Types and Sewability Improving Finishing Agents on Sewing Threads

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1. Introduction

Sewing thread defined as it is a flexible, small diameter yarn or strand usually treated with a surface coating, lubricant or both, intended to be used to stitch one or more pieces of material or an object to a material. It may be defined as smooth, evenly spun, hard-twisted ply yarn, treated by a special finishing process to make it resistant to stresses in its passage through the eye of a needle and through material involved in seaming and stitching operations. Sewing threads form efficient stitches without breaking or becoming distorted during the useful life of the product. The basic function of a thread is to deliver aesthetics and performance in stitches and seams.

Selecting the right type of threads for any sewing work is important because the color and texture of the design, and eventually the look of the final product depend on the material and type of thread used. There's a wide variety of sewing thread to choose from, so take your time to decide what type or combination should be best for the design you have in mind. More importantly, thread selections should be based on Sewability, Seam Performance and Appearance, Availability and Cost.

The least amount breakdown in thread performance consequences in losses on investments in fabric, equipment, garment engineering, and labour. Hence, it is important to know the thread thoroughly. Enhancing thread knowledge, analysing thread parameters, the right selection procedure and use of thread plays a very important role in achieving good sewing presentation and the preferred sewablity and seam quality.

2. Types of threads based on substrate

The usage of thread made from natural substrates is now minimal in industry applications. However, the most commonly used natural thread is cotton thread**.**

Cotton: It has good strength and, low extension with resistance to shrinkage .It does not melt even at high sewing rate. Abrasion resistance also found appreciable. The negative aspects of the cotton could be due to its less durable nature, weaker then the synthetic fiber made yarns and poor mildew resistance. It can withstand at a high temperature then the synthetic fiber yarns. It based on the end uses.

Synthetic: Due to the limitations of natural fibers, thread users have turned to threads made from synthetic fibers as they have desirable properties of exceptionally high tenacity, high resistance to abrasion and good resistance to chemicals. They are also not significantly affected by moisture, rot, mildew, insects or bacteria.

3. Types based on construction thread structure

Staple spun thread: It is considered one of the best and most satisfactory performing sewing thread due to high strength at cyclic loading, good chemical and abrasion resistance properties with dye and light fastness properties with low cost. Comparative hairiness in the thread reduces thread friction and improves the Suability

Core-spun Sewing Threads: Extra ordinary strength and abrasion resistance of the polyester filament are provided strong and firm seams. Superior heat insulation of cotton cover makes seam totally a heat proof and excellent elastic recovery with no thread breakage at point of stress. Lubricant is retained well in the surface of the cotton to provide superior cooling to prevent thread burnout at the needle eye.

Filament yarn: It is having good fiber strength to fineness ratio. Puckering may results due to unfavorable extension characteristics.

Multifilament yarn: Filaments often bonded with synthetic fiber copolymer that bonds the individual filaments and yarns together to give optimum sewing performance.

Textured Filament Yarns: It provides discontinuous thread in the surface, which helps to reduce the danger of thread fusion at high sewing speeds .the soft handle fulfill the soft seam requirement.

3.1. Thread construction

All conservative sewing threads begin their production series as simple yarns. These basic yarns are produced by twisting together relatively short fibers or fine continuous filaments. Some terms used in the context of thread construction are:

Twist: The 'twist' of a thread refers to the number of turns per unit length (TPI/TPM) required to hold the fibres (spiral arrangements) / plies together to give the yarn / thread material the required strength and flexibility. A thread with an extreme twist is also likely to give problem while sewing due to 'high twist', which can cause snarling, loops, knots and possible spillage that prohibit stitch formation.

Twist direction: Direction of twist is identified as 'S' for left twist and 'Z' for right twist. Most single needle lock stitch and other machines are designed for 'Z' twist threads. 'S' twist thread untwists during stitch formation. Direction of twist does not have an effect on the strength of the thread, but it can critically impair its performance when it is used on a machine for which it is not matched

Ply and cord: Yarns with many components are twisted together to form ply thread. Most commonly used are 2, 3 or 4 ply threads. Threads are twisted together to give corded thread. Most commonly used are 4, 6 or 9 cord threads.

4. Types based on thread finishing

Thread finish can have several meanings in the thread industry. Finishing can refer to any additional process that a thread goes through to alter its original physical characteristics. Examples would include mercerized, glazed, bonded and anti-wick finishes. Finish can also refer to the lubrication put on the thread prior to winding for the purpose of protecting the thread against needle heat and giving the thread good lubricity characteristics as it passes through the sewing machine.

Finishes are given to a thread for two purposes

4.1. To improve sewability

Some finishes involve increasing strength, abrasion resistance and lubrication of the thread.

"Sewability" of thread is a term used to describe a sewing thread's performance. A thread with good sewability is uniform in diameter with a good surface finish. Longitudinal uniformity of thread contributes to uniform strength and reduced friction, as it passes through the stitch forming mechanisms. It also minimises thread breakages and the associated costs incurred from rethreading machines, repairing stitches and producing inferior quality products.

Table 4.1.1: sewability improving agents and its characteristics

S.NO	DESCRIPTIONS	CHARACTERISTICS
1	Non ionic Poly ethylene Emulsion	Improves Tear and abrasion resistance. Improves Sewability.
2	Formulations of polysiloxane & Polymeric additives	Reduces coefficient of friction. Reduces the hairness of the thread. Uniform pick up across thread surface.

"Soft" spun cotton threads are converted to "Mercerized" threads when they are passed through an additional process where they are treated in a caustic solution under controlled tension. This process causes the fibers to swell, resulting in greater affinity for dye penetration. Mercerization increases the luster of cotton threads and at the same time increases their strength.

"Soft" spun cotton threads can also be converted to "Glazed" threads by coating the threads with starches, waxes, and special chemicals under controlled heat and then brushing or polishing them to a high luster. The result is a glossy, hard finish that protects the thread from abrasion and enhances its ply security.

"Bonded" finish is an additional process performed on multifilament polyester and nylon threads where a special resin is added that encapsulates the filaments forming a tough, smooth protective coating on the surface of the thread. This bonding process adds significantly to the thread's ability to resist abrasion and greatly enhances ply security during sewing.

4.2. To achieve a specific functional requirement

Some finishes include bonding, non wick, and anti-fungal, fire retardant, water repellent and anti-static finishes.

Table 4.2.1.: functional finishing agents and its Characteristics

S.NO	DESCRIPTIONS	CHARACTERISTICS
1	Antimicrobial Agent	Gives Highly effective, durable antimicrobial finish
2	Cross linking agent based on blocked isocynate compounds	Imparts durability and handle of the textiles.
3	Anionic Acrylic Co polymer	It enhances Abrasion resitance
4	Flame Retardant	Gives Flame retardant Finish on synthetics & their blends. And cotton

"Anti-wick" finish is an additional process where "soft" threads are treated with special anti-wick chemicals to enhance the threads resistance to water migration.

Thread finish or lubricant is generally added to the thread during the final winding process. Both the amount and type of lube are critical to proper sewability. Generally, the finer the thread size, the less lube that is required on the thread. Threads required to penetrate heavier and denser fabrics will require more thread lubricant to product the thread from needle head and enhance sewing performance.

5. Application Methods:

There are two types of application method:

5.1. Exhaust Method:

Where the lubricants are used post dyeing in exhausts system such as yarn dyeing apparatus

5.2. Lick Roll Method:

Where the threads are taken out of the dyeing machines, dried and then lubricants are used from a roller to the thread. This method is usually the most common method

The main function of sewing threads is to hold together parts that could be of textile, leather etc to form garments etc and other made-ups. Sewing machines are used to join the parts with the sewing thread in a process called "Sewing".

Industrial Sewing is an extremely high-speed operation (up to 12,000 stitches per minute) that demands a great deal from the sewing thread. The kinds of forces that are exerted on sewing threads during sewing are breaking force and Frictional forces at the various deflection points

In addition, it has been found that the sewing threads are exposed to extremely high temperatures (up to 400 o C in some cases) of the sewing needle. This is critical especially in case of synthetic fibre sewing threads whose melting point is about 2500 C.

6. Types of finishing agents and its applications

- ✓ Paraffin wax products
- ✓ Silicones
- ✓ Anti static agents

Table 6.1: finishing agents (products) and its applications

s.no	Finishing agents and products	Description and Characteristics
1	Profinish-LAN	40% active cationic dispersion of waxes & softeners. Lubricant for 100% cotton sewing threads. Lubricant free of silicone.
2	Sylast-TL-200	100% active, 200-250 cps viscosity lubricant based on silicone & additives. Suitable for all kind of sewing threads & embroidery yarns For the cold lick roll application.
3	Profinish-NF	Cationic sew ability improver for textile fabrics of cellulosic, synthetic or wool fibers and their blends.
4	Profinish-NPF	Wet waxing and softening agent For the finishing of yarns made of synthetic fibers, wool and blends of these; also suitable for cellulosic fibers. Low concentrations give extremely smooth yarns. High yield from long liquors. Good abrasion resistance & antistatic properties.
5	Profinish-SVN	"Thermostable, non-sublimating sewability improver with an excellent soft handle; does not cause thermo migration; no influence on whiteness"
6	Sylast-DSWS	A ready-to-use, fully-formulated, new generation polysiloxane based product, designed for application as sewing thread finish.
7	Sylast-CL	Weakly cationic conditioning agent to improve the sliding properties of bleached or dyed yarns of all types of fiber
8	Modfinish-HDNI	A softener that improves the tear strength of textile goods of all types of fibers. Key application areas: resin finishing and sewability improver.

9	graf Thread Lubricant	Adjustable lubricant pick-up from 0,5% up to 10%, depending on the type of thread
10	Graf Single thread Cold Lubrication System	Consisting of a dosing unit and the Single Lubricant Cold Application water-based lubricants on finish- or pre-winding.
11	Graf Single thread hot Lubrication System	Single Lubricant Hot Applicator - heated to exactly 80°C, is optimized for use water-free application provides immediately packable and usable bobbins.
12	Formulations of polysiloxane & Polymeric additives	Reduces coefficient of friction. Reduces the hairness of the thread. Uniform pick up across thread surface. Dries fasty at room temperatute.
13	Fatty acid polyglycol ester	Backwashing machines, galette, lick role methods Low friction values, Very good antistatic effects, Balanced grip and glide performance, non ionic nature
14	polyethylene and waxes	Low friction values attainable, Improves the sewability of piece goods, Non-ionic, weakly cationic in acid medium, Method yarn dyeing machine
15	Preparation of wax, polysiloxane compound and quaternary ammonium compound	Sewing thread lubricant for application by the exhaust method, suitable for all common fibre types, preferably for PES; wet waxing agent for weaving and knitting yarns, preferably of PES, with antistatic effects. method yarn dyeing methods
16	polysiloxane compound, wax and additives	Non-aqueous embroidery and sewing thread lubricant for galette or metering pump applications, suitable for all usual fibre types, preferably for PES. Methods lick role and metering pump.
17	Preparation of polysiloxanes, paraffin and fluorocarbon polymer	Sewing thread lubricant and water-repellent finish for sewing threads and embroidery yarns by continuous application through a galette, lick roll or metering pump methods , Cationic nature.
18	Preparation of high-molecular weight polysiloxanes, waxes and additives	Sewing thread lubricant for application according to the exhaust method, suitable for domestic sewing threads made from PES or CO as well as for CO industrial sewing threads. Method yarn dyeing method, Cationic nature.
19	Preparation of polyhydroxy carboxylic acid	Exhaustion controller/promoter for sewing thread finishing using the exhaust process yarn dyeing machine, Anionic nature.
20	Preparation of high-molecular weight waxes and additives	Sewing thread lubricants for application according to the exhaust method with individually selectable silicone-wax ratios; for the silicone-free lubrication of PES or CO sewing threads or for pre-waxing before final winding lubrication. Cationic nature.

7. Essential properties required for sewing threads

- The ability of the sewing thread to meet the functional requirements of producing the desired seam effectively.
- The ability of the sewing thread to provide the desired aesthetics and serviceability in the seam.
- The cost of sewing thread and that associated with producing the desired seam.

8. The various important properties required for sewing threads

Strength: strength is one of the essential properties of the thread. It must be capable of withstanding several kinetic/lateral movements during sewing. The strength of the sewing thread must be higher than that of the fabric so that the thread does not rupture during use. During sewing at high speeds, the needle thread is subjected to repeated tensile stresses at very high rates. The thread also comes under the influence of heat, bending, pressures, torsion and wearing. The amount of force required to break a thread. This characteristic can be measured several ways: **Breaking Strength** – force applied to each end of the thread until it breaks, measured in pounds. **Loop Strength** - when one strand of thread is looped with another strand and then broken, also measured in pounds. **Tenacity** - the breaking strength of a thread adjusted for thread size. Tenacity is measured in grams/denier. Threads made from continuous filaments are generally stronger and have higher tenacity than threads made from staple fibers.

Elongation: This is the amount a thread stretches before it breaks. Threads with high elongation will give greater seam elasticity, but can cause poor loop formation leading to excessive skipped stitches and thread breakage. The elongation of a sewing thread is determined by fiber type but can also be controlled by drawing and heat setting of synthetics such as polyester and nylon. Cotton thread has very little, if any, elongation.

Abrasion resistance: abrasion resistance is essential for good sewing performance. The thread is under tension condition, especially when the stitch is being set. The thread must be resilient enough to return to shape after the distortions, and then must maintain its physical properties to provide good performance in the seam after the sewing process is complete. Nylon and polyester offer the best resistance to abrasion.

Uniformity: Imperfections or defects in thread are thick and thin places that can cause sewing problems. The most common imperfections are: knots, slubs, neps, dropped ply, dropped filament and singles kinks. These faults may not pass through needle eye and may become one of the strong factors for thread breakage and poor seam appearance.

Lubricity: This is the frictional characteristic of thread as it passes through the sewing machine and into the seam. The soft “fuzzy” characteristic of cotton thread and spun polyester actually gives these threads greater lubricity and better sewability than continuous filament threads. Lubrication of sewing thread with a mixture of wax, emulsions with synthetic resins, and silicon based products may minimize heat generation, and the fibres surface of spun yarns may be an advantage in that a thin layer of the surrounding air will move with the thread and promote needle cooling.

Shrinkage: Low shrinkage during washing and ironing is required. Shrinkage due to fibre swelling causes seams to pucker, especially if the fabric exhibits less shrinkage than threads. Synthetic threads suffer less from this problem than cotton threads owing to their much lower moisture absorbency; however they are liable to residual shrinkage problems if unsuitable manufacturing processes are employed. Synthetic threads can suffer from the problem of thermal shrinkage during ironing but this difficulty can be

solved by the use of high temperature setting, which stabilises the thread at temperature above those normally encountered during the ironing process.

Twist: A thread with too little twist may fray and break, one with too much can cause snarling, looping and knotting. The final direction of twist insertion may be important to enable the stitch forming mechanism of the sewing machine to perform correctly; most sewing machine require Z twist, but there are a few where performance is better with S twist.

Hairiness: The hairiness of sewing thread also affects the appearance of the seam. Sewing threads for decorative seams are singed, squeezed and gloss-brushed.

Colorfastness: The ability of a thread to retain its color during normal use is its colorfastness. There are several variables that are measured.

- **Wash Fastness** - the ability to resist color change after laundering.
- **Crock Fastness** - Refers to rubbing off of color. Crocking is checked both wet and dry.
- **Sublimation** - This relates to the loss of color due to heat. Certain dyes will change from a solid to gas when exposed to high heat and will redeposit elsewhere.
- **Cold Water Migration** - This refers to the possibility of staining when light colored fabric is combined with stronger colored thread and left wet for a period of time.
- **Light Fastness** - In this test, samples are exposed for prolonged periods of time to daylight.

9. Conclusion

The sewing threads be alive a key role in retaining the fabric appearance, look and life of the garments in the run, even though it is usually represents much less than 1% by mass of the garments. These days a many verity of sewing threads are available in the market due to diverse demands from the sewing industry. Increasing use of different types of fibers and sewability improving agents in the garment industry and increasing application of textile materials in various fields like garments, leathers, automotives, sports, pursuits, filtration, home textiles, miscellaneous and other technical applications.

The finishing agents (lubricant) play very important role in the achievement of sewing process. Because incorrect thread may spoil very high quality fabric and even a good sewing machine used for the sewing and the whole process will fail. It can to waste of

time, manpower and money. It's very much required and appreciable to have different types of finishing agents which can improve the sewing operation and physical properties of sewing threads suit various application since various end uses demand specific properties.

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