

Flame-Retardant Sewing Threads: Aramid Fibres

Introduction

We are a Culimeta-Saveguard group company which specializes in the manufacturing of technical composite yarns (Dualtec® and Powerguard®) for Personal Protective Equipment (PPE) market, specifically for hand protection for global gloves industry. Recently, we have initiated manufacturing of 'inherent' flame-retardant/heat resistance (FR) sewing threads based on aramid fibres (both spun yarn and continuous filament based) in India for domestic and overseas market. A flame-retardant sewing thread may be defined as one, which does not propagate the flame, although it may burn or char when subjected to any form of heat. These threads are used to stitch various flame-retardant protective garments such as coverall, aprons, shirts, trousers, balaclavas, undershirts, gloves, to name a few. Although widely used in India, these are not being sold with complete certifications or valid test reports; hence it is very important for a stitching company or any other end user of FR sewing threads to understand parameters they need to confirm prior to using these sewing threads.

In brief, FR sewing threads can be broadly divided into two categories: 'Inherent' and 'treated'. The 'inherent' FR sewing threads are manufactured using specialized fibres composed of polymers or minerals which are inherently resistant to ignition (few examples are aramid, modacrylic, FR-viscose, e-glass, etc), whereas 'treated' FR sewing threads are

manufactured using treatment of conventional fibres (e.g. cotton, polyester, nylon, viscose, etc) with phosphorus or bromine based chemicals. The FR 'treated' sewing threads may have their flame-retardant properties removed after repeated washing. For these reasons, 'inherent' FR sewing threads are 'recommended' to be used in the stitching of both primary (designed to be worn for work activities where significant exposure to molten substance splash, radiant heat, and flame is likely to occur. e.g. firefighters' suit, defence, paratroopers clothing) and secondary (designed for continuous wear in designated locations where intermittent exposure to molten metal splash, radiant heat and flame is possible e.g. workwear for electrical maintenance, utility oil, gas, petrochemical and steel industries) FR apparels.

Through this article, we would like to share information about various parameters/test standards for aramid sewing threads which must be verified by a customer prior to buying these threads for stitching.

1. Weight and strength -

It is very important to measure weight per unit length of sewing threads supplied for each lot. Further, it would help if strength report is asked from the manufacturer for each lot. Table 1 shows comparison of para-aramid and meta-aramid sewing threads currently being manufactured by our company.

Table 1. Weight and strength comparison of FR sewing threads

FR sewing threads	Weight	Strength
Para-aramid	Ne 30/3	44.3 \curvearrowright
	Ne 40/3	33.9 \curvearrowright
NMeta-aramid	Ne 40/2	27 N approx.

2. FR test standards -

Any flame-retardant sewing threads should be tested for ISO 15025 A and ISO 17493:2000 at 260°C prior

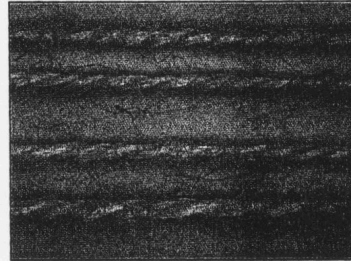
to be used for stitching. Table 2 below shows test results of our meta-aramid and para-aramid sewing threads tested as per ISO 15025 A and ISO 17493:2000.

Table 2. Test standards for FR sewing threads

Test standards	FR sewing threads	Results
ISO 15025 A	Para-aramid sewing thread (Ne 30/3)	PASS
	Meta-aramid sewing thread (Ne 40/2)	PASS
ISO 17493:2000 at 260°C	Para-aramid sewing thread (Ne 30/3)	PASS
	Meta-aramid sewing thread (Ne 40/2)	PASS

3. Hairiness -

A lubricated sewing thread has lower hairiness which makes it easier for threading and stitching owing to fewer or no entanglement,



hence improved stitched quality than that of non-lubricated sewing threads. An example of lubricated and non-lubricated p-aramid sewing thread has been shown in Figure 1 below.

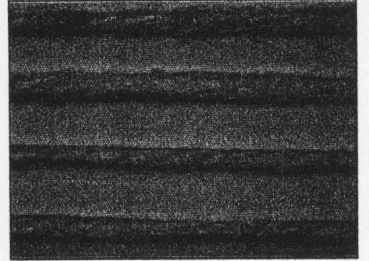


Figure 1. Example of non-lubricated and lubricated FR sewing thread

4. Twist -

A low twisted sewing thread may result in separated ends which may get entangled on stitching needles in quick succession while a highly

twisted sewing thread may result in snarling issues. Both examples are shown below in Figure 2. So, it is important to have an optimum twist in the sewing threads.

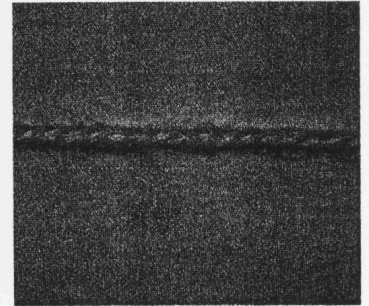
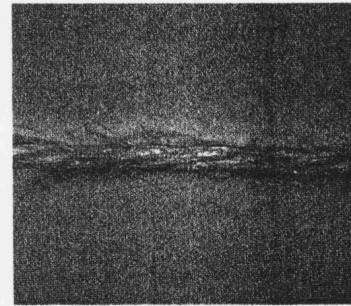


Figure 2. Low and high twisted p-aramid sewing threads

5. Spun or continuous sewing threads -

A customer should verify if their requirement is for spun yarn based FR sewing threads or continuous filament based FR sewing threads. A filament based FR sewing thread has higher strength than that of ring

spun yarn made up of staple fibres; however filament based sewing threads are costly owing to the higher cost of FR filaments, e.g. p-aramid filament (220 dtex, 440 dtex) costs in the range of 50-80 USD/kg. An example has been shown below in Figure 3 for spun and filament based p-aramid sewing threads.

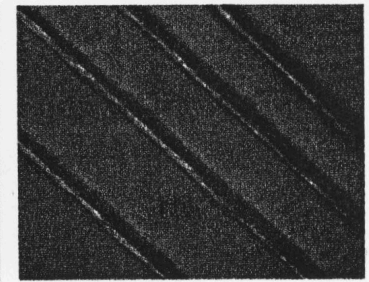
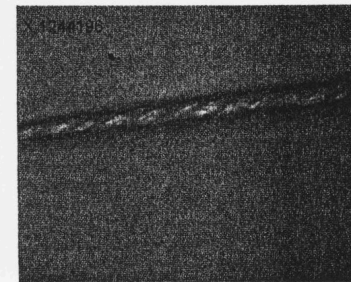


Figure 3. Spun and filament based p-aramid sewing threads

Recent developments: Metallic sewing threads

We have recently developed a high temperature resistant metallic sewing thread consisting of multiple ends of stainless steel core (AISI 304L) wrapped with p-aramid or cotton fibres (Figure 4). Owing to the presence of steel wires in core, these yarns offer a high level of heat and flame-resistance, upto 1100°C without high strain and 600°C with mechanical strain (further testing and validation is required). Further, the combinations of steel core/p-

aramid fibre or steel core/cotton fibre cover provide an excellent strength alongwith high temperature resistance. These threads can be used for stitching in high temperature applications such as insulations, sealing in turbines, pumps and power stations as in steel, electrical, construction and automotive industries. Furthermore, these sewing threads can also be used in the stitching of waste gas pipes or for anti-static applications such as carpets, mats, tarpaulins or clothing.

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