizes 60, 40, 35, 30 and 15, and AMANN's Saba is available in more than 500 different colours.

Matt embroidery with Saba

Embroidery threads are also used for **Garment Dyeing** where the raw material of the embroidery thread needs to be dyeable. AMANN's cotton embroidery thread MercifilGD is ideal for this purpose.

Embroidery on Garment Dyeing clothing

Isa Texlight is the right choice for embroideries with **special illuminating effect.** The phosphorescent embroidery thread glows in the dark and catches attention.

Isa Texlight during daylight

Isa Texlight in the dark

For special application fields, there are further **technical threads** in AMANN's product range, such as the meta-aramide embroidery threads N-tech, N-tech CS and A-tech CS for all applications that require flame-retardant features, or for non-melting materials.

Flame-retardant thread on fireproof outer fabric

In recent years, another application has come to the fore: conductivity. For this special requirement, AMANN offers Silver-tech, a special yarn with **conductive** features that can be used for embroideries.

Silver-tech in use

The table below offers guidelines for the selection of the needle size for each thread type, but these can be varied.

Embroydery thread ticket	Article examples	Recommended needle size Nm	Size	Recommended needle system (Nm Size except Fortron®)
75	Serafil fine 300 (200/2)	55–65	7–9	DB x 1(55), DB x K5
60	Serafil fine 180 (120/2), Saba 150	60–70	8–10	DB x K5
40	Isacord, Saba 120, Rasant 120	65–90	9–14	DB x K5
30	Saba 80, Rasant 75	75–100	11–16	DB x K5
20	Saba 50	90–110	14–18	DB x K5

For bobbin threads, AMANN offers the following choices:

- Isa, the standard bobbin thread is available in two different tickets and colours and combines excellent thread running properties with high strength and huge bobbin capacities.
- Isabob provides excellent unwinding properties, long running lengths and all benefits of prewound bobbin threads. Isabob is available in two different colours.
- If it is desired that the bottom side of the embroidery has the same colour as e.g. the outer fabric, Saba or Rasant are recommended, due to their large range of colours.

TIPS FOR SEWING & EMBROIDERY

CHAPTER OVERVIEW

The following table contains the most common problems during sewing and embroidering, their potential causes, as well as potential solutions to solve the problems. Generally, the recommendations of the respective sewing machine manufacturers for correct threading should be considered. Moreover, it is important to consider that the described measures can only be proceeded by mechanics or qualified personnel.

SEWING-SPECIFIC TIPS

Problem: Thread breakage	Problem: Skip stitches	Problem: Uneven seam	Problem: Seam puckering	Potential cause	Suggested solution
Sewing thread					
•	•	•		Snarling/loops	Please follow the recommendation for correct threading.
•		•		Thread spool with improper winding	The thread spools must have a precision winding.
•	•	•		Sewing thread is too thick or too thin for the used needle size	Strictly follow AMANN's needle recommendations and use appropriate needle sizes, which fit to the material conditions.
•				Sewing thread is brittle or dry	Best storage conditions: 15–25°C at 45–65 % humidity, do not expose to direct sunlight or high temperatures. Store thread in closed original card box until use – especially with waxed threads, e.g. Serabraid T90.
•		•	•	Gliding ability of sewing thread is not proper	Fault during finishing process – only use quality sewing threads.
Thread tension					
		•		Burrs or rust on thread tension discs	Insert new tension discs.
	•	•		Needle thread tension disc is dirty or blocked with dust or fibrous material	Clean thread tension disc.
		•		No bobbin thread tension	Bobbin case and tension spring with burrs, replace with new ones.
•				No thread tension lift after seam end and thread cutting	Tension lifter pin does not work properly, install or adjust newly.

Thread breakage	Skip stitches	Uneven seam	Seam puckering	Potential cause	Suggested solution
•			•	Needle and bobbin thread tension are too high	First, adjust **bobbin thread tension:** • Horizontal hook (bobbin case is put upright into machine): Bobbin has to slide down slowly with the bobbin case while holding the thread. • Vertical hook (bobbin lies in bobbin case of machine): Bobbin thread has to be pulled slightly and evenly by hand. Secondly, adjust **needle thread tension** (measurement of the highest point of thread take-up lever). Then, **check seam result** and correct settings if necessary, increase tension step by step until the result is ok.
		•		Thread slides out of the tension discs	Correct threading of pretension, check threading and correct it according to the machine supplier's threading diagram. Check needle thread tension and reduce it, if it is too high.
		•	•	Bobbin thread tension too high	With double lockstitch joining seams (stitch type 301), the interlocking of needle and bobbin thread should be in the middle of the fabric layers. The thread tension with double chainstitch seams (type 401) is ideal, when the needle thread remains as a small loop after unpicking the seam.
		•		Knot effect of needle thread on the bottom side of a double lockstitch seam	Adjust needle and bobbin thread tension correctly. Follow the rule "as low as possible, as high as necessary". The interlocking of needle and bobbin thread should be in the middle of the sewing material. Check used needle size and needle point and adjust, if necessary. Check hook, needle plate, feed dog and other machine parts for damages or burrs and polish (in direction of thread movement) or replace them, if necessary.
Thread regulator spring (Take-up spring)/Thread regulator					
•				Burr or rust on thread regulator spring.	Install new spring.
•	•	•		Thread regulator spring does not work or is broken.	Install new spring. Change spring regularly (2–3 months) as it is a wearing part.
•	•	•		Force and movement of spring is not adjusted correctly.	Spring should be at the stop position during needle penetration of the sewing material. With the biggest extension of the needle thread loop, the movement of the spring should contain approx. 1/3 of the total path.

Problem: Thread breakage	Problem: Skip stitches	Problem: Uneven seam	Problem: Seam puckering	Potential cause	Suggested solution
	•	•		Thread regulator is not adjusted properly	Adjust thread regulator so that the thread loop slides over the thickest point of the hook with low tension. Move thread regulator to the right for higher thread amount, and to the left for a smaller thread loop.
Thread take-up lever					
•				Burr or rust on thread guide	Polish burr completely.
•				Thread guide is loose	Insert new thread guide.
•				Thread take-up lever movement is too high	General repair.
Needle bar					
•				Burr on thread guide.	Polish thread guide completely or insert new thread guide.
•	•			Needle bar is too low or too high.	Needle bar is in the right position, if the top edge of the needle eye is 0.5 mm below the hook tip after the looping stroke is completed.
Sewing needle					
•	•			Wrong needle system	Insert correct needle system (see manual).
•	•			Needle is not inserted correctly	Needle is inserted correctly if the needle scarf shows to the hook.
•		•		Needle tip is damaged or bent	Insert new needle. Change needle regularly (once per shift, when sewing with hard materials, even more often). If it happens permanently, check the hook adjustment; the needle may hit the hook or could be deflected by the presser foot or the needle plate.
	•			Needle position is too high or too low	Insert needle completely into the needle bar. The needle position is correct, when the top edge of the needle eye is 0.5 mm below the hook tip after the looping stroke is completed.
•				Needle eye is sharp edged or damaged	Replace needle. If it happens regularly, check the settings, the hook may hit the needle. Use quality needles only.
•	•			Needle is clotted due to molten thread finish or sewing material	Insert new needle. Change needles regularly (once per shift). Reduce speed. Install needle air-cooling, ideally for both top and bottom.
		•		Knot effect of the needle thread on the bottom side of a double lockstitch seam	Use correct needle size and appropriate needle point, adjust needle and bobbin thread tension correctly.

Problem: Thread breakage	Problem: Skip stitches	Problem: Uneven seam	Problem: Seam puckering	Potential cause	Suggested solution
Presser foot					
		•		Bottom of the presser foot is rough and burred due to the feed dog	Polish the bottom of the presser foot or replace it.
•		•		Burr in presser foot groove	Polish the presser foot groove completely. Burr must be carefully and completely removed. Check if the foot groove fits to the sewing thread thickness.
		•	•	Sewing material "flows"	Increase the pressure of the presser foot.
		•		Presser foot does not rest flat on needle plate	Adjust accordingly.
Needle hole/Needle plate/Feed dog					
•	•	•	•	Needle hole in feed dog or needle plate is too big or too small	Stitch hole for needle sizes below Nm 100 should have a diameter of approx. 1.6 mm. If bigger needles are used, it should be accordingly bigger.
•	•	•	•	Needle hole is too widened or deformed during polishing	Insert new needle plate.
•		•		Needle hole is sharp-edged or damaged	Polish needle hole very finely, especially in the direction of the sewing thread movement.
	•			Needle plate bar is deformed or unleveled	Level and polish needle plate bar, use new needle plate.
		•		Feed dog is not flat towards the needle plate or presser foot	Adjust accordingly.
		•		Feed dog teeth are too sharp or worn	De-burr with oil stone, replace worn feed dog.
		•		Feed dog movement is too high or too low	At the highest position, the feed dog should be one tooth height above the needle plate.
		•		Feed dog movement is not adjusted correctly	Adjust accordingly.

Problem: Thread breakage	Problem: Skip stitches	Problem: Uneven seam	Problem: Seam puckering	Potential cause	Suggested solution
Bobbin thread, bobbin and bobbin case					
•	•	•	•	Thread tension is too high	Bobbin thread tension (adjust first): • Vertical hook: Bobbin has to slide down slowly with the bobbin case while holding the thread. • Horizontal hook: Bobbin thread has to be pulled slightly and evenly by hand.
		•		Thread tension spring and bobbin case are burred or rusty	Replace thread tension spring and bobbin case.
•		•		Unevenly wound bobbin	Bobbin thread must be wound with an even thread tension, parallel, and in the right angle. If the bobbin is deformed due to the thread pressure, drastically reduce the winding tension.
•		•		Uneven run of bobbin in machine	Replace, if metal or aluminum bobbin is damaged, deformed or rusty. Reduce bobbin thread tension, if bobbin thread tension is set too high.
•		•		Bobbin thread runs on, thread jumps, even after the machine has stopped	Insert the bobbin into the bobbin case so that the bobbin runs against the thread pull-off direction. Use bobbin brakes!
Hook					
•	•			Hook is not in the right position.	Correct position depends on the machine (see instruction or service manual), adjustment only by a mechanic.
•	•			Tip of hook is damaged or rusty.	Polish hook very finely or replace it.
•				Sharp edges on the bobbin thread plate of the hook or on the bobbin case.	Polish the bobbin thread plate or the bobbin case, replace it, if necessary.
•		•		Hook lubrication is not sufficient.	Check hook lubrication with paper test at idle running.
•				Thread jam in hook area.	Remove thread jam carefully, if necessary remove hook.
•	•			Burr on the hook at thread paths.	Polish thread paths completely or install new hook.

EMBROIDERY-SPECIFIC TIPS

Problem	Potential cause	Suggested solution
Thread breaks	Needle thread tension is too high	Reset needle thread tension, 125 cN is considered as the highest standard value for general embroidery work.
	Wrongly or incompletely threaded	Check thread path and correct it, if necessary.
	Thread guiding elements have sharp edges or show burrs	Polish thread paths.
	Hook shows burr (e. g. caused by hitting the needle)	Polish hook.
	Stitch density is too high/ too many stitch layers on top of each other	Change the stitching programme and digitize less densely.
	Stitching speed is too fast with large stitches	Especially for long stitches, reduce machine speed.
	Insufficient thread quality	Use branded thread featuring a high tensile strength such as Isacord.
Thread bulging in front of the needle	Needle size is too small, eyelet is too small	Use thicker needle, use DB × K5 system needle with a larger eye in order to keep the needle size as small as possible.
	Unfavourable stitching direction (for example satin stitch backwards)	Reverse stitching direction with underlay stitches, if necessary.
	Poor thread quality	Use branded thread featuring high tensile strength such as Isacord.
	Embroidery base material is very densely woven or knitted	If possible, digitize longer stitches or use a stronger needle.
Skip stitches	Needle is defective (bent)	Replace needle.
	Incorrect needle size	Select needle size that matches the embroidery material and the thread. If the needle eye is too big in relation to the thread size, skip stitches may occur.
	Needle is not set correctly into the machine	Check needle position. The needle must be fully inserted to the needle bar and must be threaded vertically from front to back (twelve o'clock position).
	Threading path is incorrect	Check if correctly threaded and if a thread loop may got caught somewhere.
	Unfavourable stitching direction on difficult base material	First, rotate the pattern and base material by 90°. If necessary, change stitching direction of fill and satin stitches in digitizing programme.
	Hook setting is incorrect	Adjust hook so that the tip of the hook can safely take up the needle thread loop.

Problem	Potential cause	Suggested solution
Material damages	Needle (point) broken	Replace needle.
	Wrong needle point used	Select needle point according to the material.
	Stitch density is too high for material/too many stitches are in the same place	Reduce stitch density, work with shorter stitch lengths on inner radiuses, offset placement of penetration points.
Loops in the embroidery	Thread tension is too low	Increase thread tension.
	Stitch length is too long	In digitizing programme, set the maximum stitch length correctly (usually not more than 7 mm).
	Stitch length is too short	In digitizing programme, use minimum stitch length.
Fabric puckers around the embroidery	Embroidery hoop is too big	Use smallest possible embroidery hoop.
	Woven material is not framed sufficiently tight	Material and backing must be tightly clamped like a drum.
	Knitted fabrics were stretched, when clamped into the frame	For knitted fabrics, frame only the backing and then fix the material by using a temporary adhesive avoiding distortion.
	Backing is not tight enough	Double thin backing or use heavier backing.
	Fabric puckers despite backing	Bond backing and fabric with a temporary or permanent adhesive in order to further reduce puckering.
	Thread tension is too high	Check needle thread and bobbin thread tension.
	Fabric is too dense	Puckering due to displacement. Use smaller needle size and less stitches.
Improper appearance of the embroidery	Unfavourable stitching direction (for example diagonally backwards)	Change stitching direction (either by digitizing or by framing and embroidering the material offset by 90°).
	Stitch length is too long or too short	Adjust minimum and maximum stitch length in digitizing programme.
	Stitch density and thread size do not match	Select actually used thread size in digitizing programme or adjust the stitch density accordingly.
	Underlay stitches are missing or do not fulfil their purpose	Check underlay stitches in digitizing programme. Contour underlay stitching is recommended for letters, while box-type underlay stitching is recommended for area embroideries. Please note: false underlay stitching is useless.
	Stitches sink into the material (for example terry cloth, velour or velvet)	The application of a water- or heat-soluble film on the top side prevents the stitches from sinking.
	Thread tension balance is incorrect	Reset thread tension. In a row of satin stitches, the bobbin thread should cover 1/3 of the width of the stitch.

Problem	Potential cause	Suggested solution
Contours are not synchronised	Too much stretching of the material in the embroidery hoop	Improve framing method.
	Pull is not considered in digitizing process	Apply pull compensation in digitizing programme.
	Hoop has loosened	Tighten frame screw further, wrap frame with textile tape for more stability.
	Digitizing fault	Check digitizing programme on the computer (for example, if the outline segment can be offset completely).
Embroidery is stiff	Backing is too stiff	Use thinner backing or less layers of backing.
	Stitch density is too high/ thread is too thick	Synchronise stitch density and thread size.
Unfavourable frame marks	Frame is too smooth/too hard for the material	Wrap inner hoop with textile tape. Slight marks can be removed with steam.
	Material is too delicate (for example tuft fabrics)	Work with temporary adhesives or Filmoplast so that the material itself does not need to be framed in the hoops, but only the backing.

ELASTIC & SOFT SEAMS

CHAPTER OVERVIEW

Seams that break, or rough seams that irritate the wearer are a common problem within the clothing industry, but they are avoidable. In this chapter, the requirements for elastic and soft seams will be explained.

Broken seam

ELASTIC SEAMS

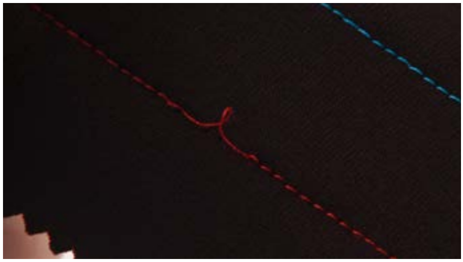
The secret of elastic seams is in the interaction of the right sewing parameters sewing thread, stitch type, thread balance and stitch density.

SEWING THREAD

If an inelastic sewing thread gets stretched, the seam will tear. Due to their technological features, synthetic sewing threads have a higher elasticity (approx. 20% and more) than sewing threads made from natural fibres, such as cotton (max. 5%). In special cases, as for elastic seams, the capabilities of synthetic threads are not always sufficient regarding seam elasticity (seam breaking strength lengthwise), seam stability (seam breaking strength crosswise) and abrasion resistance.

AMANN has developed Sabaflex, an innovative sewing thread for highly elastic seams. Sabaflex was especially designed to be used in lockstitch (stitch type 301) seams and results in extremely stretchable seams. When compared to conventional threads, Sabaflex can achieve a seam with as much as twice the elasticity. Sabaflex features an elongation of approx. 70% and is consequently much more tensile than a conventional core spun. This also affects the tension settings of the sewing machine. The rule is: “As low as possible, as high as necessary.” Further interesting information is provided in AMANN's “processing advice for Sabaflex”.

The following images show the stretch behaviour of a lockstitch seam, sewn under comparable sewing parameters, with Sabaflex and a conventional core spun.

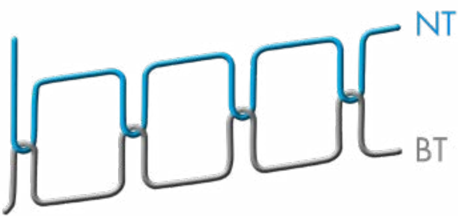


Comparison of stretch with a core spun and Sabaflex

STITCH TYPE

For elastic seams, the following stitch types are commonly used:

Lockstitsch: stitch type 301



Sketch of stitch type 301

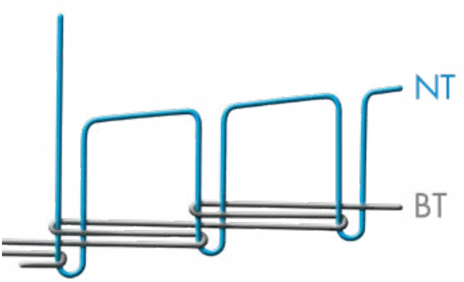
NT = needle thread
BT = bobbin thread

Upper side of the seam (stitch type 301)

Bottom side of the seam (stitch type 301)

A lockstitch (stitch type 301) seam usually has only minimal elasticity. By using Sabaflex, lockstitch seams can be used in elastic clothing and can be also used as an alternative to double chainstitch (stitch type 401). It is also an advantage that no special sewing machines are required. Moreover, lockstitch provides the seam with an unobtrusive and linear look with low thread consumption at the same time. With this stitch type, seams that unravel belong to the past. In terms of design, there are no boundaries with lockstitch, because seams can start and stop in the middle of the fabric. Besides, the seams look the same from both sides and the seam beginnings and seam ends can be secured simply.

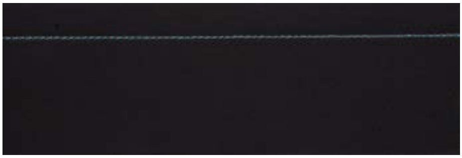
Double chainstitch: stitch type 401



Sketch of stitch type 401

NT = needle thread
LT = looper thread

Upper side of the seam (stitch type 401)

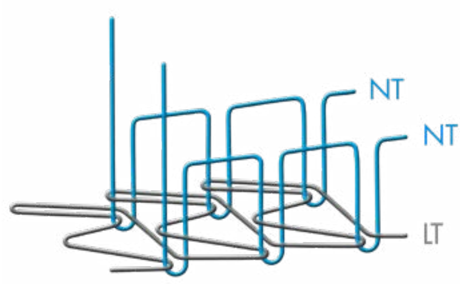


Bottom side of the seam (stitch type 401)

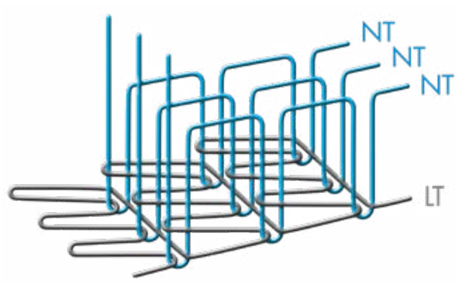
Due to its structure, double chainstitch (stitch type 401) features a higher elasticity than lockstitch. Hence, it is used for elastic seams, in combination with conventional sewing threads, such as core spuns (e.g. Saba). A disadvantage of this stitch type is the thick looper thread chain on the bottom side of the fabric, which can create an unpleasant, scratchy feeling. To avoid this issue, stitch type 301 in combination with Sabaflex is an attractive alternative.

Neckline of a typical sports shirt

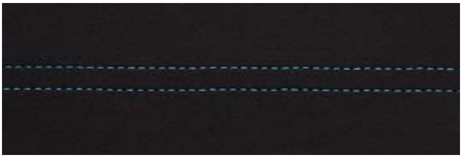
Cover chain stitch without cover thread: stitch types 406 (left) and 407 (right)



Sketch of stitch type 406
(NT = needle thread, LT = looper thread)

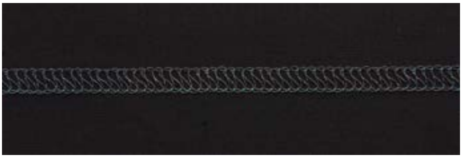


Sketch of stitch type 407
(NT = needle thread, LT = looper thread)

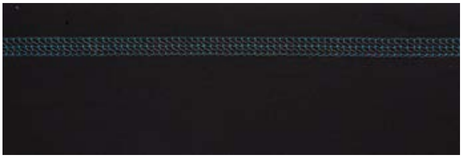


Upper side of the seam (stitch type 406)

Upper side of the seam (stitch type 407)



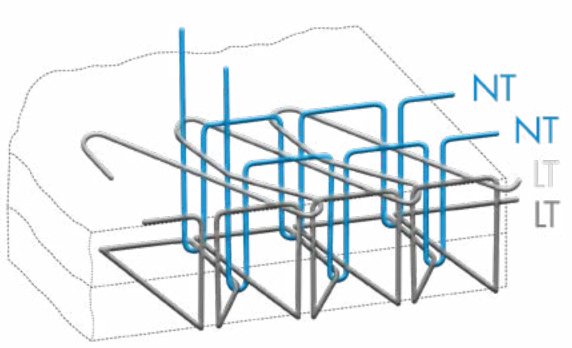
Bottom side of the seam (stitch type 406)



Bottom side of the seam (stitch type 407)

The cover chain stitches without cover thread (stitch types 406 and 407) are commonly used for hem seams and elastic materials, for which they are well-suited, due to their high elasticity. The needle threads go through the entire sewing material until they reach the bottom side, where they get looped by the looper thread. With regard to the softness of a seam, these small needle thread loops have tremendous importance.

4-thread overlock stitch: stitch type 514



NT = needle thread
LT = looper thread

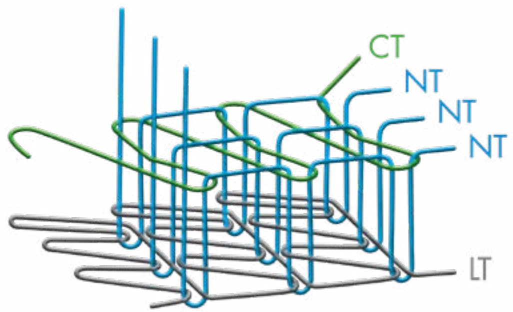
Sketch of stitch type 514

Upper side of the seam (stitch type 514)

Bottom side of the seam (stitch type 514)

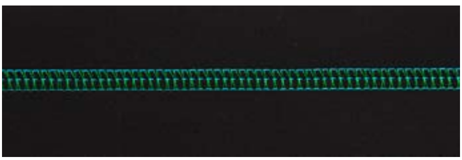
This stitch type is highly elastic and used for inside closing seams.

Cover chain stitch with cover thread: stitch types 602, 605, 607 (for overlapping closing seams)

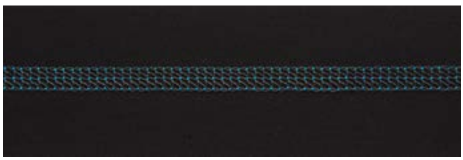


NT = needle thread
LT = looper thread
CT = cover thread

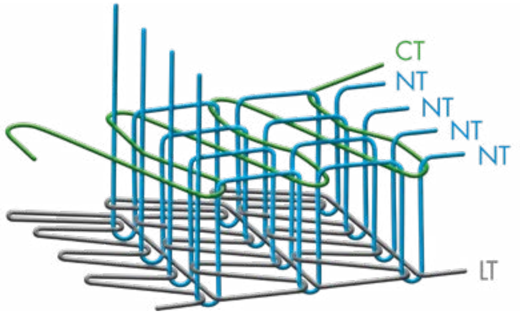
Sketch of stitch type 605



Upper side of the seam (stitch type 605)

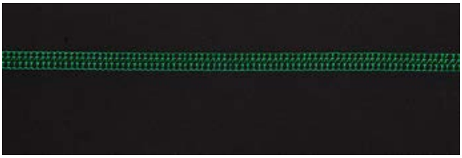


Bottom side of the seam (stitch type 605)

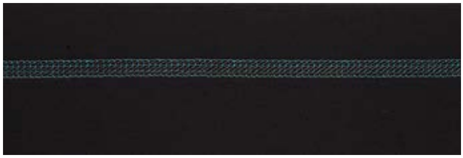


NT = needle thread
LT = looper thread
CT = cover thread

Sketch of stitch type 607



Upper side of the seam (stitch type 607)

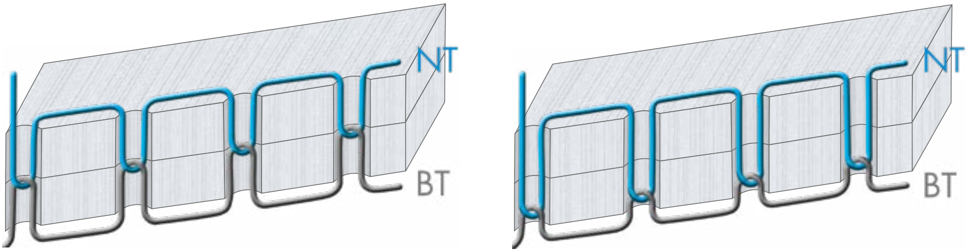


Bottom side of the seam (stitch type 607)

The stitch types 602, 605 and 607 belong to the group of cover chain stitches and feature a high elasticity due to their stitch formation. As it is the case with the already mentioned stitch types 406 and 407, the needle threads go through the entire sewing material until they reach the bottom side, where they get looped by the looper thread. With regard to the softness of a seam, these small needle thread loops are of tremendous importance. They are mainly used for overlapping closing seams. They are mainly used for overlapping closing seams.

THREAD BALANCE

A variety of broken seams is attributable to incorrect thread balances. With lockstitch, this has grave influence, because it already has a low thread amount in the seam. The following sketches show the thread balance with a lockstitch seam (illustrations are greatly enlarged): left correct, right with poor thread balance. With a poor thread balance, the tensile load can be absorbed by only one thread system, which often leads to thread breakage. The maximum stretch and tensile strength of the seam can be only achieved, if needle thread and bobbin thread are equal in length.

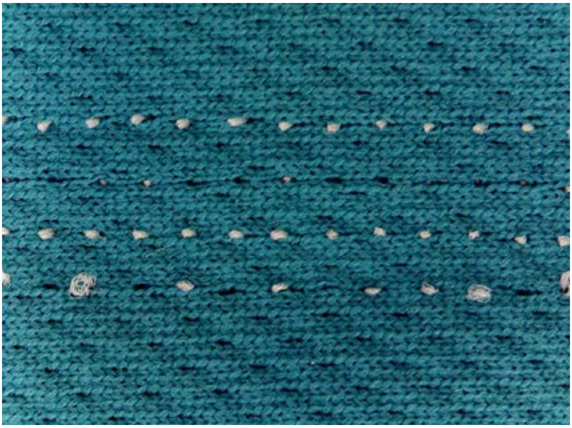


Correct (left) and unfavourable (right) thread balance with stitch type 301

With cover chain stitches, the correct thread tension can be determined by looking closely at the needle threads. They should be consistent on the bottom side of the sewing material and well visible. The following image shows the bottom side of the seam of a cover chain stitch seam (stitch type 607) with correct thread tension. The needle threads are visible as small loops.

Correct thread balance with stitch type 607: view of the bottom of the seam

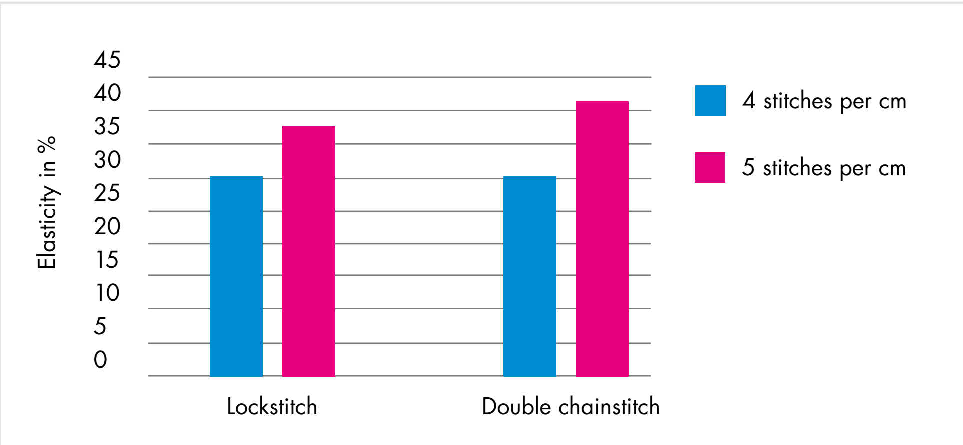
If the needle thread tension is too tight or the looper thread tension is too loose, the loops of the needle thread are only partly visible, which can result in an inconsistent optical appearance. Due to the lower thread amount of the needle thread, the seam features a lower seam elasticity. In the following image, stitch type 607 has been unpicked. The bottom side of the seam shows inconsistent and very small needle thread loops which arose due to the too high needle thread tension.



Unfavourable thread balance with stitch type 607: view of the bottom of the seam

STITCH DENSITY

Generally, as the stitch density increases, the seam elasticity also increases, because more thread is used in the seam. Whilst for inelastic clothing 3–4 stitches per cm are commonly used, for elastic clothing, such as sportswear and lingerie, a stitch density of approx. 5–6 stitches per cm has become established.



Influence of the stitch destiny on the seam elasticity

For a concrete application, it can be helpful to develop respective guidelines regarding the seam performance. With sportswear, it is interesting, how much the seam can be stretched in longitudinal direction until it tears. There is no standard procedure for testing the seam elasticity. Internationally recognised "tractive examinations" solely relate to textile surfaces. Therefore, AMANN has developed its own method by measuring the seam elasticity with the help of a tension-testing device.

Examination of the seam elasticity with the tension-testing device

SUMMARY OF THE MOST IMPORTANT HANDLING RECOMMENDATIONS

- The sewing thread should be selected according to its proposed application regarding raw material, construction type and thread size.
- The choice of the stitch type should be made according to the required elasticity and desired appearance.
- The ideal thread balance is a basic condition to achieve good seam stability. The ideal stitch balance is graphically demonstrated in chapter "Stitch types & sewing thread requirement".
- The determination of the necessary stitch density helps in achieving the desired seam stability.

To achieve the best possible sewing result, it is recommended to first conduct individual tests (e.g. regarding seam elasticity). The AMANN Sewing Technology Center is available for further information or concrete recommendations.

In AMANN's videotorials you may receive further tips and instructions, including the topic "elastic seams".

Sabaflex is the outstanding product for elastic seams – depending on the outer fabric and the sewing conditions, such the stitch density and stitch type, it might be worthwhile selecting other qualities from the AMANN range: Saba, Serafil, Sabatex.

SOFT SEAMS

In practice, the properties of softness and elasticity are not always compatible. A stitch type which makes a seam become highly elastic can e. g. lead to a scratchy feel, whereas a super soft sewing thread may not provide sufficient elasticity. This also depends on the sewn material and the chosen sewing parameters.

SEWING THREAD

IIt is often wrongly assumed that the softness of a seam is only influenced by the choice of a soft sewing thread. In this case, with cover chain stitch seams, the attention is usually on the looper thread, because the looper thread usually lies directly on the skin, which one may associate with a scratchy seam. However, especially the correct needle thread has great influence on the softness of a seam. As already mentioned, when looping with the looper thread, the needle threads form small loops on the bottom side of the seam. The softer and smaller these loops are, the softer the seam is. Once the looper thread is unpicked on the bottom side of the seam, only the interloops of the needle thread remain. With commonly used continuous filaments or core spuns, these loops may feel rough and may be responsible for scratchy seams.

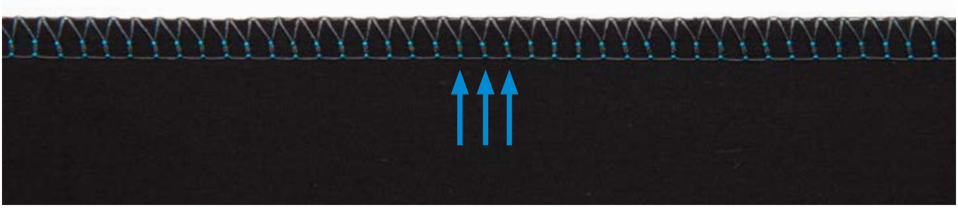
For this, new standards are set by AMANN's Sabasoft, the special sewing thread for soft cover chain stitch seams made from texturised polyester microfilaments. When compared to traditional continuous filaments, the microfilaments in Sabasoft have a far smaller diameter, thus, the sewing thread is extremely soft and smooth. The loops that are formed on the bottom side of the seam during sewing, and lead to scratchy seams, if a wrong sewing thread is chosen, are extraordinarily soft and provide a soft feel to the entire seam, if Sabasoft is selected. Sabasoft is a high-performing sewing thread and can be sewn with sewing speeds of up to 5,000 stitches per minute, depending on the machine type. Furthermore, it is resistant against yellowing and abrasion, and can be used in both needle and looper. Further interesting information is provided in AMANN's "processing advice for Sabasoft".

Soft seam

There are no standardised sewing thread recommendations for serging of seams. The choice of the sewing thread always depends on the used outer fabric, the desired appearance, the processing parameters and further influencing factors. Polyester/polyester core spuns (Saba), fine polyester continuous filaments (Serafil) or texturised polyester continuous filaments (Sabatex) can be used either completely, or in combination. Further information is summarised in chapter Overedging. The softness of the seam depends on the respective material and sewing parameters. It is recommended to conduct individual tests to select the best possible sewing thread for the respective case.

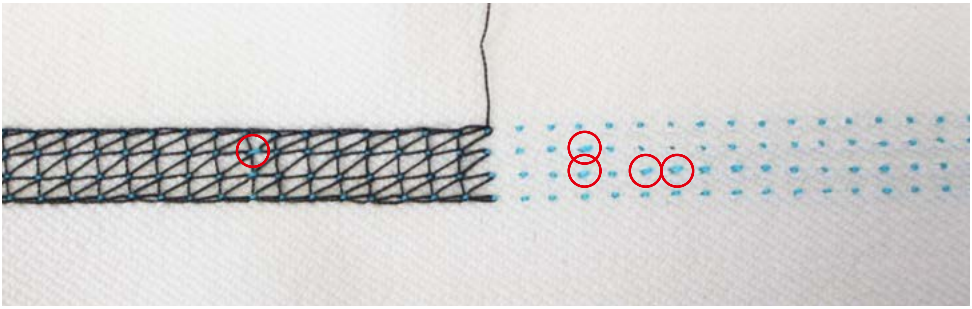
STITCH TYPE AND THREAD BALANCE

In terms of the softness of the seam, stitch type 301 is the most unobtrusive. Since the interlooping of needle and bobbin thread is centered in the sewing material, this stitch type is barely noticeable on the skin. With stitch type 514, which is mostly used for closing seams, there is potential for scratching on the bottom side of the seam, due to the small loops. Hence, it makes sense to not fold the bottom side of the seam towards the skin so that the needle thread loops do not sit directly against the skin (see also the following sketch).

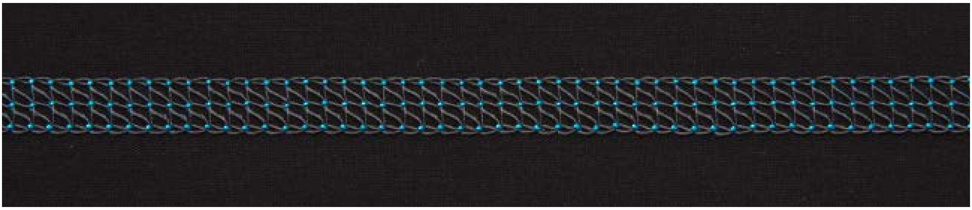


Detailed view of the needle thread loops on the bottom side of the seam with stitch type 514

With regard to cover chain stitches (406, 407, as well as 602, 605, 607), the interlooping of the sewing thread on the bottom side of the seam, as well as the large stitch width affect the softness. The looper thread is clearly visible and in the worst case also noticeable. As already mentioned, the needle thread or the needle thread loops that lie on the bottom side of the seam have a similarly high influence on the softness of the seam. With cover chain stitch seams, the deliberate loosening of the needle thread tension can lead to a softer seam, since the needle thread loops overturn, however it should be considered that seam grinning may result and the seam strength and seam elasticity can change.



Overturning needle thread loops on the bottom side of the seam with stitch type 607



Stitch type 605 with bottom side of the seam on the right side

SUMMARY OF THE MOST IMPORTANT HANDLING RECOMMENDATIONS

- The sewing thread should match the planned application with regard to raw material, construction type and thread size.
- The choice of the stitch type should consider both the desired softness and the required elasticity.
- The thread balance should come close to the ideal condition so that a good seam strength is guaranteed. If the softness of the resulting seam is not sufficient, the needle thread tension can be loosened with flatlock seams so that the needle thread loops overturn.

To achieve the best possible sewing result, it is recommended to first conduct individual tests (e.g. regarding seam softness). The AMANN Sewing Technology Center is available for further information or concrete recommendations.

In AMANN's videotorials you may receive further tips and instructions, including the topic “soft seams”.

Sabasoft is the outstanding product for soft seams – depending on the outer fabric and the sewing conditions, such as stitch density and stitch type, it might be worthwhile selecting other qualities from the AMANN range: Saba, Serafil, Sabatex


WATER-
REPELLENT
SEAMS
ONYX
40 Tex 70
2000m

CHAPTER OVERVIEW

Water-permeable seams are an often occurring problem that usually only catches attention, when moisture soaks through the seams into the inner part of the clothing item. After such an unpleasant experience, it is questionable, if we trust the same clothing item once again during rainy weather.

There are 5 main factors that are crucial for seam impermeability:

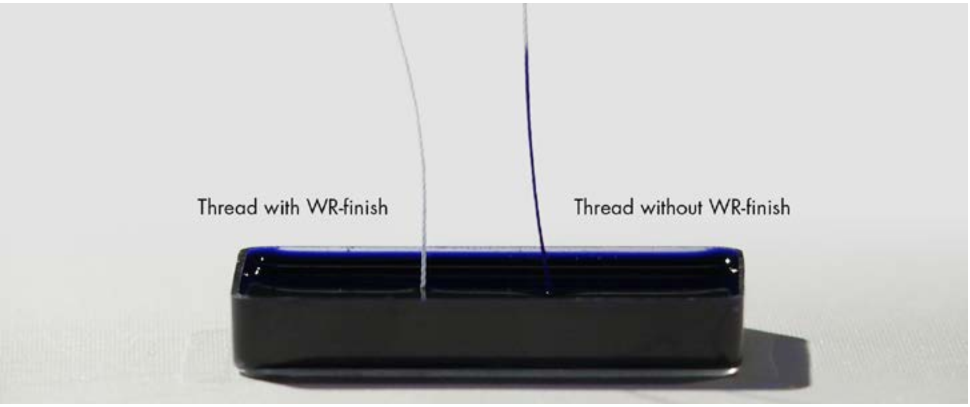
- Sewing thread
- Sewing needle
- Material
- Stitch type
- Seam construction

THE SEWING THREAD

The choice of the **sewing thread** is crucial to achieving seam impermeability. In wet conditions, normal sewing threads (i.e. without water-repellent finish) soak up moisture on the thread surface and transport it to the inside (e.g. into a tent or into a shoe). This phenomenon is called capillary or wicking effect.

Therefore, conventional sewing threads do not fulfill the criteria for seam impermeability. For this, sewing threads with WR-finish (WR = water-repellent) are required. They delay the wicking effect and consequently also the transport of moisture.

The mentioned wicking or capillary effect can be seen in a simple experiment, in which the behavior of "normal" sewing threads and sewing thread with WR-finish is compared when they get in contact with ink/water.



Comparison of capillary effect with thread with WR-finish and normal thread

Sewing thread with WR-finish

- No capillary effect
- The thread does not absorb any water

Sewing thread without WR-finish

- Capillary effect
- The water is soaked up by the thread and then transported over the stitch holes to the bottom side of the seams.

Depending on the field of application, AMANN offers polyester/polyester core spuns (Saba), polyester/cotton core spuns (Rasant) or continuous filaments made of polyester (Serafil) or polyamide (Onyx) with WR-finish or WRe-finish.

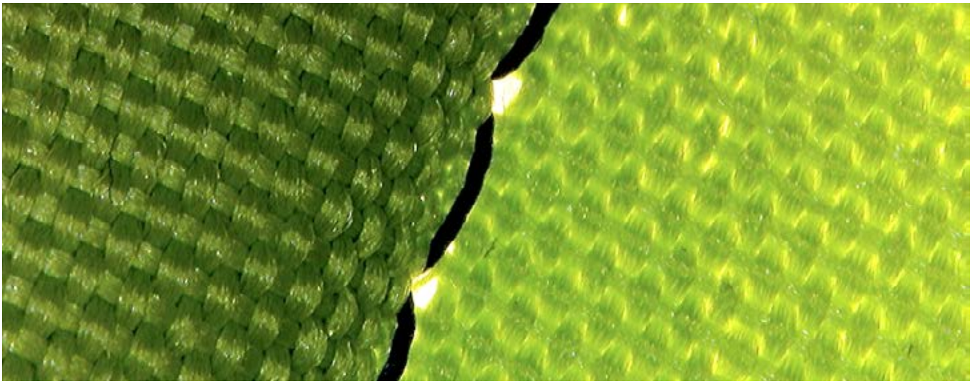
All AMANN sewing threads with WR-finish are certified according to STANDARD 100 by OEKO-TEX® and do not contain any PFOA. The WR-finish is applicable to all AMANN sewing threads. AMANN's WR-finish is washable and does not affect the sewability in any negative way.

AMANN's Road to Zero: The new WRe-finish is even more eco-friendly, since it is completely free of PFC. Certainly, the new WRe-finish is also washable and can be sewn easily.

THE SEWING NEEDLE

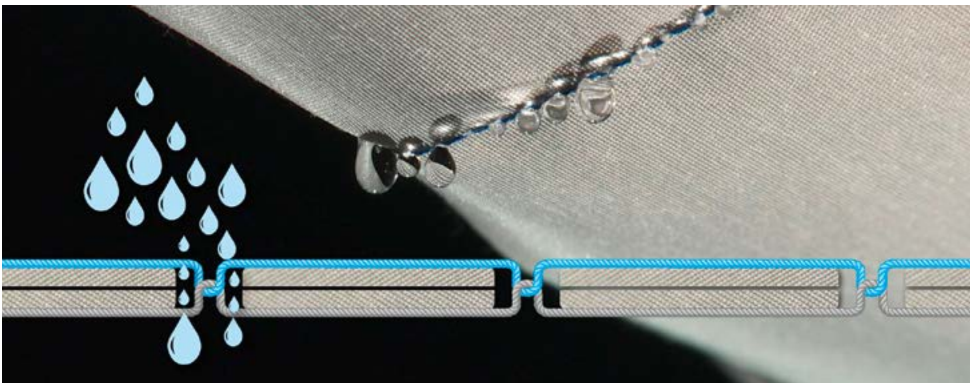
The choice of the correct **sewing needle** has also influence on seam impermeability. In this context, it needs to be considered that the choice of the needle size matches the material thickness, the type of material and the sewing thread ticket. For woven fabrics, the use of round points (R or RG) is recommended. Cutting points are not recommended, because, according to their function, they cut through the outer fabric during penetration. Later, when the seam is exposed to stress, this leads to unnecessarily big holes through which the water can enter. The needle tip needs to be regularly checked and replaced, if required. Damaged needle tips can lead to unwanted material damages.

The smallest possible needle size should be used to make the stitch hole as small as possible. This will avoid water being pushed through a too big stitch hole from the outside. The following picture shows a seam with stitch holes that are too big.



Stitch hole that is too big (enlarged view)

If water comes into contact with seams with big stitch holes, it can enter without hindrance. This also applies to sewing threads with WR-finish, because the water passes beside the sewing thread.



Water leakage with stitch hole that is too big

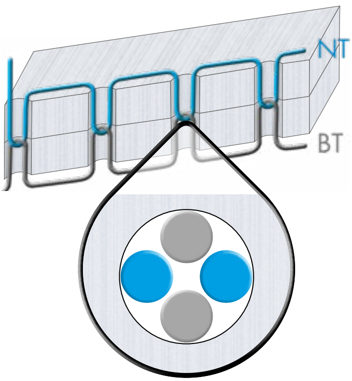
THE MATERIAL

In addition, the seam impermeability is crucially influenced by the properties of the **materials** used (especially outer fabric). In the case of sewing threads with no WR-finish, the water may drop/soak through the entire surface of the fabric and in this event even a waterproof seam will not help. If the outer fabric is indeed water-repellent, but gets damaged by the needle penetration or other factors, the water may soak through these weak spots, even though all other parameters are considered as optimal.

THE STITCH TYPE

The **stitch type** is another important criterion for seam impermeability. It is crucial for the waterproofing (sealing) of the stitch hole. Lockstitch (stitch type 301 according to ISO 4915) is well suited for water-repellent seams, because the stitch interlocking of needle thread and under thread is placed amidst the fabric. Thereby, the stitch hole gets optimally filled, as shown in the following sketch.

Lock stitch, stitch type 301

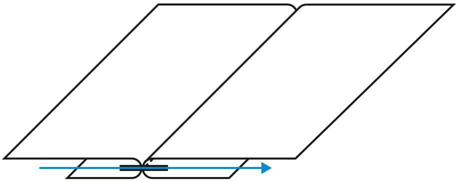


Stitch interlocking with lockstitch (stitch type 301)

THE SEAM CONSTRUCTION

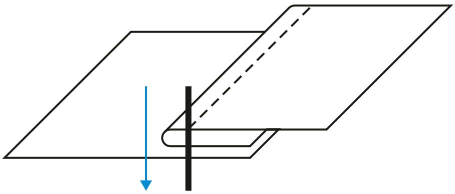
Last but not least, the seam impermeability is influenced by the **seam construction**. The most common seam types with waterproof seams are the normal closing seam, the topstitch seam and the felled seam. To ascertain the influence of the seam construction on the seam impermeability, the AMANN Sewing Technology Center has conducted several tests, with the following results:

Seam position with normal closing seam

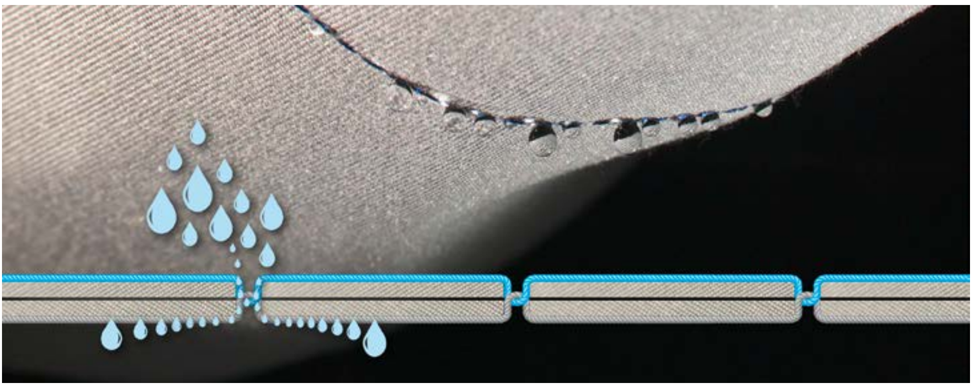


The topstitch seam which is often used within the awning industry features a higher risk for water leakage, due to the vertical position of the stitch holes. If no water-repellent sewing thread is used, the first water drops can pass through the stitch holes after only few minutes.

Seam position with topstitch seam

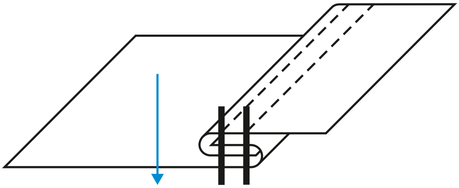


The topstitch seam which is often used within the awning industry features a higher risk for water leakage, due to the vertical position of the stitch holes. If no water-repellent sewing thread is used, the first water drops can pass through the stitch holes after only few minutes.



Water leakage with topstitch seam and conventional sewing thread

Seam position with felled seam



With felled seams (especially with smooth materials), the water can push through the folded layers of fabric, if the water pressure is accordingly high.

Water leakage with felled seam

HOLLOW TEST

A simple method to check and control seam impermeability is the hollow test which was developed by AMANN. An exemplary seam is clamped in a horizontal frame and loaded with 1 liter of water. Since the tested object is clamped statically, the seam is not under tensile stress (as it would be with a "correct" application, e.g. as a tent, jacket or shoe).

Now, it can be observed, when and where exactly the first water drops are formed on the bottom side of the material. On the one hand, the water drops can get through the stitch holes. However, it is similarly possible that the water gets through the layers of fabric, independently of sewing thread and stitch holes. In the worst-case scenario, water passes through the entire surface of the fabric until it reaches the bottom side. If all parameters are coordinated ideally, the water remains inside of the frame and does not soak through the fabric or the stitch holes.

Hollow test setup

In this context, it is important to mention that these results only apply for the respective used materials and sewing parameters. Individual tests for the selection of the best possible combination are necessary, since each material, as well as all the sewing parameters that can be influenced can affect the seam impermeability.

SUMMARY

- If **sewing threads without WR-finish** are used, the water will soak through the seam after a short time.
- If **sewing threads with WR-finish** are used, the water penetrability can be delayed so that a **seam impermeability of 24 hours and longer** can be achieved.
- A 100 % waterproof seam can only be achieved by **taping**.
- The smallest possible **needle size** shall be used to keep the stitch holes as small as possible.
- The tighter the **material**, the better is also the seam impermeability.
- Only materials with WR-finish shall be used. With regard to **coated outer fabrics**, even sewing threads with WR-finish may not achieve seams that are 100 % tight, if the coating is damaged by the needle penetration.
- **Lockstitch** is well suited, because it perfectly seals the stitch hole, if a good thread balance is given.

To achieve the best possible sewing result, it is recommended to first conduct individual tests. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

In AMANN's videotorials you may receive further tips and instructions, including the topic “water-repellent seams”.

To achieve water-repellent seams, the following products from the AMANN range that are available with WR finish or WRe-finish are recommended: Saba, Onyx, Rasant, Serafil fine, Sabaflex, Serafil, Serabraid.

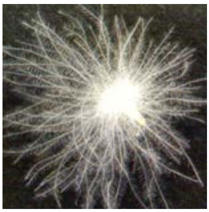
PROCESSING OF DOWN

CHAPTER OVERVIEW

If feathers or quills get pulled out from down jackets, one describes this as down leakage. Usually, it takes time until the end user notices this for the very first time. In most of the cases, the causes for down leakage already occur during the manufacture of the down article.

"Down" leakage

The term "down jacket" suggests that this type of jacket is generally only filled with down. However, out of financial reasons, feathers and broken down/feathers are often added to the premium down. Subsequently, the three filling materials are specified.

	Definition	Structure	Leakage
Down	The down looks like a fine snowflake. It is a three-dimensional construct. The soft-as-silk down barbs with most delicate ramifications radially grow out of the almost invisible core and can trap a lot of air. One single down weighs only around 0.001 to 0.002 g. One kilo comprises around a half to one million down. Down are the undercoating of the water fowl, that means geese or ducks. Land fowl, such as turkeys or chicken do not have any down. Down are growing beneath the covering plumage and can be found most often in the breast zone.		No leakage with high-quality down

	Definition	Structure	Leakage
Feather	The feather forms the outer main protection of the animal's body (horny integument). It is flat and has a two-dimensional shape. The feather has fine barbules growing from the continuous quill on both sides.		
Broken down	feather pieces or down fibres ("down barbs") that are broken off.		

CAUSES FOR DOWN LEAKAGE

Down leakage is an often occurring problem with down jackets, and yet it is easy to avoid it. For this, a critical analysis of potential causes of the down leakage is required: upper material, filling and production.

The **upper material** itself can be a main cause for down leakage. If the used material is not down-proof, the down slip through the fabric and become visible on the outside of the jacket.

Another important factor is the **quality of the filling**. As already mentioned, there is a big difference between down, feather and broken down/feathers. These products significantly differ in terms of their capability to keep warm, their weight and also in terms of their behavior regarding down leakage. Whilst down hardly ever slips through a seam or fabric, because of their three-dimensional shape, feathers are more likely to pierce through the material due to their quill. Again, due to their small size, broken down/feathers are most likely to slip through the fabric.

The next main cause for down leakage can be found in the **production process**. If the sewing work is done inaccurately or the wrong sewing thread is chosen, it may occur that the sewing thread pulls the down through the stitch hole to the outside. Down leakage can also occur over the years. For example, after years of repeated wearing and washing, the down might slip through the stitch holes.

Irrespective of the cause, down leakage is always unpleasant, especially, because it is preventable.

If the upper material is the cause for down leakage, it is recommended to discuss further potential fabric types. For instance, there are materials that are specially designed according to the specific requirements of down. They are woven tightly in order to avoid that neither down, nor feathers are pulled through the fabric. Another possibility to make a piece of clothing down-proof is to use special inlay materials (woven or non-woven).

It needs to be mentioned that the tests of an independent testing institute have shown that one should not rely on materials that are declared as "down-proof". Within the framework of a test procedure, in which the down and feather impermeability of 6 fabrics was tested in accordance with DIN EN 12131-1, it turned up that only one of the 6 tested materials was actually down-pro-of. Further, the static properties of the fabric can influence the behavior of the down. If down leak through the fabric, they either stick there or fall off. It is more striking, when the down quills get stuck within the material due to the static electric charge.

Feather leaking from the fabric

It is strongly recommended to test the respective fabric for down impermeability.

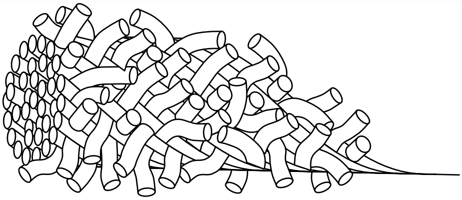
If down leakage is caused by pulling the down through the sewing thread, it is advisable to examine the used sewing thread and the associated sewing parameters.

Spuns (100% staple fibres) have a hairy and rough surface. Consequently, the down and feathers get caught and pulled out through the stitch hole. The same applies also for core spuns (approx. 65–70% continuous filament & approx. 30–35% staple fibres). Best suited for processing down are continuous filaments, such as Serafil fine 180 (120/2). Due to their smooth and even surface structure, they are perfectly suited and decrease the probability that the sewing thread pulls the down through the fabric during sewing.

PRESENTATION OF THE SURFACES OF DIFFERENT SEWING THREAD CONSTRUCTIONS

Spun (100 % staple fibres)

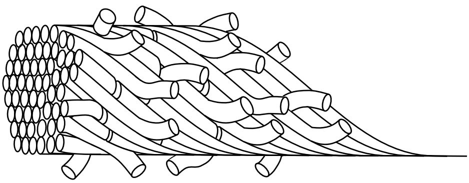
Characteristic: Hairy and rough surface



Core spun

e.g. Saba 150 (approx. 65–60 % continuous filament & approx. 30–35 % staple fibres)

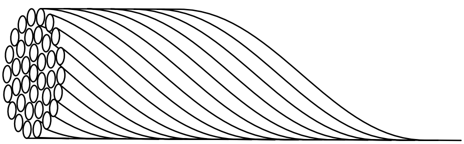
Characteristic: Slightly rough surface



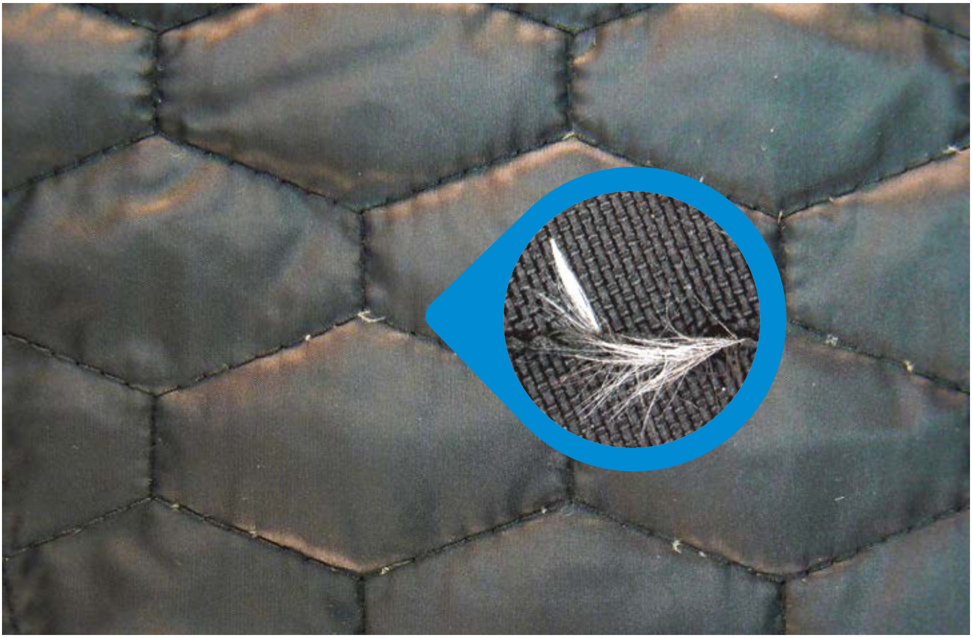
Continuous filament

e.g. Serafil fine 180 (120/2) (100 % continuous filament)

Characteristic: Smooth and even surface



Down jacket sewn with continuous filament, Serafil fine 180 (120/2)



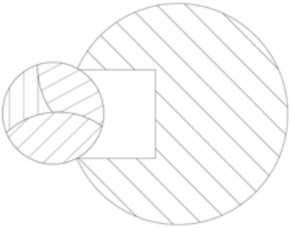
Down jacket sewn with spun or core spun

In this context, the choice of the **needle size** is also important. Generally, the needle size should be geared to the thread size, as it is shown in the following sketch. The universal recommendations are specified on AMANN's colour cards, product data sheets and on the website www.amann.com.

COORDINATION NEEDLE SIZE/THREAD SIZE

Optimal:
Least stress on the thread. The thread sits properly in the eye

→ Ideal processing



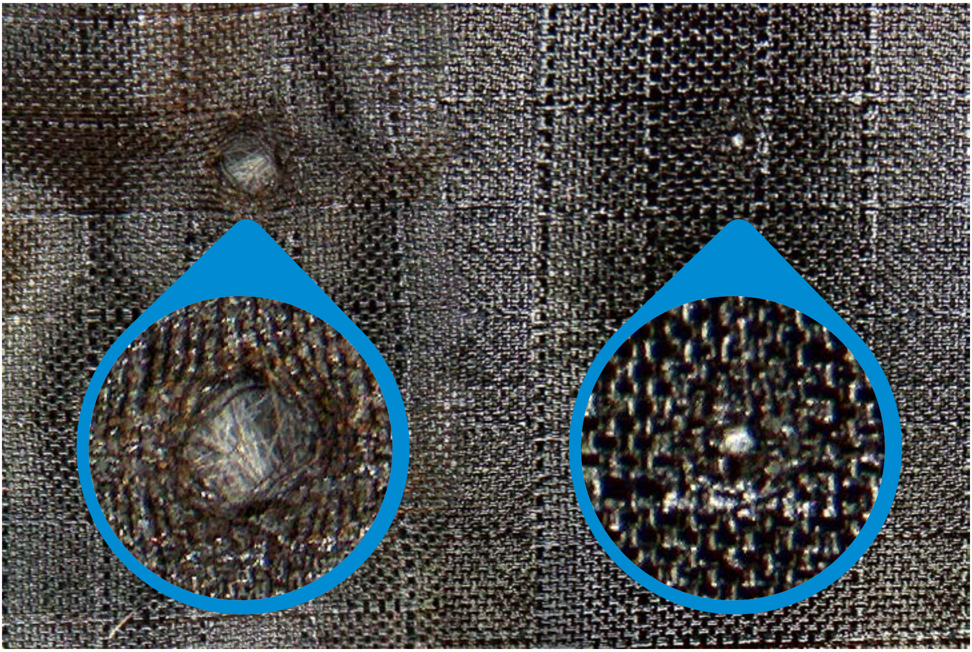
Attention:
Sewing thread is too big/Needle size is too small

→ Thread breakage

Attention:
Sewing thread too thin/Needle size too big

→ Skip stitches and damage of the sewing thread

The bigger the needle that is used, the bigger will also be the stitch hole. Even if the stitch holes are sealed/closed, depending on the texture of the fabric, they can still be made larger through wearing or washing. Hence, it make sense to use the smallest possible needles.



Comparison of stitch hole size with Nm 110 R and Nm 60 R

SUMMARY OF THE MOST IMPORTANT HANDLING RECOMMENDATIONS

- The fabric selected needs to be examined for its **down impermeability**. Fort this, test procedures according to DIN-EN 12132-1 are recommended.
- A **premium down filling** with a high amount of down and low amount of feathers and broken down/feathers reduces the likelihood of down leakage.
- The usage of the **correct sewing thread** is essential. High-quality continuous filaments, such as Serafil fine 180 (120/2), are recommended (as both needle and looper thread)
- During sewing, use **smaller needles** (e.g. Nm 60/size 8, needle tip: R, RS, SPI) to avoid big stitch holes. The rule of thumb is: the smaller, the better.

To achieve the best possible sewing result, it is recommended to conduct individual tests (e.g. regarding down impermeability or the ideal needle size) first. The AMANN Sewing Technology Center is available for further information or concrete recommendations.

In AMANN's videotorials you may receive further helpful tips and instructions, including the topic “processing of down”.

For the processing of down, the following products from the AMANN range are recommended:
Serafil fine

SPECIFICS IN EMBROIDERY

CHAPTER OVERVIEW

Common embroidery problems usually affect the appearance of the embroidery negatively. Before going into detail, it is advisable to discuss the mainly influencing factors first.

POSSIBILITIES FOR DESIGNING THE EMBROIDERY SURFACE

The following factors affect the appearance of the embroidery:

- Colourfulness
- Reflectivity
- Relief
- Manual stitches

Brilliant embroidery

COLOUR

Vibrancy of **colour** plays a major role. High contrast draws the attention immediately. Children like to play with bright and distinct colours: the flower stem is grass-green, the flower itself is fire engine red. The same flower in pastel design appears calmer and slightly more realistic and subtle. The subject appears cold and artificial if colours are used that do not comply with our ordinary colour perception. Neon colours that come into fashion from time to time are the prime example for cold colourfulness.

REFLECTIVITY

Besides the colour, the **reflectivity** plays an important role with embroideries. There are three factors which significantly affect the reflectivity of the embroidery: the yarn, the stitch length used and the stitch directions. Embroidery yarns made from viscose feature a high reflectivity, which neither appears wrong, nor exaggerated. Embroidery yarns made from polyester, such as Isacord, show a bit less reflectivity. They appear more subtle, because with polyester threads, too much reflectivity may easily appear garish and artificial. Matt embroidery yarns (e. g. Saba, Rasant) are usually used for e. g. traditional dresses. They create a textile, matt surface.

The larger the stitch length is chosen (regardless whether satin stitch or fill stitch), the more the reflective character of the yarn comes to light. A viscose yarn can lose a lot of reflectivity due to very close stitches of 1 mm or 1.5 mm. With polyester yarns in particular, an attractive sheen can be achieved due to the relatively big stitch lengths (4 to 6 mm). Moreover, long stitches also save working time. Independently of the embroidered yarn, with long stitches the filling areas appear much smoother than those with small stitches. Furthermore, the embroidery appears less stiff. Even the matt yarns can achieve a subtle silk shimmer, if the stitch length is chosen correctly. Especially with linen, which has rather less shimmer, this works very well.

RELIEF

Besides the colour and the reflectivity, there are further options to create a vivid embroidery surface. The 3rd dimension, the **relief** is also relevant. Some parts of the embroidery can be lifted due to the necessary underlay. This technique is most often used with satin stitches. The texture of coarse bark can be achieved on a single-coloured filling area by strongly underlaid satin stitch rows. If further colours and uneven shapes are then added, the trunk appears almost realistic. With letters, it creates wonderful detail, when the satin stitch seams stand out fully. If more and more underlays are added under the satin stitches until they are about to burst, it is called "Trapunto". In classic sewing, the embroidery is padded, which is nowadays simulated through multilayered underlays. So-called programmed fillings can be used to design fill patterns.

These are fill patterns whose stitch rhythm is aligned in a way that one particular motif emerges from the penetration points. Popular structures are e.g. the basketry look or snake's skin motifs. However, it is important to master this convenient tool of the digitizing programme to receive attractive results: The patterns must follow the shape of the motif, because, to further relate to the snake's skin, a snake does not have ruler-straight pattern. Consequently, the fill pattern must be shaped with the help of various direction lines. If applied correctly, acceptable effects can be achieved with only little effort. It gets very interesting when the stitch rhythms themselves can be determined (it is often described as embossing or punching, since on a determined contour, the penetrations of the crossing fill stitches come together randomly and thus, a motif from the foreground of the embroidery can subtly be recaptured in the background). Otherwise, they might appear cheap and artificial.

MANUAL STITCHES

Conclusively, the most simple and yet often most effective method for surface design needs to be mentioned: **manual stitches** that are set with the hands. As to that, not many stitches are required. An implied shadow on the one side, a second colour on the other side, and the appearance of the embroidery can already look more valuable. Someone who knows how to draw has an advantage, because it is easier to estimate, where these tiny elements make an impact.

BULGING EMBROIDERY PATTERNS

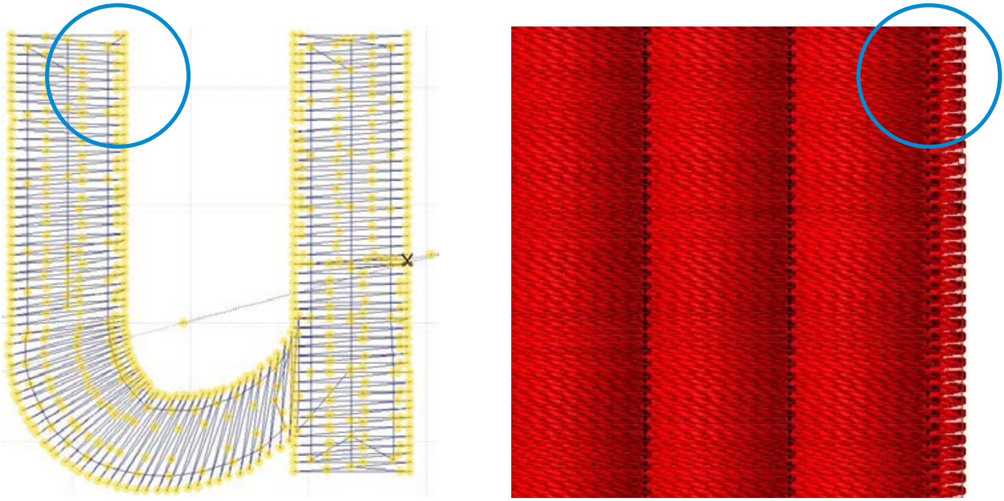
There can be several causes for bulging embroidery patterns. It won't be possible to always solve this problem through ironing. A bowl-shaped bulge of a flat embroidery pattern indicates that the stitch density of the fill stitches is too high. With woven fabrics, it can be also caused if the material is inserted too loosely into the frame.

Bulging embroidery

Knitted fabrics rather show the tendency to become wavy or to pucker around the embroidery. This happens, because the embroidery renders elastic fabric inelastic at one spot. Hence, stretchy knitted fabrics must not be inserted into the frame in stretched condition, because this stretched condition would be fixed through the embroidery. After removing the frame, the material surrounding the embroidery would slacken and cause an uneven embroidery. Help can be provided e.g. with a clamping frame in combination with a respectively stiff backing, or working with glue, if the backing is inserted tightly into the frame and the knitted fabric is affixed without tension. The underlay stitches also affect the dimensional stability of the stitch pattern. It is very rare that one does not require any underlay stitches. For shapeable materials like felt or knitted fabrics, box underlays make sense to stabilise the fabric prior to the actual sewing process and to reduce the pull. Wherever sharp contours are necessary, or the material shows inconsistent results (e.g. twill weave fabrics), contour underlays make sense.

REPEATED THREAD BREAKAGE AT THE SAME POSITION

If the embroidery yarn repeatedly breaks at the same position in the embroidery pattern, too small stitches can be the cause. Especially with fill patterns, such as rhombuses, broken repeats occur on the edges. The digitizing programme only calculates at which position the penetration for the pattern must happen. In the beginning, it is secondary, if the edge of the surface is only 0.2 mm away and thus a 0.2 mm long stitch appears. During the embroidery process, this creates a flaw, especially with the processing of metallic or viscose yarns that are mechanically less resilient than embroidery yarns made from polyester.



Too small stitches on the right edge of the embroidery pattern (left plotting, right 3D view)

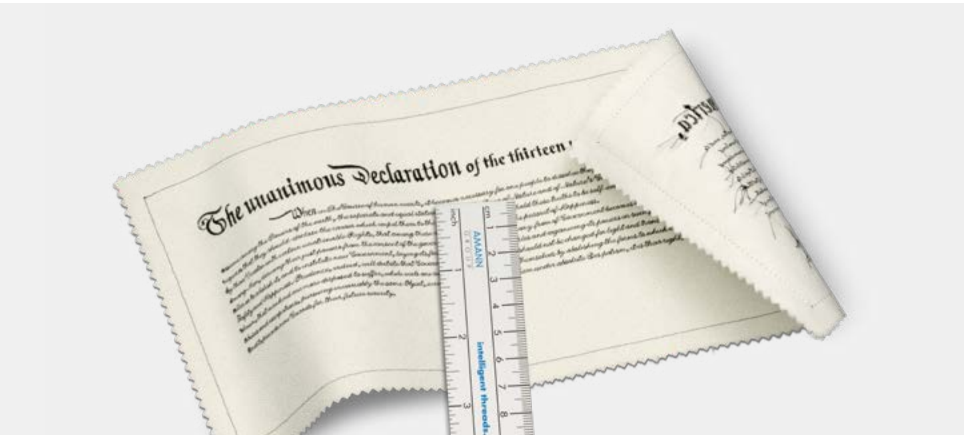
The most professional digitizing programmes offer two solutions to this problem: either a function that independently removes small stitches ("clean pattern", "remove small stitches" or "optimise pattern"), or the possibility to force a minimum stitch length. For metallic yarns, the minimum stitch length should be between 1 and 1.5 mm. Before the programme function is started, it is recommended to save the initial pattern first, so that it can be reused in the future or in emergency cases. With programmes that do not have these functions (e.g. household digitizing programmes), the stitch direction can be set in diagonal direction to the contour for small fill stitches, in order to achieve longer stitches. With fill stitches, those stitches that are too short should be manually removed from the edge.

REPEATED UNTHREADING AT THE SAME POSITION

If the thread always unthreads at the same position in the embroidery pattern, the embroidery pattern itself can be the cause for this behavior. Unthreading especially occurs, when the two still loose thread ends of needle and bobbin thread are too short to interlock with each other. The section between “too short” and “too long” may only be few millimeters. If the thread ends are too long, an unattractive thread end remains on the upper side of the embroidery. An embroidery direction that starts from the beginning point to the right (so, the frame moves to the left) is most unfavourable for initial stitches. Especially if tack stitches are applied and the machine speeds up fast, problems may occur. A multidirectional stitch tack (“Triangle – Star – Diamond”) prevents from this. Or, it is required to redigitize, to achieve another pulling direction behind the needle for the embroidery beginning. If the machine generally unthreads, the thread cutting length of the needle thread should be adjusted. This is either possible via the upper tension spring or via the setting of the picker (or also of the so-called picker timing), which keeps the thread loop extended during thread cut.

EMBROIDERING SMALL LETTERS (< 5 MM)

This small topic is a huge challenge. For instance, often it is desired to digitize a clearly readable web address in addition to an already embroidered company logo. This is what usually creates more problems than embroidering the actual logo.



Embroidery with very small lettering

The following five factors are determining a successful small lettering (height of the capital letters: < 5 mm):

- a suitable **material** for embroidering small letters
- a well-designed **embroidery programme**
- a correctly selected and applied **backing**
- a properly chosen **embroidery thread**
- a suitable **embroidery needle**

MATERIAL

The **material** that shall be embroidered determines first, whether small lettering is generally feasible or not. On many common fabrics, it is almost impossible to work successfully with small letterings:

- With terry cloth, velvet, corduroy, nicky, etc., the stitches sink into the pile of the fabric (also with use of water-soluble foil).
- With jeans, medium-fine to coarse twill fabrics, polo, raw linen, wide gauge knit, and rib knit, it is difficult to achieve adequate definition. With a small lettering, this leads to illegibility. Loose fabrics, tulle, and laces are also not suitable, because there are not enough fix points for small letterings.
- With highly elastic materials (more than 25 % of elongation and high amount of elastane), such as lycra jerseys, the stitches at the edge of the embroidery get damaged because of the elongation (despite the stiffening caused by the backing).

More suitable fabrics are those that are sufficiently tight and fine, this means very densely woven or knitted materials. The more smooth the surface is, the better it is suited for embroidering small letterings. More stable fabrics, rather than elastic ones, are easier to embroider.

Very filigree embroidery

EMBROIDERY PROGRAMME

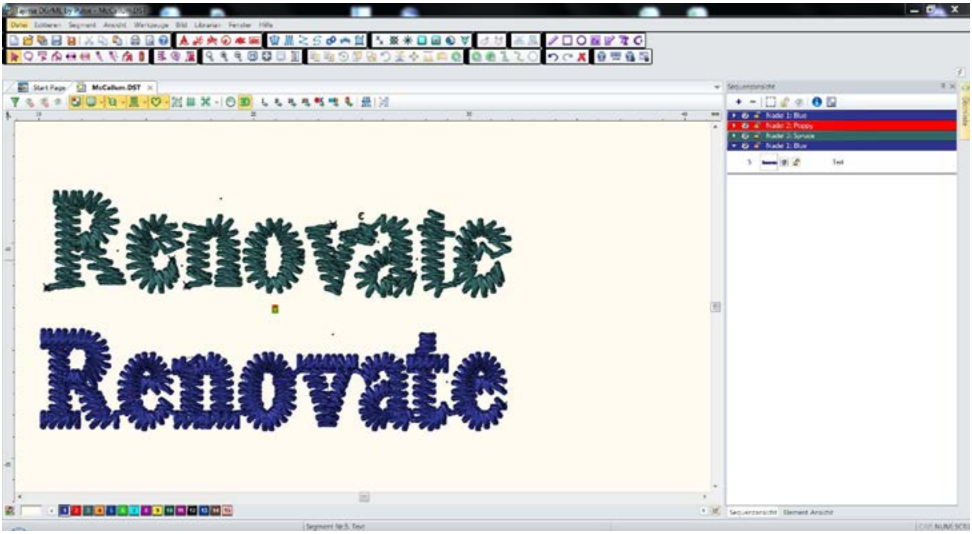
The **embroidery programme** is the next determining factor for a successful small lettering.

Most digitizing softwares now offer readily digitized letters with 3 to 5 mm font size. Usually, they are helpful, but not suitable in all cases. The special difficulty with small letterings is that the human eye perceives the tiniest deviation as an error. With a flower, it doesn't matter, if one blossom is a bit larger than the other one. Whereas with letters, every tiny irregularity is immediately noticeable.

The satin stitch is usually not ideal for small embroidered letters because the stitch widths involved are not bigger than the diameter of the thread. Nevertheless, in many cases at least parts of the small lettering can be done in finest satin stitches.

The following instructions should be followed during autonomous **digitizing**:

- Use as less stitches as possible and always keep the actual stitch length in mind. For all stitches that are shorter than 0.5 mm, it is suggested to critically question, whether they are actually necessary, as small stitches quickly result in an unattractive embroidery.
- Digitize as few thread cuts as possible. Thread cuts always carry the risk that one thread end remains, or one or two stitches cannot be gripped, which leads to a reduced readability of the letters.
- Digitize arches slightly bigger than in the draft, because the arches might shrink up a bit (e.g. “o” or the arch of the “b”).
- With satin stitches, straight stitch rows (“I” or “H”) should be digitized slightly shorter in comparison with the draft.
- Underlays should be avoided or proceeded in the middle.
- Increase gaps within one letter: set the i-dot further up and shorten the lower arc of the small “e”. Otherwise the “i” becomes an “l”, and the “e” becomes an “o”.



Poorly (above) and well (below) digitized small lettering

BACKING

A bonding between **backing** and fabric improves the readability of small letters. A permanent fixation with a fusible interfacing is ideal. However, from product side, this will not always be possible. Hence, the use of a backing that matches the fabric, that shall be embroidered (cut away backing or tear way backing) is recommended. Before the backing is inserted into the frame, it gets evenly glued on the fabric to decrease the pull as much as possible. It is better to select a thicker backing than a backing that is too thin. Woven fabrics should be inserted as tightly as possible. With elastic materials, the elongation is reduced due to the adhesive backing. In this case, the backing should be framed tightly without stretching the fabric at the same time, because every elongation decreases after embroidering and leads to puckers.

EMBROIDERY THREAD

High-quality **embroidery threads** are essential for fine embroideries, because the work with very small stitches means a higher risk for thread breakage. For the filigree details of a small lettering, often a finer embroidery thread is required if the standard ticket 40 is too thick or stiff. Then, Serafil fine 180 (120/2), Serafil fine 300 (200/2), or even Serafil fine 420 (300/2) are suitable embroidery threads. With fine letterings, the reflectivity plays a minor part, because there is only little surface that could shine. The finer the chosen thread is, the finer can also be the embroidery needle.

EMBROIDERY NEEDLE

The **embroidery needle** is the fifth and last determining factor for successful small letterings. The smaller the needle is, the more detailed the contours can be observed, and the less is the risk for material damage due to penetration holes that are closely spaced next to each other. A size 75/11 or size 100/16 thread can be even embroidered with a Nm 55/7 needle. Therewith, provided all other parameters are intact, letterings of 2.5 mm height are feasible. This corresponds with the usual letter height of a novel. For a thread with ticket 60, needle size Nm 60 or Nm 65 should be used, with a conventional embroidery thread with ticket 40, needle sizes starting from Nm 70+ can be used. The selection of the needle tip can improve the embroidery result or possibly reduce material damage. Universally, the RG tip is to be mentioned, for knitted fabrics also a more rounded tip, such as FFG, can be used.

With the help of some tricks, some rather unsuitable materials can yet be embroidered. As it turns out, embroidering a fill pattern underneath the final embroidery is often successful. A grid in the same colour as the base material is embroidered slightly bigger than the contour of the actual embroidery. The accordingly prepared surface is even and consistent and improves the embroidery result.

EMBROIDERING WITH EXPRESSIVE METALLIC THREADS

Metallic yarns can embellish embroideries with brilliant accents. On uniforms, there are embroideries that pick up on the metallic colour shade of the passements (decorative, non-functional elements on textiles) and with many embroidery motifs, “metal” can be effectively represented with a metallic thread. There is a fundamental difference between metallic threads and embroidery threads in terms of construction. The surface of metallic threads is more coarse and delicate. Compared to a high-quality polyester embroidery thread, the threads are less tear-resistant.

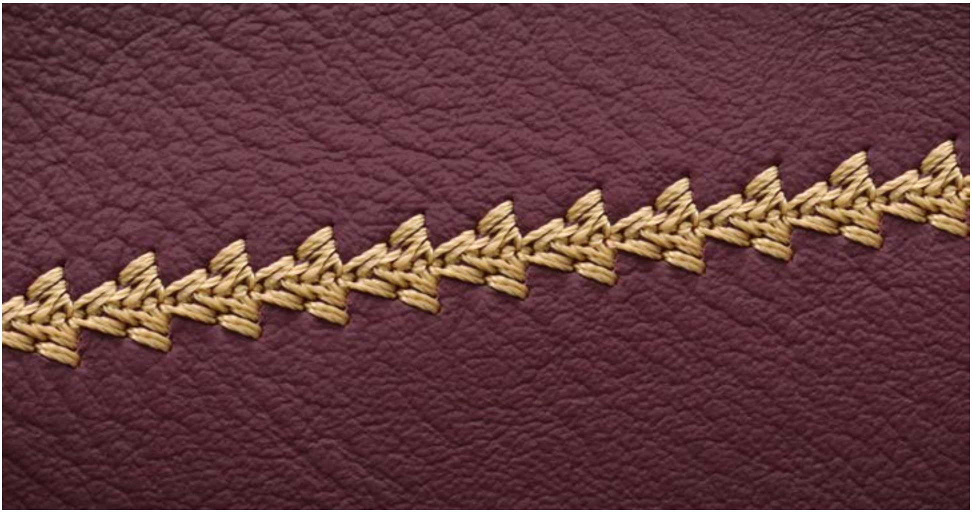
Metallic embroidery

The following advice should be followed during embroidering of metallic threads:

- The embroidery pattern should contain no, or only very few **small stitches** (< 1 mm). For this, the common digitizing programmes have a feature that automatically removes all small stitches ("clean pattern", "remove small stitches" or "optimise pattern"). Besides there is the possibility to enforce a minimum stitch length. For all metallic threads, a minimum stitch length of 1 mm or more is recommended. All edges of a textured fill pattern are particularly critical. In this case, the digitizing softwares are prone to rigidly observe the fill pattern, even if it leads to many micro stitches with a length of e.g. 0.2 mm.
- The **needle thread tension** must be as light as possible. With satin stitches, no looper thread must be visible on the bottom side. The aim is to work with a lower tension and thus, to achieve a higher thread consumption per stitch. As a consequence, the thread is mechanically spared, because it is less frequently pulled through the fabric, the longer the single stitches are.
- The **embroidery needle** must be sufficiently thick. For a metallic thread with ticket 40, needle size Nm 75 or bigger is recommended. The DB x K5 system works with an enlarged eyelet, whereby the thread is protected better. All thread-guiding elements as well as the hook of the embroidery machine must be **free of burrs** and ground in thread paths.
- With a good embroidery programme and a correctly adjusted machine, the work can be proceeded with a speed of 800 UpM. Reducing the **speed** is only necessary, when e.g. a very tight or thick material is embroidered or if the embroidery pattern still contains a relatively high amount of small stitches.

EMBROIDERING WITH THICK THREADS

Particularly for fashionable applications, embroidering with thick threads is a theme from time to time. The embroideries should look as if they are hand-stitched and are partly done with voluminous threads. Up to embroidery thread size 20, partly also 15, the normal looper setting can usually be used.



Embroidery with coarse threads

If thicker threads are to be used without converting the machine, the limits will be reached quite fast. This is based on two facts:

1: When thicker needles (bigger than needle size Nm 100/16) are used, the looper tip touches the needle during each stitch formation which leads to permanent damage. However, this damage usually only appears during embroidering of normal viscose or metallic threads. Then, these threads tear very often which leads to the assumption that they are of poor quality. In reality though, the looper tip sharpened itself to become a sharp lance that easily slashes the thread loops.

2: The rotary hook leads the threads in a slot in the hook housing around the bobbin case. This means, the thread is led from all sides precisely defined, which brings along big advantages for the stitch formation, especially with very high speeds. If a thicker thread is used, it requires more space than an embroidery thread with ticket 40. Thus, it is more slowed down due to the resistance in the slot, than a thread with ticket 40. It is noticeable that loops suddenly occur on the bottom side of the embroidery, which requires the needle thread tension to be adjusted as high as possible in order to fully pull back the thread. The needle thread tension must be sufficiently high, so that it is higher than the resistance of the thread in the slot of the looper. The thread is always pulled from the side, where there is the lowest resistance.

With some embroidery techniques (mostly with handstitch imitations based on running stitches), it is possible to achieve the look of a thicker thread by the use of multiple plies of a thinner thread. Especially with matt embroideries on linen or loden, this works very well. The machine does not need to be re-engineered. However, the running time increases accordingly.

A thick thread may be used as bobbin thread for single pieces and small-scale productions. This requires a relatively high amount of attention though, because on the one hand, embroidering happens from "the left" (thus, also inverted), on the other hand, especially during the initial stitches, it is important to mind that the thread end reliably reaches the upper side of the material. Otherwise, unfavourable knots appear in the embroidery. The low capacity of the bobbins and the associated often occurring interruptions are definitely disadvantageous.

Through a special needle, which has a deeper groove and consequently spares the looper tip, at least hook damages can be avoided. The problem with the loop formation on the bottom side can only be solved by the usage of a looper that is meant for thicker threads. Then, the looper can be adjusted to an accordingly thick needle (e.g. Nm 120 or Nm 130) without any extra effort. A needle plate with a larger stitch hole makes the converted machine perfectly suitable for embroidering thick threads. The conversion to thick threads should be carefully considered, because the return to a size 40 thread means another conversion back to the original state. Since all needles of an embroidery head work with the same looper, it is unfortunately not possible to permanently adjust only one needle for the processing of thick threads.

To achieve the best possible embroidery result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center, Embroidery Division, is available for further information or concrete recommendations.

The AMANN range for embroideries comprises the following products: Isacord, Isamet, Isa Texlight, Serafil fine, MercifilGD, Rasant, A-tech CS, N-tech CS, I-tech, N-tech

The AMANN range for bobbin threads comprises the following products: Isa, Isabob, Saba

AUTOMOTIVE INTERIOR SYSTEMS

CHAPTER OVERVIEW

Processing leather and textiles in the automotive industry places highest requirements onto materials and production processes. It is important to achieve the best possible production efficiency, and very high standards are required to ensure the trouble-free use of the components throughout the automobile's entire lifetime. The sewing thread must fulfil these requirements, too. In car interior, there are two main application fields, seating and interior systems.

SEATING SYSTEMS

Seating systems

Seating systems include seat covers, headrest covers and side bolsters. The thread is important, not only for creating a functional joining seam, but also as a visual enhancement to the vehicle. Seat comfort is as important as appealing decorative seams. Both criteria can only be fulfilled ideally using high quality sewing threads and the correct processing parameters. A speciality in seat cover manufacturing is the side-airbag deployment seam.

PROCESSING OF SEAT AND HEADREST COVERS

In almost all cases, seat and headrest covers are processed with continuous filament threads. Other sewing thread types are normally not applied due to the high requirements on the sewing thread performance during processing and in later usage of the component. Further information regarding continuous filament threads can be found in chapter Sewing thread construction.

The AMANN assortment contains following sewing threads for seating systems:

Type of seam	Product recommendation
Decorative seams	Serafil, polyester continuous filament, unbonded Ticket 10, 15, 20 as needle thread Ticket 20, 25, 30, 40 as bobbin thread Strongfil, polyamide 6.6 continuous filament, unbonded Ticket 13 as needle thread Ticket 30, 40 as bobbin thread Strongfil+, polyamide 6.6 continuous filament, unbonded Ticket 20, 30 as needle/bobbin thread
Functional seams	Serafil, polyester continuous filament, unbonded Ticket 25, 30 as needle/bobbin thread Strongfil+, polyamide 6.6 continuous filament, unbonded Ticket 30, 40 as needle/bobbin thread
Side-airbag deployment seams	Serafil, polyester continuous filament, unbonded Ticket 40 as needle thread Ticket 80 as bobbin thread Strongfil+, polyamide 6.6 continuous filament, unbonded Ticket 40 as bobbin thread
Embroidery	Isacord, polyester continuous filament, unbonded, trilobal Ticket 40 as needle thread Serafil, polyester continuous filament, unbonded Ticket 80, 120/3 as needle thread Isa polyester fibre thread, unbonded Ticket 150 as bobbin thread

Combinations of different tickets and thread types are possible. However, the following minimum requirements should be considered.

For **decorative seams**, it is imperative to choose the bobbin thread in accordance to the needle thread. Normally, the bobbin thread is twice the ticket number or half the density of the needle thread, i.e. combine needle thread ticket 20 and bobbin thread ticket 40. Extreme differences in thickness, such as needle thread 20 with bobbin thread 80 or needle thread 20 with bobbin thread 15 should be avoided. Generally, it is possible to combine polyester and polyamide sewing threads in one seam system.

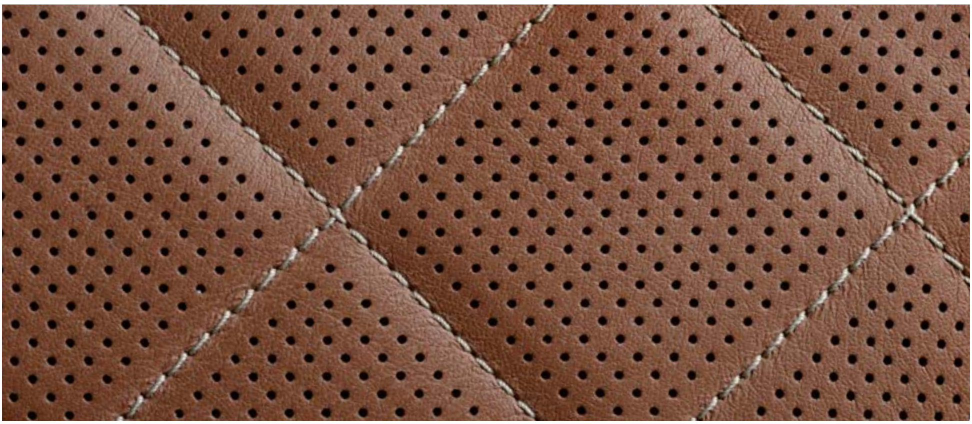
For **functional seams**, the same ticket size is used as needle and bobbin thread. Other combinations are unusual and do not provide any technical advantage. An exception is the side-airbag deployment seam.

For **side-airbag deployment seams**, normally needle thread ticket 40 is combined with bobbin thread ticket 80. For decades, Serafil 80 has been the chosen product for this safety-critical application. It fulfils all automotive requirements regarding documentation and process capability. The traceability of production data is assured by special labelling with barcode labels on the base of the spool. The seam parameters in place are precisely defined by the OEM (Original Equipment Manufacturer) and must strictly be complied with.

For **embroidery** on headrests or backrests (only in shoulder area), Isacord is usually recommended, also Serafil 80 and 120 may be used. The thread for finest lines < 1.5 mm width or letters/symbols < 2 mm is Serafil fine 180 (120/2). As bobbin thread for embroidery on leather, artificial leather, fabric or door mats, Isa in ticket 150 is the best choice; the combination of the slightly hairy staple fibre thread Isa 150 with a glossy needle thread is the solution for safe initial stitches. Using Isacord 40 on automotive seat applications for front or back seats (highly stressed areas) cannot be recommended. Generally, the requirements on abrasion resistance must be considered for each application.

REQUIREMENTS AND CHARACTERISTICS

Polyester threads, such as Serafil offer very good lightfastness, universal possibilities for automotive colour design and can also fulfil all automotive requirements in the mechanical characteristics. A very precise processing is enabled due to the very consistent performance profile of Serafil, whose substantial characteristic is the excellent gliding ability of the thread. Especially with challenging decorative seam patterns on seat middle parts, outstanding seam results featuring high process stability can be achieved.



Diamond insert at seat middle part

Strongfil+, the polyamide sewing thread has advantages, especially due to its very good mechanical product characteristics. The lightfastness and dying ability is good, related to the raw material in comparison to polyester, it is however limited.

Serafil, as well as Strongfil+, are both suitable for seat cover manufacturing, whereas the different polymer characteristics have to be considered during seat development.

IMPORTANT PROCESSING PARAMETERS

Parameter	Description
Needle size	Nm 110–180 The minimum required needle size is defined by the sewing thread diameter (the thread needs enough space in the needle eye), as well as by the sewing material and number of layers. It is recommended to conduct sufficient tests on original sewing material under serial or close to serial conditions. The needle recommendations are specified on the respective product pages.
Needle point	For decorative seams on leather/artificial leather: cutting needle points (LR, S, LL, D, DH or SD/SD1), they ensure a sufficient pull-in of interlocking and thus, accurate seams. For decorative seams on fabric or warp/weft-knitted materials: round or ball points (R, FFG/SES), cutting points damage the material. For joining seams on leather/artificial leather: round points (R), for very hard/thick leather also a small cutting point (SD/SD1)
Stitch type	Standard is double lockstitch (type 301), as 1- or 2-needle version; for sewing middle parts rarely also double chainstitch (type 401), overlock stitch (type 504, 505) for headrests
Machines	Double lockstitch machines for medium to heavy-duty applications (deco and joining seams), CNC sewing units (large-scale patterns/diamond patterns), sewing stations for documented sewing of airbag tearing seams (side-airbag deployment seam), overlock machines (serging headrests)
Stitch length	Deco seams: between 2–2.5 stitches/cm Functional seams: between 2.5–3.3 stitches/cm Side-airbag deployment seam: according to OEM specification Overlock seams: between 5–6.5 stitches/cm

SPECIFIC PROCESSING RECOMMENDATIONS

1. Knot effect

Knots appear on the lower side of decorative or functional seams due to an insufficient pull-in of interlocking. Corrective measures are the exact, repeatable adjustment of thread tension (with tension meter), the use of correct needle size and ideal needle point, the polishing of metal parts on the machine and the replacement of broken or worn parts (especially needle plate, feed dog). Leather with high variation in material thickness has to be levelled out by skiving the seam area.

Knots on the lower side of the seam

2. Profile seams

When sewing profiles onto seat covers, the thread is subject to extreme stress. Using high quality threads can prevent many problems. Due to the high quality finish of AMANN's sewing threads, the needle temperature is remarkably reduced, and less melting clots or thread breakages occur. Additional needle cooling devices are beneficial. For cardboard profiles that are difficult to process, Rasant-Oxella 20 or 25 can be an option instead of continuous filaments, such as Serafil 20, 30 or Strongfil+ 20, 30, 40.

Perfectly processed profile

3. Threading and thread tension adjustment

To eliminate sewing problems in advance, it is crucial to follow the machine supplier's guidelines for correct threading. For thread tension adjustment, it is recommended to use a tension meter. Only by doing this, the adjustment is exact and can be replicated. The measurement of the needle thread tension takes place at the top dead centre of the thread take-up lever. See also chapter Measuring of needle thread tension.

Generally, we recommend to adjust the thread tension as low as possible and only as high as necessary. For double lockstitch seams with needle thread ticket 20, a needle thread tension of 350–450 can work well, for bobbin thread ticket 40, a bobbin thread tension of 75–150 cN is adequate. In any case, values above 600 cN for needle thread or above 200 cN for bobbin thread should be avoided. Tension values that are too high can often cause problems like thread breakage, uneven decorative seams or knots.

The respective suitable value has to be tested case by case as the thread tension depends on many parameters (i.e. number of material layers, type and thickness of material, type and thickness of needle and bobbin thread, type of machine and needle).

INTERIOR SYSTEMS

Door panel

Interior systems are e.g. dashboard, armrest, console, door panel and gear shaft cover. The thread is used for safe functional seams, decorative seams as well as a tearing thread for dashboard deployment seams.

PROCESSING OF INTERIOR SYSTEMS

Only continuous filament threads are recommended when stitching interior trim. Other thread types are unsuitable due to the high thread performance required during manufacture, and the durability required from the finished component. Further information regarding continuous filament threads can be found in chapter Sewing thread construction.

The AMANN product range contains the following sewing threads for interior systems:

Type of seam	Product recommendation
Decorative seams	Serafil, polyester continuous filament, unbonded Ticket 15, 20 as needle thread Ticket 25, 30, 40 as bobbin thread Strongfil+, polyamide 6.6 continuous filament thread, unbonded Ticket 40 as bobbin thread
Functional seams	Serafil, polyester continuous filament, unbonded Ticket 25, 30, 40 as needle/bobbin thread Strongfil+, polyamide 6.6 continuous filament, unbonded Ticket 40 as needle/bobbin thread
Dashboard deployment seams	Serafil, polyester continuous filament, unbonded Ticket 120 as needle/bobbin thread

Combinations of different tickets and thread types are possible, nevertheless it is essential to consider the minimum requirements, as described in chapter Seating systems.

Normally, the bobbin thread with **decorative seams** is twice the ticket number or half the density of the needle thread (e.g. needle thread Serafil 20 and bobbin thread Serafil 40).For **functional seams**, the same ticket size as needle and bobbin thread is used (e.g. Serafil 40 as needle and bobbin thread).For **dashboard deployment seams**, Serafil 120 is used as needle and bobbin thread. For years, also Serafil 120 is the reference product for this safety-critical application and fulfils all automotive requirements regarding documentation and process capability. As already mentioned, the traceability of production data is assured by special labelling with barcode label at the spool bottom. The seam parameters in place are precisely defined by the OEM and must be strictly complied with.

REQUIREMENTS AND CHARACTERISTICS

Perfect decorative seams are essential in interior trim. Very often, contrast threads are used. Every stitch is visible and must be perfect. This can be reliably achieved by using AMANN's high quality sewing threads in combination with ideal sewing parameters. The excellent gliding ability, balanced twist ratio and very good off-winding characteristics of Serafil and Strongfil+ are the basis for a trouble-free sewing operation at high process stability and low scrap rate.

Polyester threads are the best choice for decorative seams on interior parts. Serafil stands out for application in highly UV-exposed areas due to its very good UV-resistance. Very precise processing is enabled due to the very consistent performance profile of Serafil, especially on very thin sewing materials as used for interior trim parts. Substantial characteristic is the excellent gliding ability of the thread.

Polyamide threads are used for safe functional seams, but only in ticket 40. Because of the lower lightfastness, Strongfil+ is not recommended for decorative seams on highly UV-exposed parts.

Parameter	Description
Needle size	Nm 80–150 The minimum required needle size is defined by the sewing thread diameter (the thread needs enough space in the needle eye), as well as by the sewing material and number of layers. It is recommended to conduct sufficient tests on original sewing material under serial or close to serial conditions. The needle recommendations are specified on the respective product pages.
Needle point	For decorative seams on leather/artificial leather: cutting needle points (LR, S, LL, D, DH or SD/SD1), they ensure a sufficient pull-in of interlocking and thus, accurate seams. For decorative seams on fabric or warp/weft-knitted materials: round or ball points (R, FFG/SES), cutting points damage the material. For joining seams on leather/artificial leather: round points (R), for very hard/thick leather also a small cutting point (SD/SD1)
Stitch type	Standard is double lockstitch (type 301), as 1- or 2-needle version; for stitching slush-skin dashboards or door panels also double chainstitch (type 401)
Machines	Double lockstitch machines for medium heavy-duty applications (deco and joining seams), 3D CNC sewing robot (deco seams on 3D slush-skin parts), sewing stations for documented sewing of airbag tearing seams (side-airbag deployment seam)
Stitch length	Deco seams: between 2–2.5 stitches/cm Functional seams: between 3–4 stitches/cm Dashboard deployment seam: according to OEM specification

SPECIFIC PROCESSING RECOMMENDATIONS FOR INTERIOR SYSTEMS

1. CHRISTMAS TREE EFFECT/S- AND Z-TWISTED THREADS

The so-called Christmas tree effect with 2-needle decorative seams (slanted stitches on the right needle side) is caused by the opposite threading direction and loop pick-up on the right and left needle side. Potential for improvement with leather/artificial leather lies in a corresponding cutting needle point (S or LL), and an increase of material thickness by using seam tape or using a thinner bobbin thread (e.g. Serafil 40 instead of Serafil 20). Using S-twisted threads on the left needle side does not offer any technical advantage, as the seam appears more uneven due to the different twisting direction.

Strongfil+ is not recommended for decorative seams on extremely UV-stressed items.

Twin needle seam with S- and Z-twisted thread

Twin needle seam with 2 Z-twisted threads

2. UNTWISTED NEEDLE THREAD WITH DECORATIVE SEAMS ON ARTIFICIAL LEATHER

Artificial leather is often difficult to process as the materials inherent elasticity causes high friction during processing, which can result in a twist shift of the needle thread. Measures for better processing are:

- thorough check of the machine
- neatly polishing of metal parts (especially feed dog, needle plate, hook; polish in direction of thread movement)
- use of an appropriate needle size
- testing of a seam tape
- reduction of the sewing speed

If this is not sufficient, the artificial leather can be optimised in terms of processability.

Uneven decorative seam on artificial leather

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center, Automotive Division, is available for further information and concrete recommendations via automotive-sewing@amann.com.

For Automotive interior systems, the following products are recommended from the AMANN range: Serafil, Strongfil, Strongfil+, Isacord, Isa

SAFETY-CRITICAL SYSTEMS IN AUTOMOBILES

CHAPTER OVERVIEW

AIRBAGS

Airbags are standard safety features in automobiles. Driver, passenger, side or curtain-airbag, they all must prove function. In case of an accident, it can be a matter of life or death. Thus, highest requirements are set on the production: processing problems such as thread breakage, seam irregularities or material damage lead to scrap. A barcode identification secures the documentation of the entire production process and allows monitoring and storing of all relevant processing parameters. For production, there are specific requirements based on quality management systems, such as IATF 16949. The sewing threads in use are subject to strict and extensive specifications defined by the OEM or Tiers. The approval process for serial deliveries includes highly elaborate procedures and testing.

Curtain-Airbag

PROCESSING OF AIRBAGS

Airbags are sewn exclusively with continuous filament threads. Other thread types are not applied due to the high demands on the sewing thread performance. The sewing threads must feature a consistent high quality level showing narrow tolerances. Further information regarding continuous filament threads can be found in chapter Sewing thread construction.

Due to their outstanding technological performance profile, primarily polyamide 6.6 continuous filament threads are used. The processing mainly happens multidirectional.

The AMANN assortment contains following sewing threads for airbag sewing:

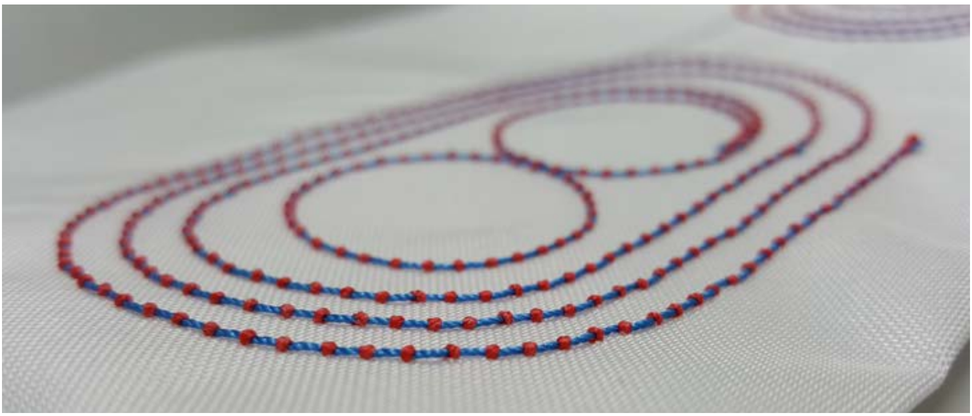
Type of seam	Product
All Airbag applications	Oxcel+, polyamide 6.6 continuous filament, bonded Tickets 13, 20, 30, 40, 60, 80 as needle/bobbin thread
Bobbin thread for alternative seam construction	Wardex, polyamide 6.6 continuous filament, unbonded Ticket 20 as bobbin thread
Higher temperature resistance	Oxcel HT, polyamide 4.6 continuous filament, bonded Ticket 20 as needle/bobbin thread
Very high temperature resistance	Kc-tech, Kevlar DuPont® continuous filament, bonded Ticket 20, 20/1 as needle/bobbin thread

REQUIREMENTS AND CHARACTERISTICS

Seams with heavy exposure to thermal stress in the alternator' intake opening area are often stitched with para-aramide or polyamide 4.6 continuous filament threads. These raw materials offer a higher thermal absorption capacity compared to polyamide 6.6.

The key for these demanding sewing operations is process stability. To enhance the seam performance, especially with multidirectional sewing operations, the use of bonded needle threads was proven successful and became common practice. Bonding prevents from twist shift and thus, from untwisting the needle thread.

The AMANN bonding is specially designed for processing several polyurethane coated layers of airbag nylon at high sewing speeds in multidirectional seams and thus, ensures trouble-free, fully-automatic processes.



Multidirectional sewing operation

IMPORTANT PROCESSING PARAMETERS

Parameter	Description
Needle size	Nm 80–160 The minimum required needle size is defined by the sewing thread diameter (the thread needs enough space in the needle eye), as well as by the sewing material and number of layers. It is recommended to conduct sufficient tests on original sewing material under serial or close to serial conditions. The needle recommendations are specified on the respective product pages. To support a trouble-free sewing process, the needle types SERV 7 (Schmetz) or SAN® 5.2 (Groz-Beckert) can be tested. Both needle types with reinforced shaft construction ensure a higher needle stability and thus, less needle deflection (avoidance of skip stitches).
Needle point	Round and ball points, e.g. R, RG or FFG/SES. RG points put less stress onto sewing materials during penetration and show reduced wearing – ideal preconditions to avoid material damage.
Stitch type	Double lockstitch (301) or double chainstitch (401), depending on the seam position.
Machines	CNC sewing units and special lockstitch or chainstitch machines. Due to the obligation for documentation, each sewing unit or machine is equipped with a system to monitor and record the relevant parameters.
Stitch length	2–5 stitches/cm

Needle type SAN® 5.2 Groz-Beckert, source: Groz-Beckert

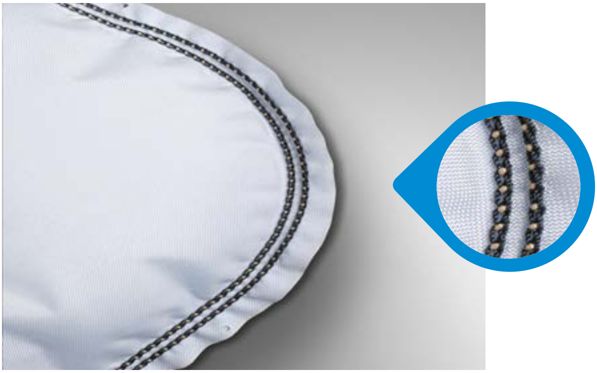
SPECIFIC PROCESSING RECOMMENDATIONS

1. Needle change

As the needle is highly stressed, a regular needle change is crucial; generally, a needle change interval is defined in the production standards. Under the aspect of zero-defect production and the related preventive quality assurance, a needle change at the beginning of every shift is helpful.

2. Thread colours for simple quality control

For visual quality, control needles and bobbin threads of different colours are used. Thus, the interlocking can be checked quickly and easily, partly also automated.



Chainstitch seam with two different thread colours for visual control

3. Processing speed

During processing of densely woven airbag fabrics, high needle temperatures can result, which generate thermal damages. To avoid this, the work should not be proceeded with sewing speeds that are too high. Besides this, needle air cooling devices should be installed.

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center, Automotive Division is available for information and concrete recommendations via automotive-sewing@amann.com.

For airbag systems in automobiles, the following products from the AMANN range are recommended: Oxcel+, Kc-tech, Wardex

SEAT BELTS

Seat belt

Safety belts are an essential safety feature in automobiles. The lifetime of a car is around 15 years. At least for this period of time, faultless functioning must be guaranteed. The thread as the joining element, as well as its correct processing determine the system's durability. The strength of the thread in combination with the chosen seam pattern and the number of stitches defines the strength of seam.

PROCESSING OF SAFETY BELTS

Mainly continuous filament threads made of polyester are used due to material purity to polyester belts. The linear density of thread complies with the requested seam strength and is generally indicated in exact specifications. Standard tickets are 8–15.

With a thread strength of 22,500 cN, Serafil 8 can achieve a seam break strength of approx. 71,300 cn/cm in seam patterns with an appropriate number of stitches. Mainly spun-dyed black threads are in use, e.g. Serafil 8 spun-dyed black. These products combine very high strength with very good colourfastness characteristics.

The AMANN assortment contains following sewing threads for sewing seat belts:

Type of seam	Product
Safety relevant seams	Serafil, polyester continuous filament, unbonded, bath-dyed (colour) Ticket 8, 10, 13, 15 as needle/bobbin thread Serafil, polyester continuous filament, unbonded, spun-dyed black (SW) Ticket 8 SW, 10 SW, 13 SW as needle/bobbin thread
Other seams (stitching labels, butterfly seams)	Serafil, polyester continuous filament, unbonded Ticket 20, 30, 40, 60

REQUIREMENTS AND CHARACTERISTICS

Due to the extremely densely woven belt webbings and the high needle sizes, the friction between needle and material is immense. The result is a high needle temperature, bearing the risk of thermal damage to both material and thread. The thread finish with an appropriate lubrication is one of the key factors. The lubrication has a cooling effect and also ensures a smooth gliding of the thread through the thread guiding elements. A fully automated process can be ensured without any thread deposit.

This is a significant processing advantage over bonded threads. Due to excessive friction, the bonding comes off and soils the machines. Frequent cleaning intervals are the result. Further, due to the deposit in the hook area, important automatic bobbin thread control systems cannot work completely, which is a big disadvantage with seat belt assembly lines with high level of automatisation.

Sewing speed reduction and needle air cooling devices are additionally required with demanding applications. A regular needle change is fundamental as a damaged needle can cause material damage and plenty of scrap parts. A needle change at the beginning of every shift is recommended.

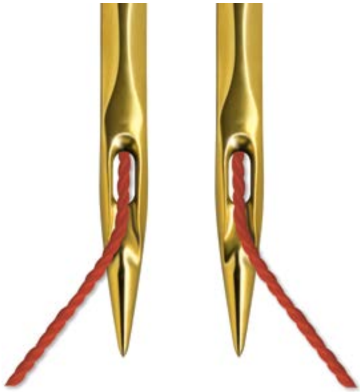
IMPORTANT PROCESSING PARAMETERS

Parameter	Description
Needle size	Nm 180–250 The minimum needle size depends on the sewing thread diameter (the thread needs enough space in the needle eye), as well as by the sewing material and number of layers. It is recommended to conduct sufficient tests on original sewing material under serial or close to serial conditions. The needle recommendations are specified on the respective product pages.
Needle point	Round and ball points, e.g. R, RG or FFG/SES. Cutting points would ease needle penetration in hard belts, but are unacceptable, because of the inherent risk of material damage.
Stitch type	Exclusively double lockstitch (stitch type 301).
Machines	Double lockstitch automatic pattern stitcher or programmable sewing units for medium/heavy-duty application, often integrated in automated production lines. Automatic short pattern stitcher create the typical seam patterns to fix the belt on the safety belt lock. The sewing field size is up to 100 × 80 mm^2, different seam patterns can be programmed. A seam pattern is always stitched multidirectional.
Stitch length	2–4 stitches/cm

SPECIFIC PROCESSING RECOMMENDATIONS

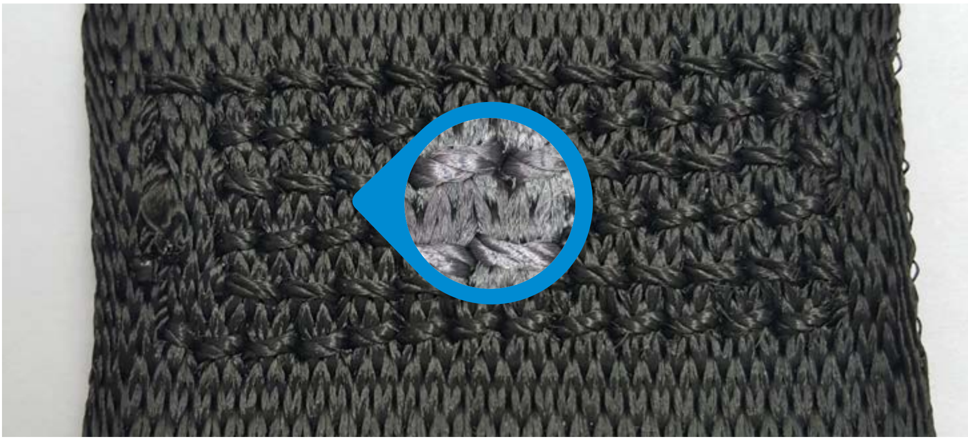
1. Multidirectional sewing

During multidirectional sewing, the sewing field is moved in the required direction. That means any direction within 360° is possible. Thus, the thread can be subject to twist shift and untwisting. Sewing problems can be the result. To avoid this, a low thread tension and the use of special needles like SERV 7 from Schmetz or SAN® 5.2 from Groz-Beckert can be beneficial.



SAN® 5.2. with special needle point for multidirectional sewing, source: Groz-Beckert

If all parameters are well coordinated, twist shift can be prevented.



Twisting with multidirectional seam (microscope)

2. Hot cutting device

A speciality in belt production is the hot cutting of thread ends. Therefore, the sewing machines are equipped with a hot cutting device. Instead of the common backtacking at the beginning and end of seam, the seam end is secured by hot-cut thread ends. To not use backtacking stitches prevents from seam damage at this area and increases seam stability. The seam should always end at the side of the belt, because these areas are less exposed to stress than the centre of the belt.

3. Thread balance

During belt production with double lockstitch, an equal ratio of needle and bobbin thread with interlocking in the middle of sewing material cannot be realized. The reason for this is the hard belt material, in which no interlocking can be pulled in. Normally, the interlocking lies on the lower side of the seam.

4. Seam pattern

In practice, different seam patterns are in use (cross-box, meander or zig-zag), depending on the belt material and the required seam strength. Only with sewing tests and subsequent tearing tests, the best possible match of all parameters can be identified (seam pattern, belt, thread, needle, machine adjustments).

To achieve the best possible sewing result, it is recommended to conduct individual tests first. The AMANN Sewing Technology Center, Automotive Division is available for information and concrete recommendations via automotive-sewing@amann.com.

For seat belt systems in automobiles, the following products from the AMANN range are recommended: Serafil

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