PRECITEX HANDBOOK OF APRONS & COTS

PRECITEX TECHNICAL SERVICE

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ABOUT PRECITEX

PRECITEX was incorporated in 1971. Since the beginning of its operations, PRECITEX has grown to become the leader in the aprons and cots market in India. Our total commitment to quality, state of the art manufacturing units, a work force of highly qualified, trained, motivated and experienced technicians, and sales persons are the factors that have authored this success story.

Our products are designed and developed to suit various machine applications, howsoever demanding they may be. These products meet different machinery manufacturers' specifications for draw frames, combers, speed frames, ring frames, open end spinning and texturising machinery.

"Quality" is the watch word that drives us to research, innovate and develop a range of aprons, cots and specialty products that help you make superior quality yarn thus increasing your productivity, global competitiveness and profitability.

Our products are tested at every stage of their manufacture, right from selection of raw materials and mixing of compounds to the final product. Highly sophisticated and, advanced process control systems and equipments are used to ensure Total Quality Control.

PRECITEX aprons and cots have worldwide acceptance and are exported to more than forty countries across the globe. We are the largest exporters of aprons and cots from India and as a result we have been winning highly prestigious export awards year after year.

We reach you through our customer-oriented distribution and sales network that is highly sensitive to your needs. Your PRECITEX representative acts as your most trusted and reliable ally, always ready with cost effective solutions to your problems.

These are some of the reasons that have helped PRECITEX win the trust of a global clientele and its name has come to represent aprons and cots of world class quality.

QUALITY POLICY

At Precision Rubber Industries Pvt. Ltd., Customers' Satisfaction has always been the guiding principle in supplying Aprons & Cots to agreed specifications. We are aiming to make the brand 'PRECITEX' synonymous with Aprons & Cots.

We dedicate ourselves to achieve and sustain consistency in the quality of our products by following continuous improvements through enhanced quality systems and the team work of our employees and distributors.

Place : Mumbai
Date : 4th September, 2006.

G. T. DEMBLA
Chairman

PURPOSE OF HANDBOOK

PRECITEX has always endeavored to promote excellence in textile spinning. In the past, we have been undertaking technical workshops, conducting contests, and various other awareness programmes through Precitex Spinners' Club, which has its chapters in major textile centers.

We always felt the need to provide a handy and simple reference guide to the spinning technologists across the globe to help them perform better at the shop floor and enhance their cost effectiveness, productivity, and competitiveness.

The PRECITEX HANDBOOK OF APRONS & COTS gives you a fairly detailed overview of how you should select, install, and maintain aprons and cots to achieve better spinning performance. It has been written with the sole objective of making your job easier.

The handbook contains about 90 pages and more than fifty illustrations, graphs, and tables. It also has important data as annexure for further references and studies.

Though the handbook is as comprehensive as it can be, there is always some room for improvement in a work of this kind. We shall look forward to your feed back. Please send the same to us at the following address: -

Precitex Technical Service (PTS)
201 A, Poonam Chambers, Worli, MUMBAI 400 018.
Phone: + 91 22 4004 9750 / 51 Fax: + 91 22 6660 5382 / 83
E. Mail: priplho@vsnl.com Web Site: www.precitex.com

We would also like you to keep us posted of your own experiences as a spinning technologist. Such an interaction will always be useful in updating the handbook which will be an ongoing exercise at PTS.

APRONS & COTS

Introduction

Aprons and Cots are technological components that have very strong influence on yarn quality, productivity and overall performance of the machine. The choice of aprons and cots is determined by the application and the need of the customer, which in turn depends on the type of material being spun (cotton, synthetics, wool, etc.), the yarn count, and the speed of the machine.

Raw material for Aprons and Cots

Aprons and Cots are manufactured from Synthetic Nitrile Rubber, which is a petroleum bi-product. It offers chemical and abrasion resistance. It also provides protection from oils, grease, and other petroleum products apart from some acids and caustics. In this handbook an attempt is made to discuss various details regarding selection, application and maintenance of aprons and cots.

COTS

Essential Characteristics

1. Good fibre handling properties.
2. Good abrasion resistance.
3. Resistance to aging.
4. Excellent resilience properties.
5. Good surface resistivity to minimize incidence of lap ups or repelling of fibres.

Types

Cot manufacturers often use technical terms like Electrolytic, Antistatic, charge dissipative, etc. Hence it is important to understand the meaning of these terms.

Electrolytic cots

Synthetic rubber is a poor conductor of electricity. The concept of **Electrolytic Cot** was introduced primarily to improve the conductivity through electrolytic process.

Due to continuous contact with fibre, static electricity builds up on the surface of the cot. This attracts the fibre to the cot's surface that results in lapping. Certain hydroscopic electrolytes are introduced in the rubber matrix that bring about an electrolytic cell reaction by ionizing the water molecules present in the atmosphere. The electrolytes present in the rubber matrix reduce the volume resistivity of the cot and improve the conductivity. This dissipates the charges present on the surface of the cot and reduces the static charge build up.

Antistatic cots

Electrolytic cots worked all right in old times, when only hard cots were used. With the presence of the hydroscopic electrolytes in good proportion it was quite easy to make cots of higher shore hardness. However, the process had to be changed with the advent of soft cots. This led to the development of antistatic cots.

Specific ionic substances or surface active repellants were introduced in the rubber matrix to reduce the surface resistivity. These agents repel the charges and prevent their accumulation on the surface. Though soft cots also contain electrolytic hydroscopic materials that set up the cell reaction as discussed earlier, their proportion is less and the ionic substances do the major job in antistatic cots.

Construction

Cots are available in different types of constructions.

1. Gluefit *(Also called Plain)*
2. Springrip
3. Pressfit

1. Gluefit Cots

These are conventional cots that are mounted on rollers by using glue or adhesives. The rollers for plain cots should have grooves so that they can retain the glue and ensure proper bonding with the cot.

2. Springrip Cots

Spring-grip cots have 3-layer construction consisting of: -

a. Hard inner layer of rubber.
b. Outer layer of rubber of specified shore hardness.
c. Thread reinforcement between the two layers of rubber to provide grip on the metal roller once the cot is mounted. These cots do not require adhesives* for mounting when used for ring frame application.

** Springrip cots, when used in other applications like draw frame roller and gill box roller, require the application of adhesive.*

3. Pressfit Cots

Press fit cots have a metal or a polymer core. Initially, these were offered with brass core. Now, most of the manufacturers offer cots with aluminum alloy core. These are commonly known as Alucore cots.

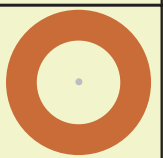
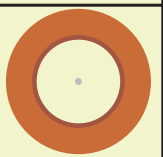
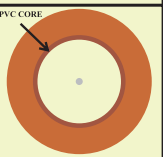
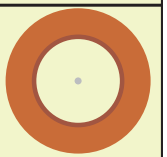
As an alternative, PVC core cots, offered by PRECITEX, give perfect fit, and match the characteristics of the Alucore cots. A comparison of relative features of different type of cots is given in the table on the next page.

Specifications

The following specifications should be mentioned while placing orders for cots: -

1. B.R.D. (Bare Roller Diameter)
2. F.O.D. (Finished Outside Diameter)
3. Length (or Width)
4. Construction (Plain / Springrip / PVC core / Alucore)
5. Edge construction
6. Shore hardness (A)

COMPARISON OF COTS OF DIFFERENT CONSTRUCTIONS

FEATURES	PLAIN COTS	SPRINGRIP COTS THREAD REINFORCED	PRECITEX PVC CORE COTS	ALUCORE COTS
Construction	 Single Layer	 Three Layer	 Two Layer	 Two Layer
Expansion after mounting	1.5mm	1mm	0.2- 0.3 mm	0.1mm
Surface Stress in cot after mounting	Very much	High	Negligible	Nil
Adhesive used for mounting	Required	Not Required	Not required	Not required
Waiting period for initial grinding after mounting	24 hrs	Nil	Nil	Nil
Grinding after mounting	More	More	Minimum	Minimum
User Friendly	Least	Least	Excellent	Good

1. B.R.D. (Bare Roller Diameter)

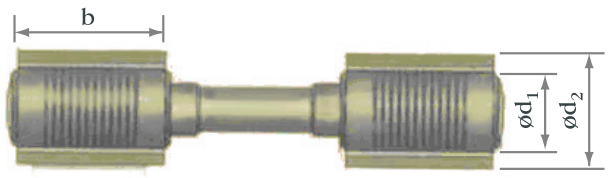


Fig. 1 Top Roller

d_1 - B.R.D. d_2 - F.O.D. b - Length

Please see Fig. 1 where the B.R.D. is shown as d_1. It is the diameter of the roller on which the cot is to be mounted. For ring frame and roving frame the B.R.D. of the top roller is 19 mm usually. Sometimes, while placing the order, the user tends to mention bore diameter of the cot (or internal diameter of the cot). This should be avoided. The I.D. specification of the cot may vary from one manufacturer to another, especially in case of Plain or Springrip cots. Hence, only the B.R.D. should be mentioned as a standard practice.

Importance of giving accurate B.R.D.

The information on the B.R.D. should be very accurate especially for a long cot application with Alucore cot. In the case of Alucore cot, the interference between the roller diameter and the I.D. of the cot is in microns. Hence accurate B.R.D. should be provided. In such cases the B.R.D. should be measured using a micrometer. It should also be ensured that the top rollers for this application are sourced from reputed manufacturers and they adhere to strict dimensional tolerances as specified by the machinery maker.

For example, in a certain make of comber the B.R.D. of the detaching roller is 15.92 mm. Sometimes, while ordering the cot, the user may mention as16.0 mm B.R.D. The difference of 0.08 mm is very high for an Alucore cot. This will lead to wrong supply of the cot, resulting in either loose or else very tight fitting . This may damage the cot during the mounting process.

2. F.O.D. (Finished Outside Diameter)

The F.O.D. is the diameter of the cot after mounting and the initial grinding before its use. Depending on the F.O.D. specified by the customer, the supplier will decide the O.D. of the cot (Outer diameter of the cot at the time of supply). This will be based on: -

1. Construction of the cot
2. Hardness of the cot
3. Diameter of the cot

Expansion of the cot after mounting depends on these factors. The O.D. of the cot will always be higher than the F.O.D. The supplier usually gives extra wall thickness of rubber that should be ground and removed while correcting the eccentricity of the cot.

Cot is a semi-finished product and its surface may be uneven, and rough. There can be diameter variations between cots as well. All these should be corrected after mounting the cot on the roller and grinding it. The cot should be used on the machine only after this.

3. Length/Width

As shown as **'b'** in Fig. 1, usually the length of the unmounted cot will be greater than the actual length desired after mounting. This is to account for the lateral shrinkage due to the expansion of the cot after mounting. This is more prominent in the case of Gluefit cots that expand more after mounting.

4. Construction of Cot

The user should mention the construction of the cot like Gluefit / Springrip / PVC core or Alucore cot.

5. Edge Construction

Commonly available edge constructions are: -

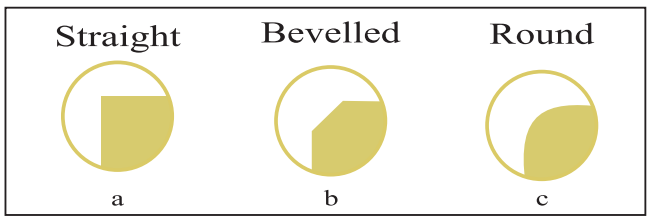


Fig. 2 Edge Construction

a. Straight edge

Straight edge is preferred mainly for cots used on apron top roller. In some drafting systems the apron top roller is covered with a cot on which the top apron is moving. These cots should have straight edge so that the top apron is supported through its entire width. (Refer Fig. 2a)

b. Bevelled edge

Bevelled edge construction is preferred in limited applications like in open end spinning machine, for the take off roller cot or even in roving frame application. It plays similar role as that of the round edge. (Refer Fig. 2b)

c. Round edge

Round edge cots are often preferred in ring frame application. It is relatively easy to remove the lapped up fibres from the cot surface as the fibre bunch can be easily slipped by the side of round edges. (Refer Fig. 2c)

6. Shore Hardness

Shore hardness of a cot is measured using a Durometer (Fig. 3) and expressed in A scale.

Cots are available in many shore hardness ranging from 65^0 to 90^0 shore A. Cots of different shore hardness are offered depending on: -

a. Material processed
b. Yarn count
c. Type of application/machine
d. Ambient conditions

Fig. 3 Durometer

It is a well-known phenomenon that soft cots (65^0 shore A and 70^0 shore A) give better yarn quality compared to the cots of higher shore hardness. But soft cots have their own drawbacks. Their wear out rate is faster and hence the regrinding interval is shorter.

Damage to the cot's surface will be more in soft cots compared to hard cots in case the operator uses a knife for removing fibre lap ups. If the ambient condition in the spinning department is not well maintained, the soft cot will display greater tendency for lapping.

The grinding machine operator should be highly skilled for achieving good surface characteristics after grinding. The user has to strike the right balance between the pros and the cons of using a soft cot and then decide on the optimum hardness.

Definition of Shore Hardness

Often there is a disagreement on the real hardness of a cot. For example, manufacturers claim hardness as 63^0 or 65^0 shore A in their product catalogues, but when measured at the user's end it is always on the higher side. Hence we should understand the correct methodology of measuring the hardness.

Hardness may be defined as the resistance to indentation under conditions that do not puncture the rubber. It is called the elastic modulus of the compound. Hardness test is based on the measurement of the penetration of the rigid ball into the rubber test piece under specified conditions. The measured penetration is converted into hardness degrees.

Spring Loaded Pocket Durometer is the most common instrument for measuring hardness of the elastomers. Shore A Durometer is used for measuring soft solid rubber compounds, whereas, Shore D measures hardness of ebonite and very hard rubber compounds. One reason for the popularity of this instrument is its portability in field use. Difficulties arise, however, in reproducibility of results by different operators. *Therefore a difference of 5 units as practical tolerance is acceptable.*

Better reproducibility is obtained by dead weight loading. The hardness is expressed in **I**nternational **R**ubber **H**ardness **D**egrees. Both Durometer and **IRHD** dead load require samples of specific dimensions. The correct method for measuring hardness of rubber is as per the procedure outlined under **ASTM D 2240** standard. It also defines the apparatus to be used and its specifications such as the diameter and length of the indentor, force of the spring, etc.

Specifications of the sample (specimen) is outlined under **ASTM D 1415**. As per this, the test specimen shall be at least 6 mm in thickness. The lateral dimensions of the specimen should be sufficient to permit measurements at least 12 mm from the edges. Surface of the specimen should be flat over sufficient area, to permit the presser foot to contact the specimen, over an area having a radius of at least 6 mm from indentor point.

Fig. 4 Hardness Measuring Equipment

Conditioning

Tests should be made at 23° ± 2° C. The specimens should be conditioned at the temperature of test for at least 1 hour.

Thus it is evident that the way shore hardness is measured on a cot surface in a mill is far different from the procedure explained under the ASTM standards. Hence the hardness as measured on a cot surface will always be higher than the shore hardness specified by the manufacturer.

Mounting

Cots should be mounted properly on the top roller using correct tools and equipment. The mounting methods, machines, and procedures differ from one cot to another depending on their construction such as: -

1. Gluefit cots
2. Springrip cots
3. Pressfit cots (Alucore / PVC core)
4. Draw frame cots

1. Mounting of Gluefit cots

Please ensure that you have the correct type of roller for this purpose. Ideally the roller for plain cots should have grooves that can retain adhesive. If plain surface roller is used it may not retain adhesive and it may lead to cot slippage.

Points to be taken care of before and during mounting.

a. Preparation of roller

1. The roller surface should be clean and free from dirt and greasy material. Clean the roller preferably with a solvent.

2. Remove the old traces of rubber / adhesive from the grooves of the roller thoroughly.
3. While cleaning the roller with a solvent (MEK / ACETONE), please take care that it does not enter inside to affect the bearing area.

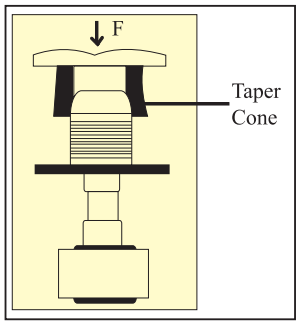


Fig. 5 Cot Mounting

b. Preparation of adhesive

It is preferable to use a two-component adhesive consisting of hardner and resin. They give higher bonding strength compared to a single component epoxy based adhesive.

Fig. 6 Two Component Adhesive

1. Take equal quantity of resin and hardner in a container suitable for 25 to 30 rollers.
2. Mix them thoroughly till a viscous paste is formed.

c. Application of adhesive

1. Apply adhesive using a spatula on 25 to 30 top rollers at a time.
2. The rollers should be kept on a stand, in such a way that the adhesive applied portion does not come in contact with dirt/dust.

3. Apply adhesive inside the cot bore using a rod.
4. The adhesive starts setting after certain time and it will become hard. Hence it should be used preferably within 30 minutes of mixing.

Mounting procedure

Once the roller and cot is ready, the cot can be pushed onto the roller using a mounting equipment. For mounting ring frame / speed frame cots, vertical mounting machine (Fig. 7) can be used for better results. Horizontal mounting machine will give good results for long cots.

While mounting the ring frame / speed frame cot, it is better to use a taper cone (Fig. 5 & 8). Taper cone allows gradual expansion of the bore that facilitates easy mounting. If the taper cone is not used, the cot may get damaged or it may lead to cross and incorrect mounting . The mounted rollers should be kept for 24 hours in idle condition so that the adhesive gets set completely, ensuring proper bonding between the cot and the roller.

Fig. 7 Manual Cot Mounting Machine

Fig. 8 Taper Cone

2. Mounting of Springrip cots

These cots do not require any adhesive. The roller should be thoroughly cleaned and the surface should be free from dirt, oily or greasy material. Taper cone should be used for mounting the cot. The cot should be mounted in one swift stroke. Repeated strokes should not be given to avoid the bulging of the cot in the center.

3. Mounting of Pressfit cots (PVC core / Alucore)

These cots require precise and perfect mounting techniques. Special care should be taken with respect to the following: -

a. The mounting machine should be secured firmly on a concrete platform at a height that is convenient for the operator. The machine should not tilt while mounting, as the Alucore cot requires more effort/force for mounting.
b. The alignment of the mounting ram with respect to the base plate on which the roller is kept should be perfect. Any misalignment will

PRESSFIT COTS

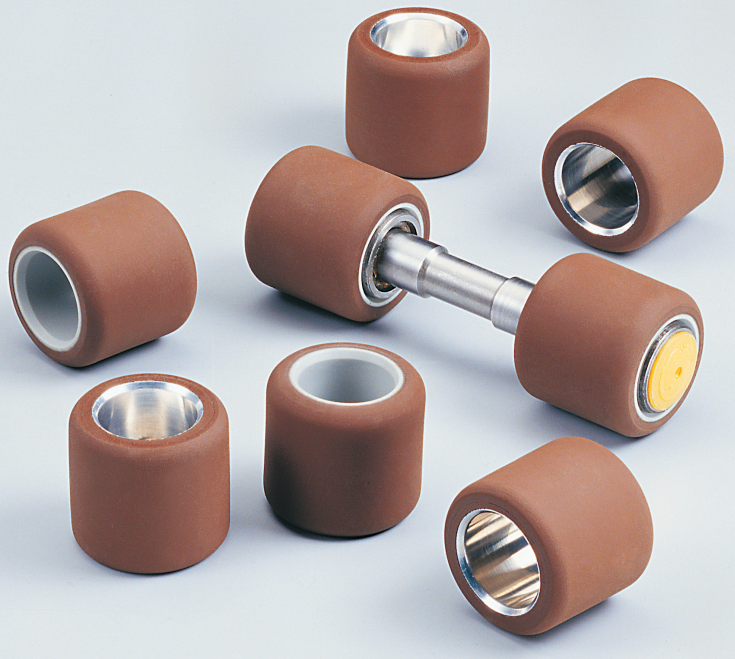


Fig. 9

Fig. 10 Pneumatic Cot Mounting Machine

damage the cot

c. The base plate should have a recess in which the top roller should fit properly, so that it will not tilt when the cot is pushed. Usually, the base plate wears out at this place after repeated use. If the plate is worn out it should be replaced. These small components should be given due importance to ensure good mounting.
d. To ensure proper mounting it is better to equip the machine with a centering pin assembly (Refer Fig.12). This will have a spring-loaded plunger that holds the Alucore / PVC core cot in proper position till it is guided on to the roller. When the cot is being mounted, the roller pushes the plunger inside. Most of the machines are equipped with this assembly. If it is not provided, the same can be obtained from cot manufacturers. This can be attached to the mounting machine. The centering pin also helps to position the cot accurately to ensure error free mounting.

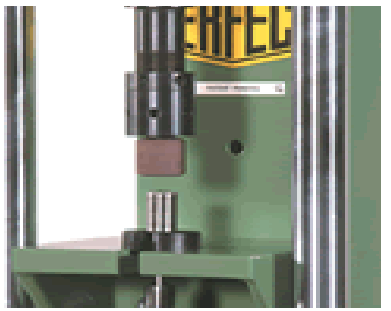


Fig. 11 Mounting of Pressfit Cots

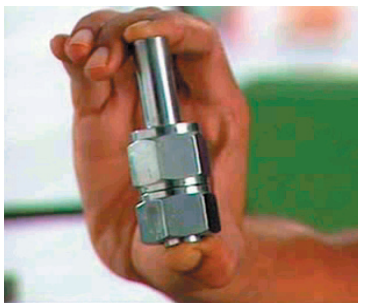


Fig. 12 Centering Pin Assembly

4. Mounting of draw frame cots

Long cots are supplied in various constructions such as:-

a. Gluefit type
b. Two core
c. Two core with thread reinforcement
d. Alucore

The first 3 types are to be fitted with glue.

Mounting procedure

Gluefit cots (Plain / two core types)

Horizontal mounting machine (Fig. 13) is preferred for mounting of long cots. Before mounting the cots, please ensure the following: -

1. The roller is free from eccentricity and the area where the bearing fits is not worn out.

Fig. 13 Horizontal Mounting Machine for Long Cots

2. The top roller should have proper grooves (for Gluefit cots) so that the adhesive is retained in this groove, which increases the bonding between the rubber and the roller. This is a very important aspect and should be taken care of before mounting. Sometimes mills may use plain surface roller (which are ideal for Alucore cots) for Gluefit cots. As draw frame rollers work at high speeds and are subjected to high loads, the possibility of cot slippage is quite high and hence due care should be taken while selecting the rollers.
3. Before mounting cots, clean the roller surface thoroughly with solvents, such as Acetone or MEK.
4. Preparation of adhesive and its application is same as discussed earlier (Refer Page 16, 17).
5. The extra adhesive oozing out at the edges should be wiped clean using the solvent.
6. Please take care that the cot does not get twisted while mounting. For this purpose, you can draw a line on the cot surface, with a marker, before mounting. After mounting, the line on the cot surface should be straight, which would confirm it is mounted perfectly. If the line is distorted, the mounting is faulty.
7. The cot should be immediately calendared in a calendering equipment (Refer Fig. 14) before the adhesive dries up. This is to remove the air entrapped during mounting. If the entrapped air is not removed, the cot may burst open during high-speed operation. It may also lead to uneven surface after use for some time. (Refer Fig. 15)
8. Two core cots or two core cots with thread reinforcement provide additional gripping, due to which the possibility of cot slippage at high speeds gets reduced further. Conventional plain cots are used for slow speed machines having speed up to 200 m/min. If the speeds are little higher, it is better to use two core or two core with thread

reinforced cots. These cots also have to be fixed with adhesive. The hard rubber inner core with thread reinforcement provides additional gripping apart from glue bonding.

9. The I.D. of plain cots / two core cots will be approximately 1.5 mm lower than the B.R.D. of the roller. In case of thread reinforced cot, the I.D. is approximately 0.5 mm lower than the roller diameter. Even then it may be a little difficult to mount this type of cot, hence adequate care should be taken while mounting.

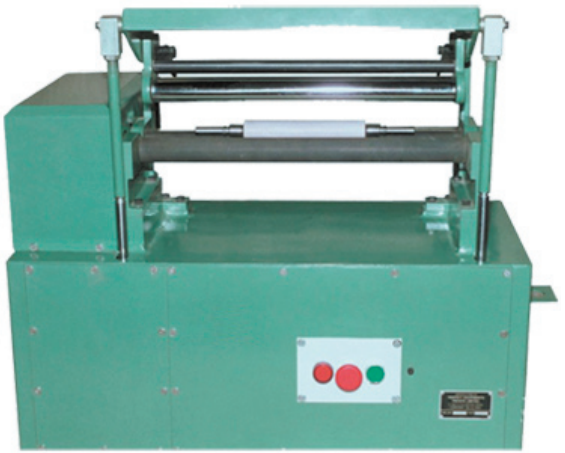


Fig. 14 Calendaring Machine

<u>Mounting of Alucore cot</u>

Mounting of long Alucore cot requires: -

1. Good machine
2. Skilled operator

Alucore cots for draw frame and comber are available in various lengths from 150 to 350 mm. Mounting of these cots requires technical expertise. The following points should be taken care of before mounting.

a. Roller

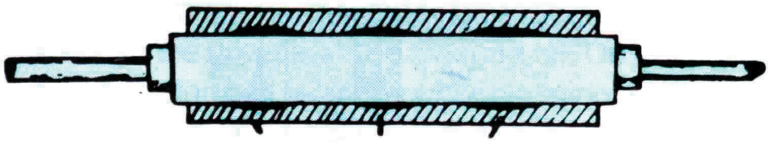
1. The roller should have plain surface without any grooves. The surface should be smooth and even.
2. The rollers should have been procured either from the machinery manufacturer or from a reputed accessories supplier. The dimension of the roller should be precise. As the interference fit between the bore diameter of the cot and the B.R.D. of the roller varies from 30 to 150 microns (depending on the application), rollers should also have the same accuracy. The diameter variation should be within +/-0.01 mm.
3. The straightness of the roller should be within the acceptable norm.

Mounted cot

Pockets of adhesive and air.

If the calendering is not done properly, the pockets of adhesive and air will remain.

Ground cot



After griding, the pockets of adhesive and air still remain. The cot can collapse and become concave or wavy.

The cot has distorted

Fig. 15

b. Machine

1. Horizontal mounting machine, operated with hydraulic or pneumatic assistance, is better for mounting long Alucore cots. Long Alucore cots require higher mounting force, which cannot be achieved by a manually operated equipment.
2. Make sure the machine is equipped with correct adaptors suitable for cots of different dimensions. These adaptors should be used for keeping the cot in a straight position so that they do not tilt during mounting.
3. Little bit of lubrication will help in easy mounting of cots. Apply a thin film of oil on the roller, which will minimize the friction during mounting.

Grinding

Different types of grinding machines are available for specific use in textile industry such as: -

1. Traverse Grinder
2. Plunge Grinder

1. Traverse Grinder

In this type of grinder, there is a sliding table that carries the roller past a rotating grinding wheel. Usually the width of the grinding stone is one inch. This is quite an old type. The accuracy of grinding will be less, compared to the new grinding machines where a wider width grinding wheel is used.

2. Plunge Grinder

This type of grinder has a wide grinding surface, enabling contact with the full length of the cot (Refer Fig. 16). Generally this type of grinder is equipped with an auto roller feed. The width of the grinding wheel is usually 200 mm. The grinding moves laterally during the grinding process thus giving fine finish to the cot.

Details of the machine

Various models of the machine are available with different levels of automation. Output rate will be from 200 to 400 top rollers per hour. It is equipped with center-less grinding attachment for grinding speed and ring frame rollers. Center grinding attachment for long cot is also possible. In this case the width of the grinding wheel is usually 25 mm. Table traverse motion is very precisely controlled by hydraulic means.

Fig. 16 Grinding Machine

Notes on Grinding

The objective of grinding is to remove the outer layer of rubber which no longer has the desired drafting characteristics, as a result of wear and ozone effect or exposure to various chemical agents.

The process of grinding depends on various factors such as: -

1. Hardness of cot
2. Machine type
3. Spinning process
4. Fibre type
5. Yarn count
6. Yarn quality requirement

Grinding Stone Specification

Selection of grinding stone is important for getting desired results. Depending on the hardness of cot, type of grinding wheel used may vary. For soft cots of shore hardness 65^0 to 70^0 A, it is better to use 80 grit stone. For cots of higher hardness it is better to use 60 grit stone.

Selection of Grinding Wheel

Grinding wheel specifically used for rubber products is available from reputed manufacturers. The following aspects should be considered while selecting the grinding wheel: -

The standard recommendation of grinding wheel for cots is **38 A 60 J 8 V BE**. The wheel is made of Aluminum Oxide having 60 grit and medium grade. Some mills use 80 grit also for getting a fine ground surface. Cot is a semi-finished product and hence when it is delivered, it has slight rough surface. Usually, cot manufacturers use 36 grit stone

for grinding during the early stages of the manufacturing process. Sometimes, after mounting new cots, the mill technicians have to grind the cot more (especially in case of plain cots due to higher expansion) and they generally use 46 grit wheel for higher depth of grinding. Subsequently, they use fine grit wheel for getting desired surface finish and accuracy. (Refer to the chart on page 28)

Extent of Grinding

This depends on the extent of wear out noticed on the surface. Usually the grinding interval should be fixed in such a way, that a perfect surface is obtained which is free from groove or deformation by taking 0.2 mm to 0.25 mm of grinding. If excessive grinding is required, adequate care should be taken and it should be done in steps. For example, with 80 grit stone, the depth of grinding per stroke should not be more than 0.1 mm to 0.15 mm. If a larger cut is taken it will lead to the burning of the wheel. With 60 grit stone, grinding cut of 0.2 mm to 0.25 mm can be taken.

Usually when a new cot is mounted, the extent of grinding will be more for removal of eccentricity, as well as diameter correction. It is better to do the initial grinding after mounting, by using 60 grit stone or even a grinding wheel of coarser grit specification. Final polishing can be given using an 80 grit stone.

Dimensional Tolerance after Grinding

Eccentricity of ground cot should be absolute minimum. The industry norms are:-

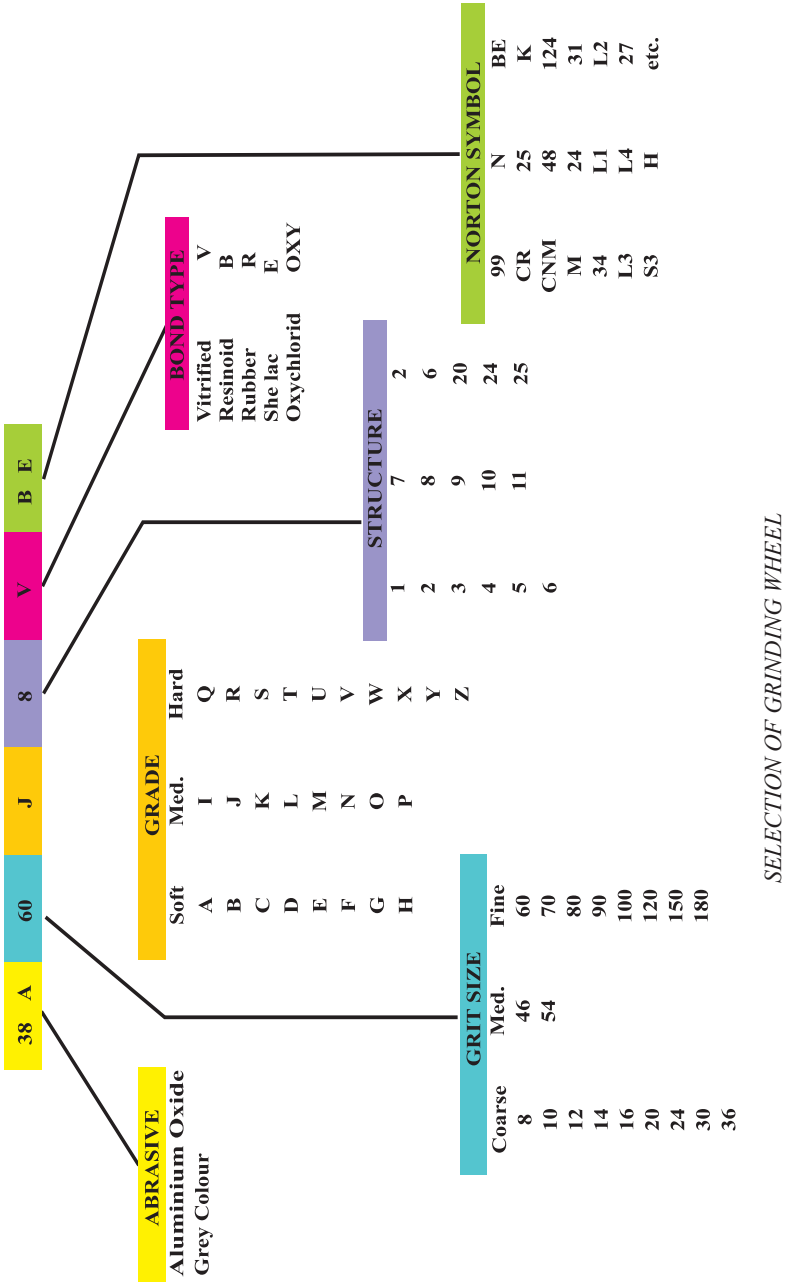
Concentricity	Within 0.02 mm
Parallelism	Up to 0.03 mm for cot of width up to 40 mm
	Up to 0.04 mm for cot of width 41 mm to 100 mm
	Up to 0.06 mm for cot of width over 100 mm

Instruments are available for measuring eccentricity and parallelism . These should be procured and used periodically (Fig. 17).

Surface Roughness

For optimum performance, in addition to concentricity and parallelism, good surface finish is also essential. Factors that affect the surface finish are: -

a. Hardness of cot
b. Extent of grinding
c. Condition of grinding machine (whether it is having vibration or misalignment of parts etc.)
d. Grinding stone condition and specification.



SELECTION OF GRINDING WHEEL

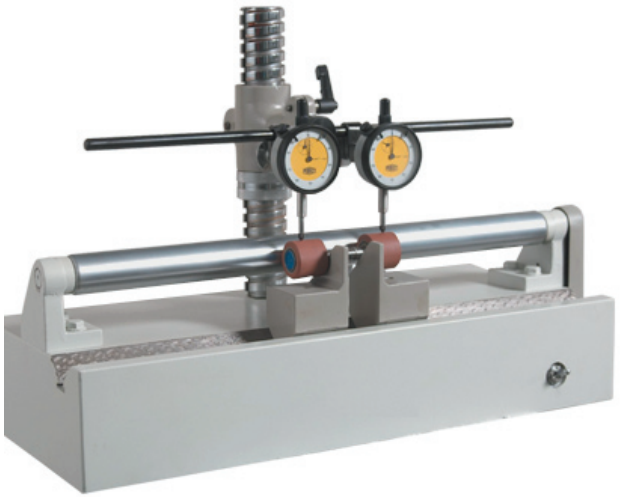


Fig. 17 Eccentricity Tester

e. Grinding time and polishing time.

We have already discussed about points **a** to **d**. Let us study the influence of polishing time.

Polishing of cot

Polishing of cot after grinding improves the surface finish. For example, for cots of shore hardness 65^{O} A if the grinding time is 3 seconds, the polishing can be for 5 seconds. Optimum combination can be arrived at, for getting good surface finish with proper fibre handling characteristics, by varying the grinding and polishing time.

Norms of Surface Finish

Surface finish can be measured by using a Perthometer (Fig. 18).

The measuring probe analyzes the surface and gives a graphical print out where Ra (Average Surface Roughness) is mentioned in microns (Fig. 19). For optimum spinning performance, Ra value should be 0.6 to 0.8 micron. If it is over 1.0 micron, the surface is rough and it will increase the possibility of lapping. If the surface is too smooth, for example 0.3 to 0.4 micron, there can be undrafted ends due to improper fibre control.

The grinding wheel, after continuous use for a long time, gets loaded with grinding dust. This affects the grinding performance. The surface also becomes a little blunt if the wheel is used for grinding cots of higher hardness. It is very important to achieve proper surface finish

after the grinding for better performance of the cot. If the Perthometer is not available with the mills, the cots should be sent to the supplier to check the surface finish. Alternatively, a control sample of the cot with surface finish under 1.0 micron can be obtained and used for geting some approximate idea (by feel).

Fig. 18 Perthometer

Dressing of Grinding Wheel

The grinding stone surface should be dressed and made new at frequent intervals. For this purpose the manufacturers of grinding machines provide a dressing tool attachment. This dressing tool has a diamond tip that is hard enough to dress the wheel. The stone should be dressed after grinding 1500 to 2000 cots. Stone of finer grit requires more frequent dressing interval. The stone must be cleaned regularly using compressed air or a brush of soft metal bristles.

Grinding Interval

What should be the grinding interval of cots? This is an important question often posed to a cot manufacturer. As we know, it depends on various factors such as: -

a. Extent of surface wear
b. Hardness of cot
c. Yarn quality level
d. Type of machine
e. Yarn count
f. Material processed

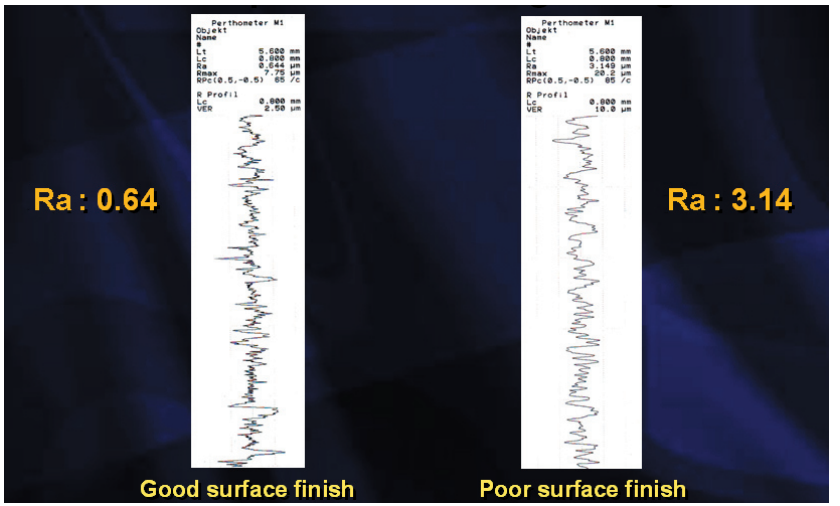


Fig. 19 Perthographs

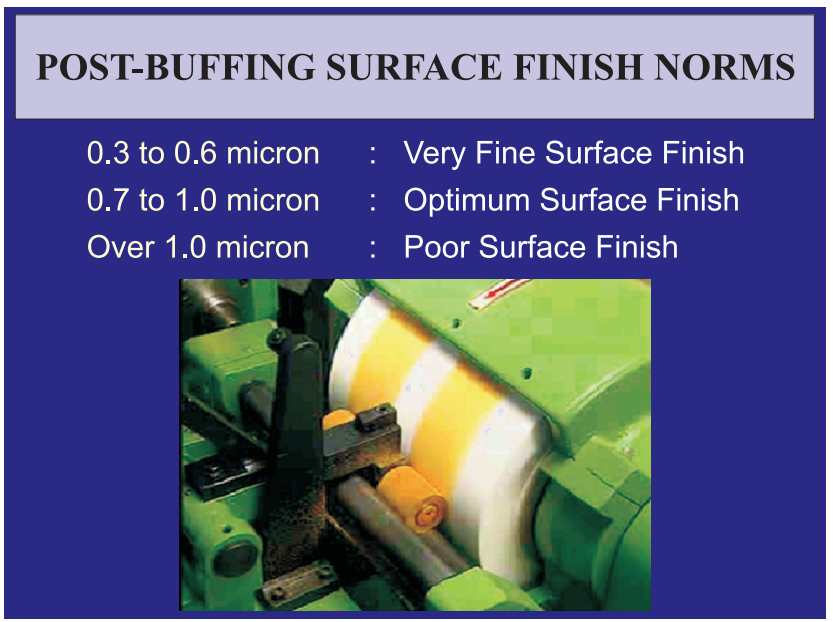


Fig. 20 Surface Finish Norms

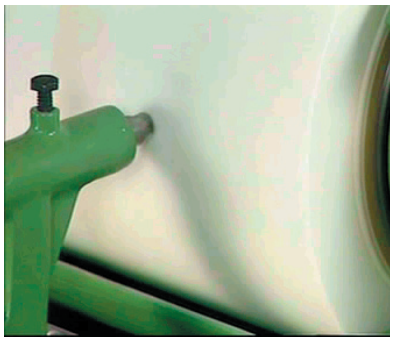


Fig. 21 Dressing of Grinding Wheel

Sometimes regrinding interval is fixed in terms of months irrespective of the spinning conditions, which is not correct. Regrinding interval cannot be the same for cots used, for example in 20^s Ne and 60^s Ne yarn production. Ideally, it should be based on the length or quantum of materials passed through the cot just like the practice adopted in case of card wire. However, it is practically impossible to fix it due to frequent yarn count and material changes, etc. Mills, generally fix the grinding interval that suits their local conditions. Hence, only a rough guideline can be given for different applications. (Please refer to the table on Page 33)

Surface Treatment

Generally, the performance of cots gets affected after grinding and sometimes it results in lapping, when used immediately. Many counter measures can be taken to prevent it.

A. Conditioning of cots

After grinding, the rollers are kept in the department and exposed to the ambient conditions for 24 hours. During this time it gets conditioned and the subsequent performance will be better. One should have an extra set of top rollers to implement this, so that after re-grinding, idle machine time for longer duration can be avoided.

B. Simple irradiation

By simply keeping the top roller under a heating lamp and giving exposure for 3 to 4 hours, will also improve the performance. This equipment can be fabricated in a mill. A series of rollers are kept in a fully enclosed box. A heating lamp is provided at the top of the box. A tray is kept beneath the rollers where fine grinding dust can fall and get collected. The top roller can be placed between the rollers and

Guidelines for Regrinding Interval *
(Grinding Interval in hours)

Application		Yarn	Type of Cot (shore A)		
			<70	70-75	>75
Ring Spinning machine	Delivery Top Roller	Fine	1250-1750	1500-2000	2000-2500
		Medium	1000-1500	1250-1750	1750-2250
		Coarse	Not recommended	1000-1500	1250-1750
Roving	Delivery top roller		2500-3000	3000-3500	3500-4000
Drawframe			500-750	500-750	550-750
Comber	Detaching roller (65 Shore A)		1500		
	Drawbox roller (65 Shore A)		1500		
	Take off roller (83 Shore A)				Check at 1500
OE	Nip roller (83 Shore A)				1500

** This is for general understanding only. The figures may vary depending on mill conditions.*

are exposed to the heating lamps. The rollers can be rotated at a regular interval so that the entire surface of cots can be exposed to the heating light rays.

C. Surface treatment with chemicals

Single component or two component chemicals are available that can be coated on the surface of the cot. The solution should be prepared as per the manufacturer's guidelines. Adequate care should be taken while applying the solution as they are made of chemicals. The operator should use a pair of gloves and the room should be properly ventilated. If the solution is too strong and not properly dried it may react with rubber and cause its swelling.

D. Acid treatment

Treating the cot surface with acid causes oxidation of the surface. The rough spots are evened out and a smoother surface finish is obtained.

Fig. 22 Acid Treatment Machine

Acid treatment is a cumbersome process, if done manually. However, semi automatic plants are now available. A typical semi automatic plant will have: -

1. Acid treatment chamber
2. Washing chamber
3. Alkali chamber for neutralization followed by rinsing with water
4. Drying compartment

The top rollers are fed from one end on a pair of inclined rollers, which are driven at variable speeds. Due to the inclination, the top rollers move from one chamber to another chamber getting different treatment in succession such as: -

Acid - Wash - Neutralization – Rinse – Dry

The treated cot is collected at the other end of the equipment. The treated cot should be checked with a litmus paper. It should display neutral characteristics. The acid and alkali container should be topped up at regular intervals for getting effective treatment.

Generally, Sulphuric Acid of 95% concentration is used for the treatment. The Alkali can be Sodium Hydroxide (NaOH) or washing soda solution ($Na_2 CO_3$, 20% concentration.).

Sometimes, excessive acid treatment may result in following disadvantages: -

a. Undrafted ends due to highly smooth and slippery surface.
b. Surface cracking, especially in case of soft cots.
c. Rapid increase in shore hardness of the cot.

It is better to avoid acid treatment of soft cot. It is rather advisable to go for some other surface treatments like UV treatment.

E. Ultraviolet Rays (UV Rays) treatment or Berkolising

Surface treatment with UV rays is commonly referred as Berkolising.

Fig. 23 UV Treatment Machine

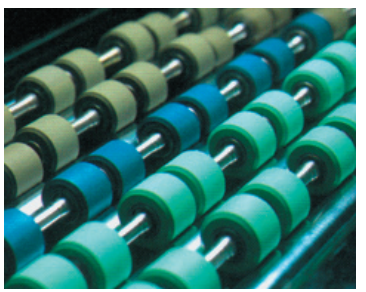


Fig. 24 UV Treatment of Cots

This equipment consists of a closed chamber where an UV lamp is kept. At the bottom of the chamber, top rollers are placed on rows of revolving rollers. They rotate slowly due to the surface contact and the entire cot surface gets exposed to the UV rays.

Time and temperature controllers are provided to adjust the extent of exposure. UV lamp of 3000 watts capacity is generally used for this purpose. It gets hot during working and a blower cools it from below. During the radiation process, ozone is also generated. Hot air, and ozone fumes, should be removed from the chamber by using an exhaust fan.

Radiation Time

Radiation time is set based on the hardness and the diameter of the cot.

Radiation time for cots of various shore hardness and diameter upto 35 mm.

65 ^{0} A shore - 15 min.
75 ^{0} A shore - 13 min.
85 ^{0} A shore - 11 min.

For diameter over 35 mm and upto 44 mm add 2 minutes.
For diameter over 45 mm add 4 minutes.

Effect of Berkolising

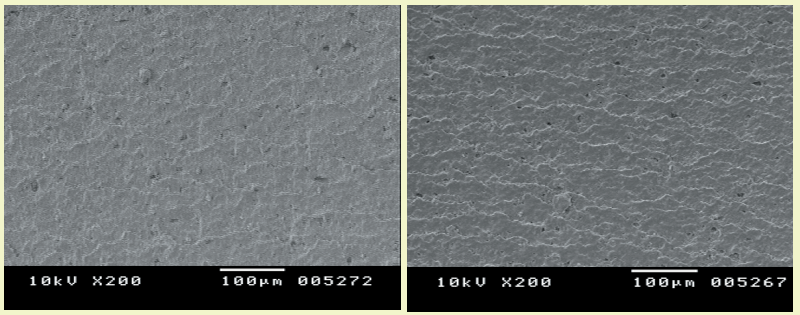
It is always essential to give a very good grinding before giving Berkolising treatment. Excellent surface finish with RA value ranging from 0.6 to 0.8 microns is essential for getting desired result after the UV ray treatment.

Please note that the UV ray treatment is not an alternative to a poor surface finish. It can give better results only if the ground cot has a good surface. From the enlarged pictures of their surface, (Fig. 25 & 26), it is evident that it becomes more even and free from crests after exposure to the UV rays. The surface also gets much cleaner as the grinding dust and other impurities get removed during the process of UV ray treatment.

Mechanical scanning instruments cannot detect the difference in the surface, and the RA value of treated and untreated rubber surface may also be the same. The UV treatment modifies the rubber matrix and only by using an electronic microscope of high resolution can one see the resultant change.

Cot Surface Analysis 1
(As seen in a Scanning Electronic Microscope)
PRECITEX 83^O A COT

Ground Surface | Ground & Berkolised



Magnified 200 times

Ground Surface | Ground & Berkolised

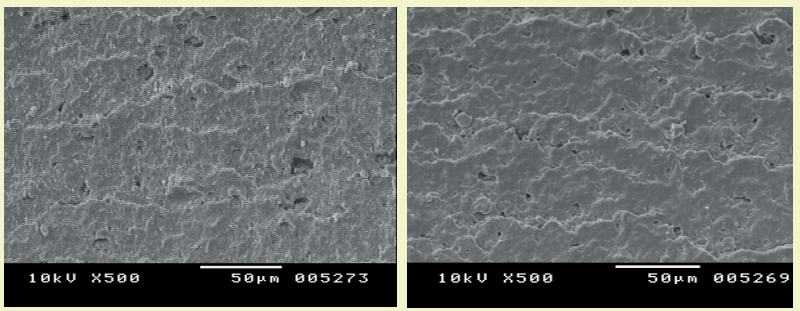


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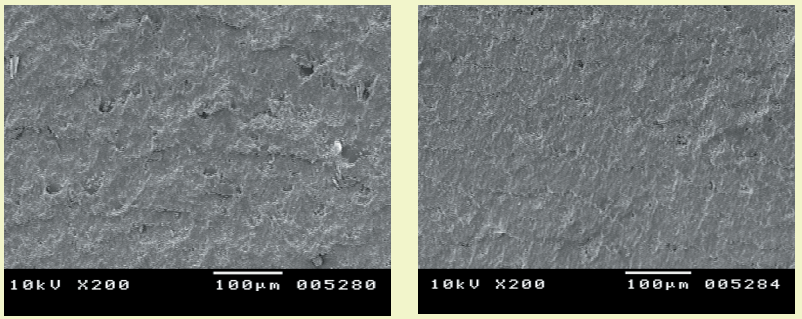
Fig. 25

Cot Surface Analysis 2

(As seen in a Scanning Electronic Microscope)

PRECITEX 65^{O} A COT

Ground Surface | Ground & Berkolised



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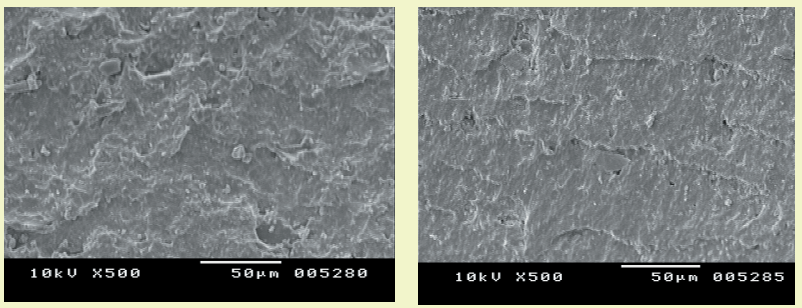
Ground Surface | Ground & Berkolised



Magnified 500 times

Fig. 26

Some Important Points to Remember

1. Always use hand gloves to remove treated cots. Do not touch the surface with bare hands.
2. Handle the top roller only after they are cooled.
3. Use black sunglasses as UV rays may damage the eyes and can cause painful inflammation.
4. Always keep one UV lamp as spare.
5. Strictly follow the operating instruction given by the manufacturer of UV equipment.

Storage of Cots

Cots should be stored in closed containers. They should be stored in a place where there are constant atmospheric conditions. The temperature should be in the range of 20^{O} to 30^{O} Celsius with 40% to 60% RH. Direct exposure to sunlight / moisture / heat should be avoided.

Cot Conditioning

Before cots are mounted and ground they should be acclimatized to the spinning department conditions. They can be kept in the spinning department for a minimum period of 24 hours. This will greatly improve their start-up performance. Some times if the cots that are stored in highly humid conditions are used without conditioning they may have poor “Compression Set” properties and may result in flute roller markings. Conditioning of cots will avoid all such problems.

Information on Lapping

Top roller lapping is a major subject, which is often discussed in a spinning mill. There are many factors that influence the lapping behavior besides the cot.

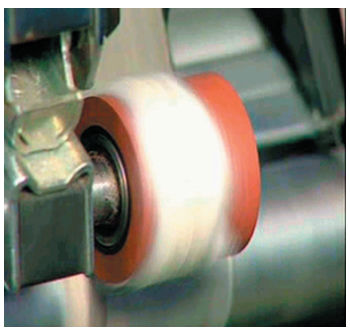


Fig. 27 Lapping

Let us look at some of the major reasons.

1. Surface Finish of Cot

First ensure proper surface finish after grinding of cots (Refer page 29)

2. Material Processed

Depending on the fibres processed, adequate care should be taken while selecting the raw material.

2.1 Cotton

While processing cotton, check for the following parameters: -

a. Honey dew content.
b. Sugar content. If it is more than 0.3%, the cotton will have a sticking tendency.
c. Immature fibres contain high degree of sugar like fructose and glucose, which increases sticking tendency. Cottons with more than 30% immature fibres are likely to give lapping problem. Micronaire can also give an indication.
d. Presence of oily seed coat fragments increase lapping tendency. Excessive wax content adds to lapping. Normal level of wax in cotton is between 0.4% to 0.7%.
e. If the wax is sticky and tacky in nature, roller lapping is encountered even at normal levels of wax. Rapid build-up of yellow to brownish coating on cots is an indication of sticky wax.

2.2 Polyester

a. Spin Finish

The amount of spin finish should be neither too low nor too high. The application should be uniform on the surface. Normal level of spin finish is between 0.15% to 0.20%. Sticky nature of spin finish will lead to lapping.

b. Abnormalities

Abnormalities in the fibre like encrustation on the surface of fibre by oligomers or molten polymers contribute to lapping.

c. Tinting

Improper tinting is often a source of lapping. Tint should be applied uniformly in the form of fine automised spray. Exposed area of fibre to tint should be as large as possible. Percentage of tint should be kept minimum. About 0.04% to 0.5% of tint on the total weight of material is normally adequate. Adequate drying of tinted material should be ensured.

d. Antistat

Static generation during spinning is another cause of lapping. Although polyester manufacturers incorporate antistat agents in the spin finish, it needs to be supplemented by application of antistat at the time of preparation of mixing. Quantum of antistat varies between 0.02% to 0.1% with grey fibre and 0.1% to 1.5% in dyed fibre.

3. Other Factors

a. Finer fibre generally increases lapping as there are more number of fibres in the strand, which increases the contact area.
b. Longer fibres are normally associated with higher lapping. This is because the fibre is in contact with the cot for a long time. Also it is more troublesome with long fibres to remove the lapped up fibres from the cot.

4. Strand Width

Higher strand width under front roller nip increases the lapping tendency because of increased fibre contacts. Therefore, spinning from a coarser hank with a higher ring frame draft increases lapping.

5. Top Roller Pressure

Heavier top roller pressure increases lapping tendency as it increases the contact between the fibre and the cot.

6. Cot Characteristic

a. Diameter - Bigger cot diameter brings down lapping incidence.
b. Hardness - Lapping tendency increases with softer cots because of increased area of contact.
c. Surface Smoothness.
d. Buffing Frequency - Regrinding interval strongly influence roller lapping. As the surface gets old, the surface characteristics change and it will have negative impact on the working.

7. Suction Pressure

Suction pressure should be good, and at the farther end of the pneumafil motor it should not be less than 8 cm of water column. Correct alignment of suction tube and also good surface of suction tube without any fibre chocking is a must to prevent lapping.

8. Yarn Breakage

Yarn breaks during working as well as during restart after doffing, should be within acceptable norms.

APRONS

Introduction

Aprons play the vital role of carrying the drafted strand of fibre in front of the drafting zone. Proper maintenance of aprons is essential for getting good performance and yarn quality.

Construction

Aprons have a 3-layered construction.

1. Outer layer of rubber
2. Inner layer of rubber
3. Cord reinforcement between the two layers

1. Outer layer

The outer layer of apron is a ground surface. It should have a fine ground surface with surface roughness value up to 1.0 micron (for spinning application). The essential requirements of the outer layer are: -

a. Good ozone resistance
b. Good abrasion resistance
c. Good surface characteristics for proper fibre handling

2. Inner Layer

The inner layer has a glossy and shining finish because it is vulcanized when it is mounted on a chrome plated mandrel. The essential characteristics of the inner layer should be: -

a. Excellent abrasion and wear resistance as it is always pressed against sharp knurled bottom roller.
b. Very low coefficient of friction so that the apron will move freely over the bridge bar & the tensioning arrangement.

3. Cord Reinforcement

The cord is provided for giving stability and for improving the tensile properties.

Specifications

1. Internal Diameter (I.D.)
2. Width
3. Thickness

The following dimensions and specifications should be mentioned while ordering the apron.

1. Internal Diameter

Special type of measuring equipment or caliper is available for measuring the I.D. of the apron. Generally, machinery manufacturers mention in their manual the specification of apron, including I.D. x width x thickness. Mills can design their own plug type gauge to measure the I.D. In case of top aprons, the I.D. is critical and it should be within close tolerances. For long bottom aprons, due to the apron tensioning system, the tolerance range for I.D. can be slightly flexible.

In case of short bottom apron, the I.D. is very critical. Here, the tolerance range is extremely narrow and accurate dimensions must be specified. If correct details regarding dimensions are not available, samples can be sent to the apron manufacturer for measurement under controlled conditions using appropriate laboratory equipment. The load applied on the apron during the I.D. measurement will vary depending on the apron thickness and width.

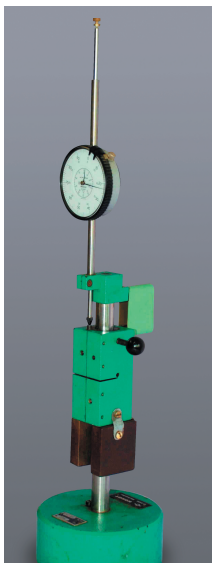


Fig. 28 I.D. Measuring Equipment for Short Bottom Apron

2. Width

The width of the apron can be measured using a Vernier Caliper. Generally the actual width of the apron is 0.3 to 0.5 mm lower than the specified width. This is done to avoid the rubbing of apron edges with the sidewall of the metal cradle (top apron) or the tension hook (in case

of the bottom apron).

3. Thickness

Aprons of thickness ranging from 0.9 mm to 1.1 mm are commonly used. In case of the top apron, thickness of 0.9 mm to 1.05 mm is generally preferred. It is not appropriate to use top apron with higher thickness as it may lead to premature development of cracks.

Bottom aprons are generally offered in thickness 1.0 mm to 1.1 mm. Short bottom aprons of 1.2 mm to 1.4 mm thickness are also used in some machines.

Apron dimensions depend on the machinery specifications and design. Hence the guidelines given by the machinery maker or drafting supplier should be strictly followed.

How to select the right type of apron?

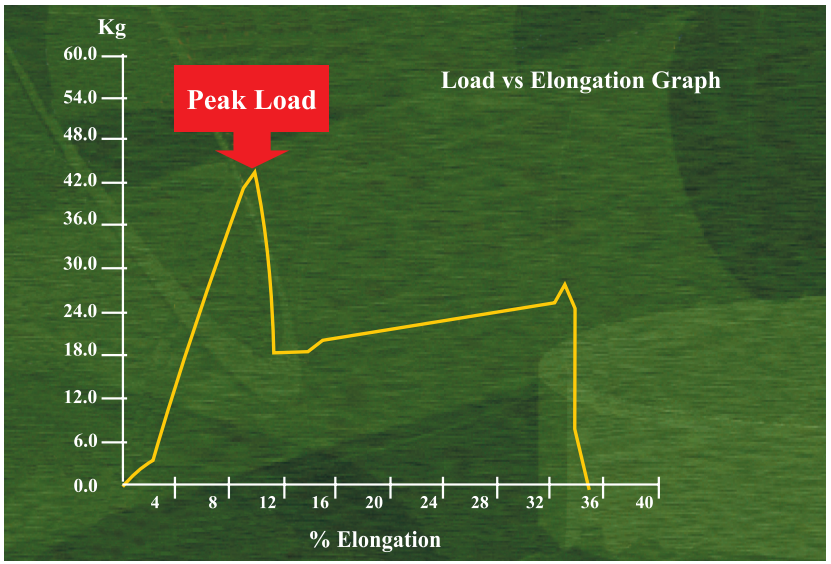
Every apron manufacturer offers multiple choices of aprons. The type of apron varies depending on the yarn count, material spun, type of machine or application, etc. The apron manufacturers try their best to develop aprons that match the technical requirements based on the application. Some details are given in the table below.

Fibre	CHARACTERISTICS OF APRON	
	Inner Layer	Outer Layer
Cotton	Good abrasion resistance. Smooth gliding property.	Good abrasion resistance. Excellent Ozone resistance. Fine outer surface.
Synthetics	Excellent resistance to abrasion.	Excellent resistance to abrasion.
Worsted	Smooth gliding property. Less tendancy for buckling.	Very fine outer surface to avoid lapping. Good Ozone resistance.

Dimensional stability of apron

It was mentioned earlier that the reinforcement cord is provided to impart dimensional stability to the apron. Thread of a certain specification is spirally wound between the inner and outer layer of apron. When the assembly of 3 layers is vulcanized it becomes one composite unit. The reinforcement cord provides dimensional stability, tensile properties and also minimizes elongation up to a certain load. When an endless

apron is clamped between the two jaws of tensile testing equipment and stretched, the Load vs. Elongation graph will be as under: -



Breaking Load of Endless Apron

It requires as much as 48 to 55 Kilogram Force (kgf) load to break the cord of the apron (This is the peak load). Once the cord is broken the rubber gets stretched till it snaps fully.

Under normal working conditions, a spinning apron is not subjected to this kind of pulling force. The force exerted on the bottom apron by the tension mechanism is hardly 1.5 to 2.5 kgf. Despite this, there are issues like higher apron breakages being faced by the mills. Reasons for the apron breakage are discussed on page 54.

Open Apron

Open apron is an instant remedy for production loss due to a broken endless apron. Endless apron of a specific I.D. is made first, which is then clamped and spliced in a pneumatically operated machine and converted into an "Open Apron". Hence, while placing the order for open aprons, it is always better to specify the I.D. only (though supplied in open condition), rather than mentioning the length of the apron.

The angle of skiving and width of skived portion vary from manufacturer to manufacturer. The angle varies generally from 16^0 to 18^0 in case of aprons of width up to 50 mm. In case of an apron of higher width, the angle is around 12^0 to 13^0. The width of the skived portion varies from

5.5 mm to 7.0 mm.

How to join a skived apron?

In order to get good performance from skived aprons, it is essential to train the operator about the correct method of joining the apron and the use of right type of adhesive.

1. Use press clamp for joining.
2. Use a recommended adhesive, preferably a cyno acrylate based adhesive. The adhesive should be kept in a cool dark place and the cap should be properly sealed every time after use. Check for the expiry date of the adhesive.
3. Excessive application of adhesive should be avoided. Excessive adhesive will spill over the apron surface and make it hard, thereby hindering its proper movement.
4. The apron should be joined making use of the arrow mark given on it. The lines, if aligned perfectly, will make a good joint that will last for a reasonably longer time. The arrow mark indicates the direction of rotation. The apron should be assembled in such a way that the arrow mark should be as per the direction of the rotation. This will reduce the tendency for the apron joint to open up after frequent revolutions.
5. Any excess adhesive from the clamp base should be immediately wiped clean. It is better to change the "Teflon" cloth provided in the base after some period of usage.

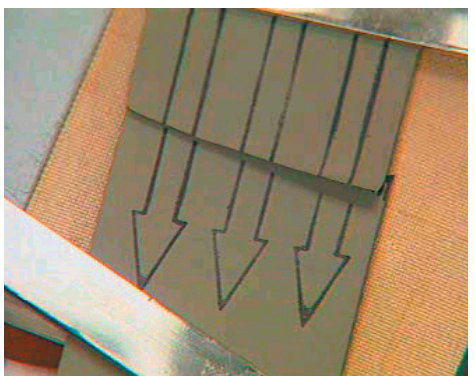
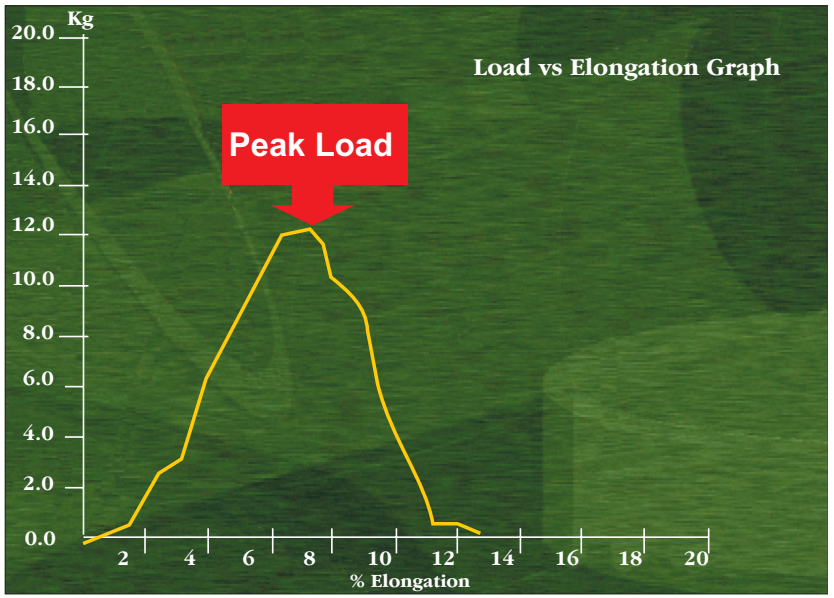


Fig. 29 Joining Skived Aprons

BREAKING STRENGTH OF OPEN APRON

The breaking strength of the open apron is certainly lower than that of an endless apron. If the apron is subjected to load, the graph of load *vs.* elongation, will be, as shown on the next page: -



Breaking Load of Skived Apron

In the above graph the peak load is about 12 kgf. If the apron is joined properly using a good adhesive and clamp by a skilled operator, the breaking strength is as high as 18 to 20 kgf. It should be noted that the open apron is to be used only as an alternative to a broken endless apron. In any machine, if the quantity of open aprons exceeds 5% of the total aprons, it is better to remove the open aprons during machine overhauling and replace them with new endless aprons.

The consumption of open aprons will be high if mills face excessive apron breakage due to various reasons. When an endless apron with high tensile value can break, the chances of frequent breakage of open aprons having lower tensile values will be still higher. This will further increase the consumption of open aprons. Such mills should add extra endless aprons in each staff of the roller stand so that whenever the endless apron breaks, the spare apron can be used. Up to 25% spare aprons can be kept in the machine for this purpose.

Consumption of glue

It is better to buy glue in smaller packs of 5 gm or 10 gm. One tube of 20 gm glue can be used for joining approximately 200 to 250 open aprons.

Effect of ozone on apron

What is ozone? It is a modified version of normal oxygen available

in the atmosphere. Normal oxygen, commonly referred as O_2 contain two oxygen atoms whereas ozone contains three atoms i.e. O_3. Ozone is highly reactive and has a strong bactericidal and bleaching action on various substances.

How is ozone generated in the spinning mill?

Ozone is present everywhere. The atmosphere of the earth has an ozone layer at about 40 to 50 KM which absorbs the UV rays from the Sun. Usually the concentration of ozone in the atmospheric air varies between 0 to 7 parts per hundred million (pphm). In the spinning department, repeated air changes, pneumafil suction system, development of static charges, etc. are responsible for producing ozone little more than atmospheric concentration. The effect of ozone will be severe on rubber, specially when they are in a stretched condition by over 5 %.

How does it affect the apron life?

Ozone has high reactivity. Every ozone molecule reacts with a chain of polymer molecules and breaks the chain. Rubber under stress is an easy target for ozone reaction. Aprons used in spinning consist of polymeric chains, and they are in a stretched condition on the machine. Hence they are prone to cracking due to reaction with ozone.

Factors that influence ozone concentration in the department

1. Modern spinning plants are generally equipped with automatic air engineering plants with number of air changes as high as 40 per hour. Conventional plants offer 8 to 10 air changes per hour. With more air changes, the ozone attack on the apron will be higher.
2. In modern spinning machinery installation, overhead travelling cleaner (OHTC) is used extensively. Most of the mills have one OHTC per long frame. In older installations, the ratio may be one OHTC per 6 or 8 short frames. Increased patrolling of OHTC increases the volume of air discharged on the drafting zone. This increases possible reaction by ozone also.
3. If the apron is coated by some foreign matter like wax, etc., it gets protected from the ozone attack. This can be always seen in an apron that has worked for a long time. The ozone cracks always start from the sides. In the middle portion of the apron, it will be minimum as the traverse area is protected by wax coating from the cotton.
4. Cleaner the atmosphere, higher will be the chances for ozone reaction. Generally dust particles present in the air react with ozone. If the air is clean, more ozone is available for reaction with rubber.

To sum it up, modern textile machinery installations pose bigger challenge to the apron manufacturers for taking care of the ozone-cracking problem.

Remedy

Apron manufacturers are constantly working on this and have come out with solutions. New polymers are available with inherent ozone resistance properties. Certain chemicals are added during compounding time. These chemicals migrate to the surface of the apron during working and they form a protective layer minimizing the reaction with ozone. Ozone testing equipment (Fig. 30 & 31) is available for accelerated testing with regard to ozone cracking.

Ozone resistance testing equipment

In this equipment, ozone concentration of about 50 pphm is created and aprons are tested for their resistance. Aprons are stretched and clamped between pairs of moving jaws. They are flexed continuously and the apron condition is checked at regular intervals. Aprons are studied for the cracks initiation and propagation time, etc., and compared with existing standards. Aprons with higher ozone resistance can be developed based on these findings.

Fig. 30 Ozone Resistance Testing Equipment

Fig. 31 Ozone Chamber

How to get better life out of aprons?

Unlike other accessories used in a spinning mill such as card wire, ring and ring traveller etc., which are made of metal, aprons and cots are essentially rubber products and thus come under focus with regard to their life and consumption. If the machine is not maintained and its settings are inadequate, it will lead to premature wear of aprons and cots.

Factors to be taken care of to improve the working of aprons

1. Roving Traverse

Traverse mechanism is provided in the machine so that at least one third of the width of the apron is utilized. The thumb rule for minimum traverse width is that it should be equal to 1/3rd of the width of the cot.

Generally width of the ring frame cot is 28 to 30 mm and it is preferable to have a traverse width of at least 10 mm.

2. Centering of Bottom Aprons

In order to work with maximum traverse width, the following things should be ensured: -

a. Edges of flute portion of the bottom roller should be in one line. This should be taken care of while installing the machine.
b. Top arm centering with respect to the flutes.
c. Centering of roving guides with respect to the flutes.
d. Minimum variation in the center to center distance of the roving guides
e. Proper alignment of apron tension system with respect to the knurled portion of the middle bottom roller. Apron should run in the center and should not drift.
f. Lateral movement of the apron tensioning system should not be there, as this will disturb the working position of the apron.
g. Top roller saddles should be aligned properly and there should not be any tilting or misalignment.

Thus, it can be seen from the above that a lot of care should be taken while installing the machine itself.

3. Malfunctioning of Roving Traverse Mechanism

Having optimum width of the roving traverse is not just enough. The mechanism should function properly. Premature apron wear out can arise due to the following defects: -

a. Higher dwelling time
b. Jerky or intermittent motion

a. Higher dwelling time

The linear movement of the traverse bar is derived from the rotary movement of a component in the ring frame. In some ring frames, traverse mechanism is attached to the back bottom roller and it derives the linear movement from the rotary movement of the bottom roller. In some machines a heart cam and follower is used for giving drive to the traverse mechanism.

Whenever the rotary motion is converted to linear movement, there will be a momentary stop at the point of the reversal of the movement. This is called "DWELLING" time. Due to wear and tear of the components, the dwelling time increases. This phenomenon is illustrated in Fig. 32.

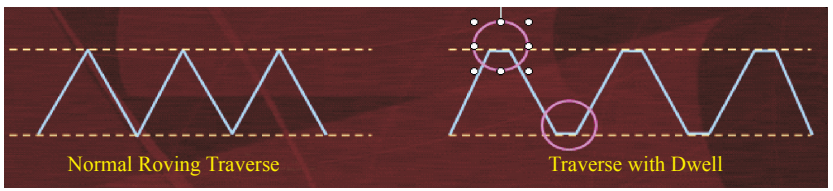


Fig. 32

Due to higher dwelling, the roving tend to spend more time at the point of reversal, leading to the accelerated wear at that point. In case of apron wear due to dwelling, two prominent grooves will be there at the edges and there will not be any sign of wear in the middle area of the traverse. In some of the latest machines, new type of traverse mechanism is introduced e.g. twin traverse by Toyoda. They offer traverse motion with multiple reversal points and hence the load gets distributed evenly (Fig. 33).

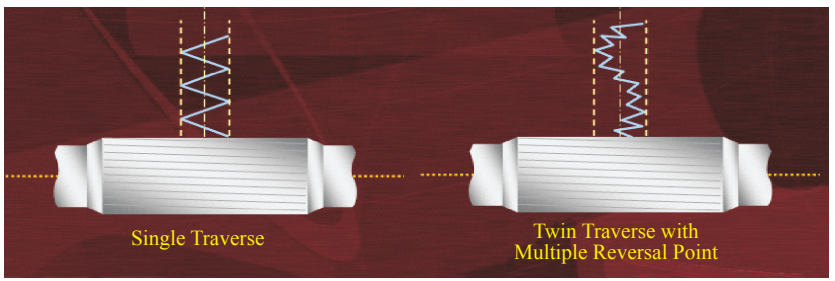


Fig. 33

Zinser-make ring frame offers similar type of roving traverse mechanism, which is referred to as OP-TI-MOVE. According to the information given in their product catalog, the traverse dwelling time is reduced from 22% to 5% .

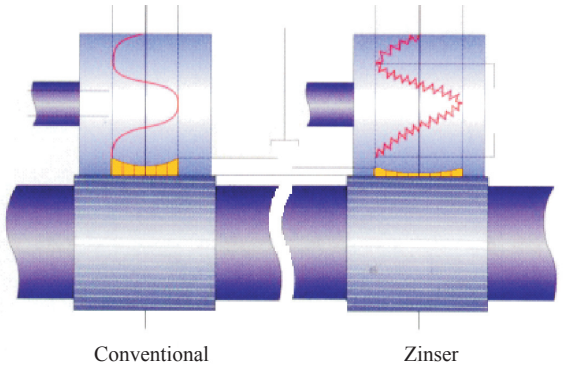


Fig. 34 OP-TI-MOVE

b. Jerky / intermittent movement of traverse mechanism

Due to wear and tear of the mechanical components, the linear movement of the traverse bar may become intermittent at times. A typical example is shown in the illustration.

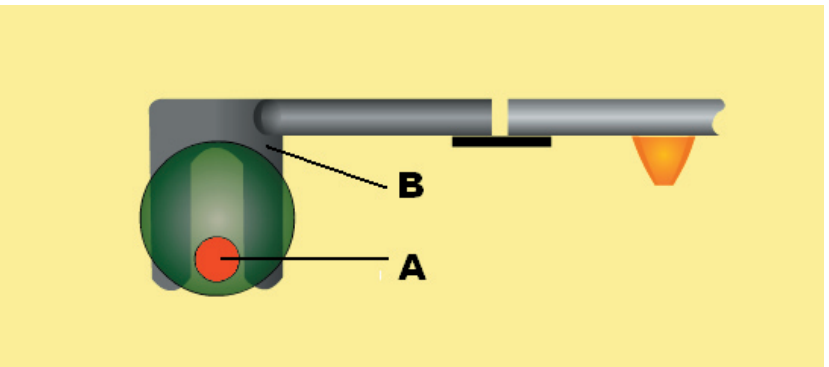


Fig. 35 Roving Traverse Mechanism

Ideally, there should be no gap between pin (A) and the inverted U shaped bracket (B). So, when the disc rotates the pin moves the bar to and fro giving it the traverse movement. If the components wear out and there is a gap between A&B the movement will be intermittent and erratic. This will result in grooves within the traverse area.

Even in traverse mechanism, which is operated with 'heart-cam' arrangement, the components may wear out due to insufficient lubrication leading to erratic movement.

Apron breakage

This is another major issue often raised by spinners. The linear speed of a spinning apron is around 1 to 2 metre/min. depending on the count / draft and material spun. At this slow speed, ideally speaking, chances for apron breakage should be minimum.

The apron is negatively driven due to its surface contact with the bottom roller. It passes over the apron bridge bar (or nose bar) and the apron tension hook. Both these elements, which are stationery, offer friction to the movement of the apron. Of course, the apron is given a special chemical treatment in order to minimize the frictional forces so that it will glide over this surface. Despite this, its free movement may get hampered due to certain factors. Some of them are listed below: -

a. Insufficient apron tension and the loosely fitted apron.
b. Incorrect apron bridge bar height adjustment. The gap between the bridge bar and the middle bottom roller should be less and it should not allow the apron to get trapped.
c. Misalignment of apron due to the shifting of the tension hook. Due to wear in the coil spring, the tension hook start shifting after some years. This leads to misalignment of aprons and results in its breakage.
d. Misalignment of apron especially when the machine is restarted after stoppage for periodical cleaning / overhauling.
e. Roller lapping is a major source of apron breakage especially in coarser synthetic counts. In case of yarn break, it will result in lapping if it is not attended in time. The lapped up material soon start hindering the movement of the apron. The apron starts buckling and gets pulled leading to its breakage.
f. Incorrect top roller setting also contributes to apron breakage. The middle top roller has back overhang compared to the middle bottom roller (Refer Fig. 36). This will help the apron to move straight. Sometimes, the user may move the apron top roller forward in order to maintain closer setting. As the apron is nipped in front, it may try to go between the apron bridge bar and the middle bottom roller, causing its buckling. To avoid this, roller setting should be done strictly as per machinery manufacturer's recommendation.
g. Using a very thin spacer increases the pressure on the apron and it hinders its smooth movement.
h. Sometimes mills use chalk powder (especially after cleaning and oiling). They get deposited on the inner surface of the apron or on the tension hook and it increases the friction.
h. Misalignment of tension pulleys, worn out pulleys, rusted pulleys, and the pulleys that do not revolve freely, all increase apron breakage.

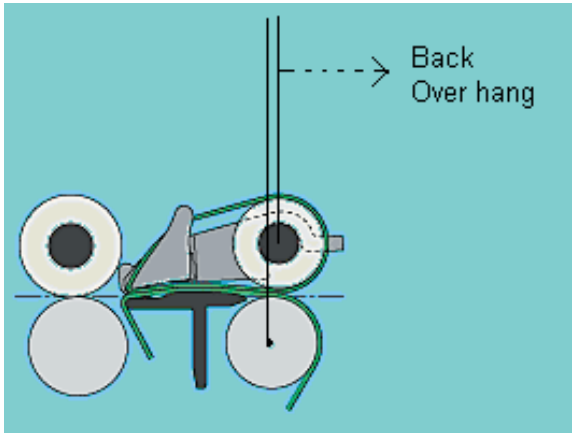


Fig. 36 Top roller Setting

Wear out in the inner surface of bottom apron

The inner surface of the bottom apron wears out fast especially in certain machines where the middle bottom roller is having sharp knurls. Apron with tough inner layer is specially designed for such application. If the apron tension is more than what is recommended by the machinery maker, the apron's inner layer gets abraded fast.

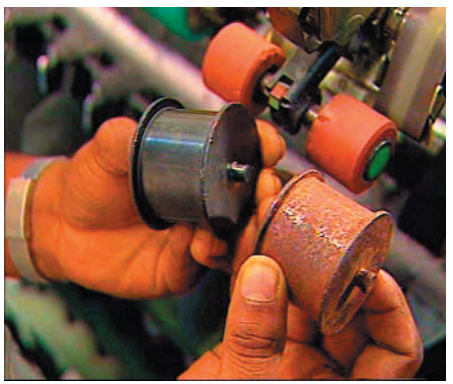


Fig. 37 Apron Tension Pulley

Problems associated with top apron

Generally the top apron gives trouble free performance compared to the bottom apron because the load on the top apron is less. Some of the common issues are discussed on the following page.

Loose running of top apron

This complaint is generally associated with metallic cradle. Metallic cradle's dimensions get altered due to mishandling. They may get bent or warped and due to this the apron may fit loosely. Loose running is not faced in polyamide cradles, as well as cradles with self-tensioning system (Fig. 38).

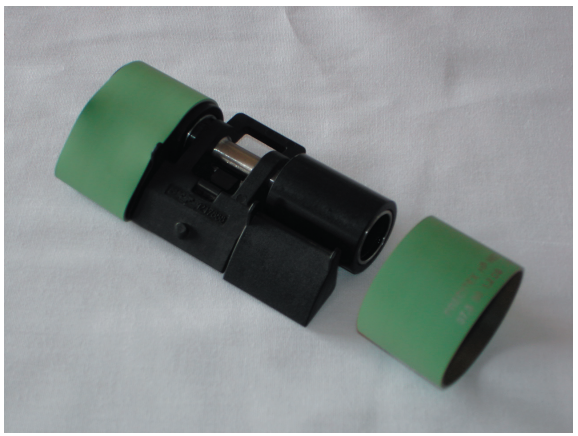


Fig. 38 Polyamide Cradle with Self Tensioning System

Wear in the inner layer of apron

Generally the inner layer does not show any sign of wear-out. Sometimes, due to rough edges of the metallic cradle, the inner layer may get scrapped which will increase the friction between the apron and metal roller.

Decoloration of metal top roller

This is often mistakenly referred to as "the rusting of the top roller".

Fig. 39 Corrosion Free Sleeve for Apron Top Roller

It is said that the metal roller gets rusted because of the apron. This phenomenon is severe especially when processing blends and 100% synthetics. Various factors such as chemicals used in apron or fibres processed or even the RH in the atmosphere may contribute to this. The right solution to this issue is to have suitable type of roller, which will not react with the apron surface.

In certain drafting systems, the apron top roller is covered with a cot (usually of shore hardness 80 ^{0}A). In this roller, obviously, this problem of the corrosion of the top roller will not arise.

Certain drafting manufacturers who were earlier supplying steel top rollers now offer top rollers fitted with special sleeve (Fig. 39), which ensures corrosion free working surface for the apron. Such permanent solutions should be adopted (rather than experimenting with aprons), for avoiding this phenomenon.

Lapping on aprons

Some times the user does face the problem of lapping or wrapping of fibres on top apron. This is noticed in cases like: -

a. Roving frame apron, especially while processing long synthetic fibres (51 mm) of fine denier or micro denier fibres.
b. In worsted spinning system (especially with feed material from "Rubbing" frame).

Though this problem is not a very common one, it is noticed sometimes in worsted spinning system. In the worsted spinning system the feed material to a ring frame can be from: -

a. Roving machine
b. Rubbing machine

In case of roving, the compact and twisted material does not give any problem. However, rubbing is flat ribbon like material without twist. As the fibre length is quite high (for example upto 120 mm) it has a tendency to cling to the apron surface. The top aprons for worsted application are generally made with very fine finished outer surface to minimise this tendency. The extent of spinning additives added to the fibre can be controlled to mitigate this problem. Aprons can be washed periodically, so that the deposits of chemical or wax from the apron surface can be removed and this will certainly get this issue under control.

Apron Storage & Maintenance

Washing

During continuous working, outer and inner surfaces of aprons get

soiled. Spinfinish / tint / waxy material gets deposited on the outer layer. In the inner layer also there will be dust collection from the spinning environment. These lead to increased frictional characteristics that hamper the free movement of the apron. It is better to wash the apron in lukewarm mild soap solution so that these external deposits are removed. The apron should be rinsed and dried thoroughly before further use. Strong soap solutions should not be used as they have harmful effects.

Fig. 40 Washing of Aprons

Storage

Aprons should be stored in cool and dark place. Exposure to direct sunlight, heat, or moisture should be avoided. Preferred climatic condition will be 25^{O} to 30^{O} Celsius with 50% to 60 % RH. Avoid storage of aprons for a long time. Use FIFO (First In First Out) method to avoid loss in life due to longer storage.

It is better to store the apron in loose condition as in Fig. 41 **(B)**. When the aprons are stacked together Fig. 41 **(A),** the stress concentration will be at the flexed area making it more susceptible for any damage due to highly varying atmospheric conditions. Aprons of smaller I.D. (less than 55 mm) should never be stored in stacked condition to avoid permanent set of deformation.

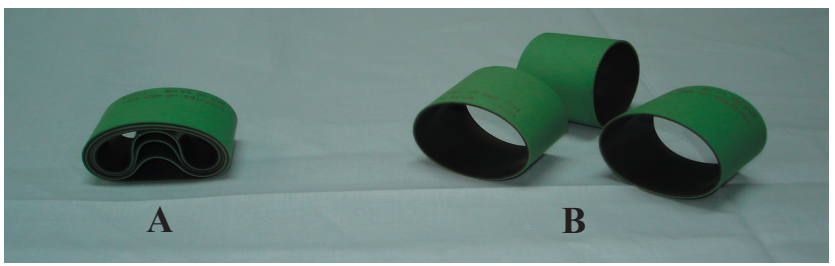


Fig. 41 Storage

Apron conditioning / running – in

New aprons may have a little stiffness due to storage. Hence it is better to keep them in open conditions in the spinning department, at least for 24 hours before using them on the machine. This will give good start up performance.

Another way to give "running in" for new aprons is to run the apron in the machine without material for some time. This is generally done when the new machine is installed

Another commonly adopted practice is to go for staggered replacement of the top and the bottom aprons. They are never replaced at the same time. If both the aprons are new, it may result in undrafted ends due to improper movement. It is better to space their replacement by 2 to 4 weeks. Many mills follow this procedure.

Cordless Apron

Aprons without cord are manufactured for certain specific applications. They are referred as "Cordless Sleeves" also. They are mainly used in:

a. OE Machine
b. Two For One Twisting Machine (TFO)
c. Application in Worsted Machinery

Cordless Sleeve for OE Machine and TFO Twister

In these machinery, the sleeve is mounted on the winding drum on which the yarn package rests. Essential features of this sleeve are: -

1. The outer surface should be rough (having Ra > 2.0 microns) so that the drive transmission efficiency is higher. Some TFO manufacturers like Murata recommend sleeve with special outer surface having knurl impressions.
2. The inner surface should have a good grip on the winding roller so that it will not slip
3. There should not be any gap between the edge of the sleeve and the drum. The gap may trap the yarn and there will be frequent yarn breakages.

The cordless sleeve for TFO generally lasts for 3 to 4 years depending on the winding speed, yarn package weight, and the material processed. After a certain period, the outer surface of the sleeve becomes very smooth which may result in loose package build up or even TPI variation.

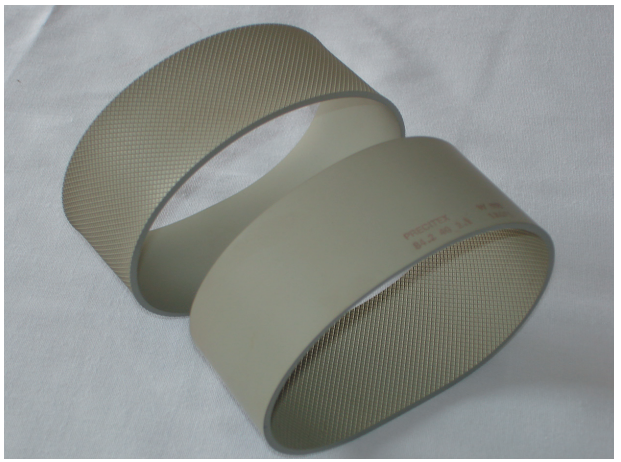


Fig. 42 Cordless Sleeve for TFO Twister

Proper replacement programme should be chalked out for cordless sleeves too. Cordless sleeves are also available in open condition for instant use. However, they should be strictly used for short period only. As far as possible, endless sleeves should be used.

Cordless Aprons in Worsted Machinery

Cordless aprons are used in gill box and the rubbing machine. While ordering these aprons, this should be specified. These aprons, if supplied with cord, cannot be mounted on the machine.

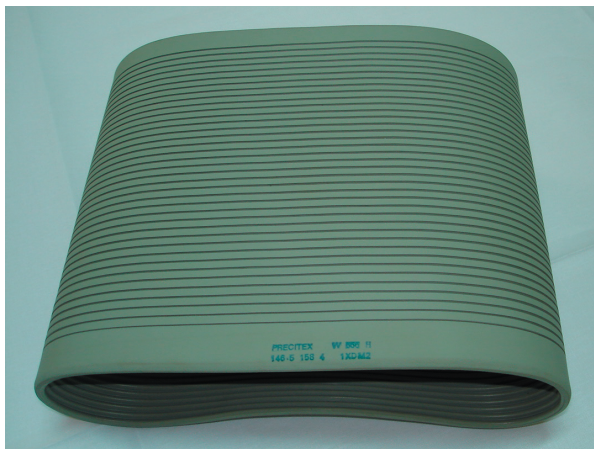
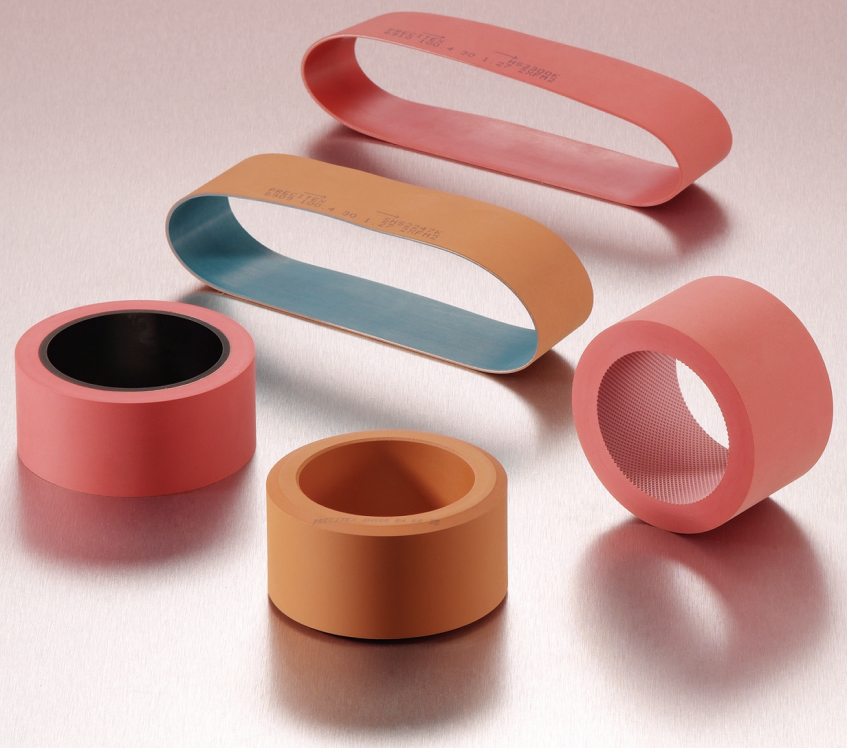


Fig. 43 Rubbing Apron

TEXTURISING APRONS & COTS



APRONS & COTS FOR SPECIFIC APPLICATIONS

These applications are :-

1. Jet Spinning
2. Texturising

1. Aprons and Cots for Jet Spinning

Jet Spinning offers high productivity and eliminates few processes in the conventional spinning system. Yarn is delivered at 400 to 450 m/min which is 15 to 20 times higher compared to conventional ring spinning process. Considering the higher operating speeds, aprons and cots of special type are used in this application.

Cots

Generally Alucore cots are used considering the high speeds.

Recessed cots are used in Vortex machine. They permit better air movement that avoids fly collection on the roller. The yarn quality will be better and the slub formation is also less.

The regrinding interval of cots are very short and are usually in the range of 7 to 10 days.

Fig. 44 Cots for Jet Spinning

Aprons

Both top and bottom aprons are of shorter diameter. They have a special knurled inner surface to provide adequate grip at a high speeds.

The outer layer of the apron should have very high abrasion resistance.

More number of revolutions together with shorter I.D. makes the apron more vulnerable for flex cracks. Hence, aprons should be made of superior polymer that offers more flexibility and suppleness.

The aprons should be stored in loose condition and should be in a relaxed state. Initial stiffness will result in more yarn faults during start-up working.

The life of aprons is usually in the range of 45 to 90 days depending on the speed, yarn count and material spun etc.

Fig. 45 Aprons for Jet Spinning

2. Aprons & Cots for Texturising

Cots

These are commonly referred to as Nip Roller Cots. These cots are made of special polymer aiming at: -

a. Higher abrasion resistance
b. Special “matt” surface for proper grip of the filament

Cots are available in all constructions such as Gluefit (plain bore/ knurled bore), Springrip, and Pressfit (Alucore and PVC core). Where delivery speeds are quite high like 800 to 1200 m/min, it is better to use Springrip or Pressfit cots. Mounting procedure is the same as what we

discussed earlier in case of spinning machine cots.

Recommended tolerances after grinding

Concentricity	:	0.0125 mm
Parallelism	:	0.040 mm
Surface finish	:	1.0 to 1.4 micron Ra

Recommended Shore Hardness

60^0 to 63^0 A for fine denier.
70^0 to 73^O A for coarse denier.

Aprons

Texturising aprons operate at much higher speeds. Based on their application, their characteristics are different from that of the spinning aprons.

1. Outer layer of apron

The outer layer of the apron should offer a very high degree of wear resistance considering the fact that the filament yarn will have abrasive action at high speeds. The apron gets the rotary motion due to surface contact between its outer layer and a chrome-plated roller that rotates at high speeds. The outer surface should have a special "matt" surface of higher Ra value so that the drive transmission is more effective.

2. Inner layer of apron

The apron is held in position around the drive roller by means of two guide rollers. These guide rollers have a crowned surface and the inner layer of the apron is in constant touch with this surface. The frictional characteristics between the apron's inner layer and the crown roller are important to keep the apron in its working position without lateral shifting.

3. Composite tensile strength

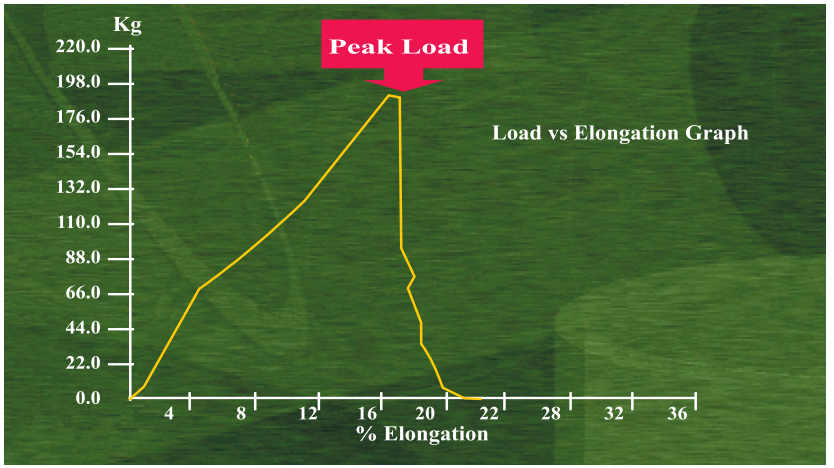
As these aprons work at very high speeds, they should have very high tensile properties compared to normal spinning aprons. The tensile strength of the texturizing apron is nearly 4 to 5 times higher than that of the spinning apron.

Life of texturising aprons

Depending on the speed, the denier of material or the type of material (Polyamide or POY), the life span of these aprons varies. In fine denier (75 D to 150 D), it varies from 3 to 4 months.

Generally aprons are first used in position 1 and 2, that are considered

to be critical for about 6 to 8 weeks. After this, they are sorted out and the ones in good condition are reused in position 3 (winding), that is considered less critical.



Breaking load of texturising apron

When the apron is working in the 1st position, sometimes it may have to be removed for routine maintenance/setting etc. While assembling back, it should be mounted in the same way as before to ensure correct alignment. For this purpose, some manufacturers print arrow marks on the side of the apron indicating the direction of rotation.

Common problems/causes

Due to high-speed operation, there can be certain performance related problems. Some of them are listed below:

No.	Problem	Cause
1.	Apron crack/ breakage	Check alignment Check tensile properties
2.	Shifting of aprons	Check alignment of crown rollers Surface finish of crown rollers Free revolution of the rollers
3.	Vibration of apron	Dimensional stability of apron Condition of bearing of crown roller
4.	Untexturised yarn	Glazed surface of apron Slippage of apron

ANNEXURE

ISO 5235 Standard for Top Aprons

Table 1 - Inside Diameters

Value in mm

I.D.	Tolerance
up to 48	0.3
over 48 to 65	0.4
over 65 to 90	0.5
over 90 to 110	0.8
over 110	1.0

Table 2 - Widths

Value in mm

W	Deviation
26 28 30 32 34 36 38 40 45 50 55 60	0.0 - 0.5
65 70 80 90 100	0.0 - 1.0
W>100 in 10 mm in-crements	0.0 - 1%

Table 3 - Thickness

Value in mm

S	Tolerance
0.8 0.9 1.0 1.1 1.2 1.5	0.1

ISO 5235 Standard for Bottom Aprons

Table 4 - Inside Diameters

Value in mm

I.D.	Tolerance
up to 90	2.0
over 90 to 140	3.0
over 110	1.0

Table 5 - Widths

Value in mm

W	Deviation
28 30 32 34 36 38 40 42 45 50 55 60 65 70 80 90 100	0.0 - 0.1
W>100 in 10 mm in-crements	0.0 - 1%

Table 6 - Thickness

Value in mm

S	Tolerance
0.8 0.9 1.0 1.1 1.2 1.5 2.0	0.1

When aprons for Bottom position are operating on fixed centres without self adjusting tension arrangement tolerances and deviations shall be as for top aprons.

Dimensions of Aprons and Cots for Popular Makes of Machinery

S.No.	Make of Machine.	Dimension	Remarks
TOP APRONS FOR RING FRAMES			
1	LR (DJ/5)	37.7 x 33.5 x 0.9	Short Cage
2	LR (DJ/5)	43 x 33.5 x 0.9	Medium Cage
3	LR (DJ/5)	53.8 x 33.5 x 0.9	Long Cage
4	LR (G5/1)	39.2 x 30 x 1.05	Short Cage- Apron Top Roller Dia 27 mm
5	LR (G5/1)	43.3 x 30 x 1.05	Medium Cage
6	LR (G5/1)	53.8 x 30 x 1.05	Long Cage
6.1	LMW Model LR 6	38.1 x 30 x 1.05	Short Cage-Apron Top Roller Dia 25 mm
6.1	LMW Model LR 6	38.7 x 30 x 1.05	Short Cage-Apron Top Roller Dia 27 mm
7	Texmaco Toyoda	37 x 28 x 0.9	PK 225 (Short Cage)
8	Texmaco Toyoda	41.5 x 28 x 0.9	PK 225 (Medium Cage)
9	Texmaco Toyoda	51.3 x 28 x 0.9	PK 235 (Long Cage)
10	Textool (DJ/50)	37 x 28 x 0.9	PK 225
11	Jeetstex	37 x 28 x 0.9	PK 225
12	Textool (Worsted)	84.1 x 32 x 1.1	SKF PK1601
13	KTTM (RX I 240)	37 x 28 x 0.9	Short Cage
14	KTTM (RX I 240)	41.5 x 28 x 0.9	Medium Cage
15	Suessen (Fiomax 1000)	37 x 30 x 1.0	Short Cage
16	Suessen (Fiomax 1000)	41.5 x 30 x 1.0	Medium Cage
17	Rieter K44	43.3 x 30 x 1.0	43 mm Cage

Continued...

BOTTOM APRONS FOR RINGFRAMES			
1	LR (DJ/5)	95 x 34 x 0.9	For Short & Medium cages
2	LR (DJ/5)	109 x 34 x 0.9	For Long Cage
3	LR (G5/1)	80.5 x 30 x 1.05	For Short Cage
4	LR (G5/1)	82 x 30 x 1.05	For Medium Cage
5	LR (G5/1)	88 x 30 x 1.05	For Large Cage
6	MMC	76 x 32 x 0.9	
7	Textool (DJ/50)	90 x 30 x 0.9	PK 225 drafting
8	Textool (Worsted Frame)	120 x 34 x 1.1	
9	Jeetstex	80 x 30 x 0.9	
10	Texmaco Toyoda (RY5)	76 x 30 x 0.9	PK 225 Drafting for Short & Medium Cage
11	Texmaco Toyoda (RY5)	80 x 30 x 0.9	PK 235 Drafting
		82 x 30 x 0.9	Long Cradle
12	KTTM	37.3 x 30 x 1.20	Short Cage
13	KTTM	41.6 x 30 x 1.20	Medium Cage
14	Suessen	38.1 x 30 x 1.00	Short Cage
15	Suessen	41.5 x 30 x 1.00	Medium Cage
16	Zinser	72.5 x 30 x 1.10	
17	Marzoli	72.5 x 30 x 1.10	
18	Rieter K44	72.5 x 30 x 1.10	Knurled inner surface
19	Chinese (Jingwei)	83 x 30 x 1.10	Short Cage
TOP APRONS FOR SPEEDFRAMES			
1	LMW (LF 1400 & GS)	42 x 65 x 0.9	36 mm Cage
2	LMW (LF 1400 & GS)	42 x 65 x 0.9	43 mm Cage
3	LMW (LF 1400)	50.6 x 65 x 0.9	50 mm Cage
4	LMW (LF & GS)	56.2 x 65 x 0.9	59 mm Cage
5	Textool (TS 15)	37 x 39.8 x 0.9	Short Cage

Continued...

6	Textool (TS 15)	43.3 x 39.8 x 0.9	Medium Cage
7	Textool (TS 15)	52.7 x 39.8 x 0.9	Long Cage
8	Texmaco Howa	37 x 40 x 0.9	Short Cage
9	Texmaco Howa	51.3 x 40 x 0.9	Long Cage
10	Texmaco (RME)	37 x 39.8 x 1.1	
11	LMW (LF1400A)	42 x 38.5 x 0.9	36 mm Cage
12	LMW (LF1400A)	46 x 38.5 x 0.9	43 mm Cage
13	LMW (LF1400A)	50.6 x 38.5 x 0.9	50 mm Cage
14	Zinser	37 x 40 x 0.9	PK 1600 drafting.
15	Toyoda FL 16	37 x 40 x 1.0	Short Cage
BOTTOM APRONS FOR SPEED FRAMES			
1	LMW (LF 400&GS)	97 x 67 x 0.9	For 36 & 43 mm Cage
2	LMW (LF 1400&GS)	108 x 67 x 0.9	For 50 & 29 mm Cage
3	Textool	97 x 40 x 1.0	Short & Medium Cage
4	Textool	104 x 40 x 1.0	Long Cage
5	Marzoli	82 x 40 x 0.9	
6	Texmaco Toyoda	90 x 40 x 0.9	Short Cage
7	Texmaco Toyoda	97 x 40 x 0.9	Long Cage
8	Texmaco (RME Model)	37.5 x 40 x 1.4	
9	LMW (LF 1400A)	76 x 40 x 0.9	36 & 43 mm Cage
10	Toyoda FL16	38.8 x 39.8 x 1.4	Short Cage
11	Toyoda FL16	43.3 x 39.8 x 1.4	Medium Cage
12	Zinser	36.25 x 42 x 1.1	
CORDLESS SLEEVES			
1	Veejaylaxmi VJ150HS - TFO	70 x 61.7 x 2.1	
2	Veejaylaxmi VJ180HS - TFO	70 x 62.9 x 2.1	
3	Prerna - TFO	84.2 x 40 x 2	Knurled Outer

Continued...

4	Volkman V T 08 - TFO	97 x 67 x 2.1	
5	Volkman V TS 06 - TFO	92.8 x 127 x 2.0	
6	Alidhara TFO	84.2 x 40 x 2	Knurled Outer
7	Star Volkman T.F.O (Model VTS090F)	95 x 46 x 2	
8	Murata - TFO	95 x 47 x 2 / 2.2	Knurled Outer
		95 x 62 x 2/ 2.2	Knurled Outer
9	BD 200 (SN) (Open end Spg)	61.7 x 24 x 1.0	
		55 x 27 x 1.2	
COTS FOR DRAWFRAMES			
1	L.R. (DO/2S)	20.2 x 40 x 210.5	83° A
2	Padmatex	20 x 30 x 160	83° A (II^{nd} & III^{rd} Row)
		23 x 34 x 160	83° A (I^{st} Row)
3	Rieter (RSB 51)	26 x 38 x 150	78° A
4	Rieter (SB 52)	26 x 38 x 150	78° A
5	Rieter (Including Ingolstadf & Lakshmi Rieter) Models RSB-1, RSB-2, RSB-851, RSB-951, SB-2, SB-51, SB-52	26 x 38 x 150/158/160	
6	Rieter SB D-10 & RSB D-30	26 x 38 x 150/158/160	
7	Rieter D1/1 & D1/2A	25.2 x 39 x 218	Big
		19.8 x 29 x 218	Small
8	Trutzchler HSR-900	23 x 34 x 186	
9	Rieter LR D06	25.3 x 39 x 186	
10	Trutzchler HSR-1000	23 x 34 x 175	
11	Zinser 720 / Padmatex (4 over 3)	23 x 34 x 160	

Continued...

12	Zinser 720 / Padmatex (5 over 3)	20 x 30 x 160	
13	Zinser 730	23 x 34 x 180	
14	Vouk SH-802	30 x 45 x 175	Big
		23.1 x 34 x 175	Small
15	Vouk VS-4A	30 x 45 x 220	Big
		23.1 x 38 x 220	Small
16	Cherry Hara DX-400 / DX-500	22 x 34 x 180	
17	Cherry Hara / Toyoda USC-600 / DYH-800 / DX7H2/ DT-110A	23 x 34 x 180	
18	Howa / Texmaco Howa DFK-2CD	24 x 34 x 180	
19	Howa DFH5 / DFH8	24 x 34 x 216	
20	DX 7A (Hara)	26 x 38 x 160	
		23 x 34 x 160	
21	DX 8	26 x 38 x 160	
COTS FOR RING FRAMES			
1	LMW (G5/1 / LR 6)	19 x 30 x 28.5	Front & Back (for M/c. with 27mm dia bottom roller)
2	LMW (G5/1 / LR 6)	19 x 32 x 28.5	Front & Back (for M/c. with 30mm dia bottom roller)
3	LMW (G5/1)	19 x 27 x 28.5	Middle row
3.1	LMW (LR 6)	19 x 25 x 28.5	Middle row
4	LMW (DJ/5)	19 x 28 x 34	Front & Back (Short Cage)
		19 x 29 x 34	Front & Back (Medium Cage)
		19 x 32 x 34	Front & Back (Long Cage)

Continued...

5	Textool (DJ/50)	19 x 29 x 25	
6	Jeetstex	19 x 28.5 x 25	
7	Texmaco	19 x 28.5 x 25.4	Pk 225 Short & Medium Cage
		19 x 35 x 25	Pk 235 Long Cage
8	KTTM	19 x 29 x 28	Short
		19 x 35 x 28	Medium
9	Suessen	19 x 29 x 28	Short
10	Suessen Elite	19 x 29 x 20	
		19 x 40 x 20	
11	Rocos	13 x 25 x 16	Back (1.1 version)
		13 x 20 x 16	Front (1.1 version)
		13 x 21 x 19	Front (1.4 version)
		13 x 28 x 22	Back (1.4 version)
12	Rieter K 44	19 x 32 x 28	
13	Worsted System	19 x 50 x 30	Front & back Row
		19 x 48 x 30	Middle Row
COTS FOR SPEED FRAMES			
1	LMW (LF1400 & GS)	19 x 29 x 54	For 36mm Cage 1,3 & 4row (4 over 4 drafting) and 1st & 3rd Row (3 over 3 drafting) - 83° A
2	LMW (LF1400 & GS)	19 x 31 x 68	2nd row (3 over 3 drafting) - 80° A
3	LMW (LF1400 & GS)	19 x 32 x 54	For 43/50/59mm Cage 1st,3rd & 4th rows (4 over 4 drafting) and 1st & 3rd row (3 over 3 drafting) - 83° A

Continued...

4	Texmaco	19 x 28.5 x 40	Pk 1660 Drafting for Front/Back.
		19 x 25 x 40	For Apron Roller - 80° A
5	LMW (LF1400A)	19 x 31 x 42	2nd row Apron roller - 80° A
		19 x 29 x 42	1st & 3rd row (for 36/43mm cage) - 83° A
		19 x 32 x 42	1st & 3rd row (for 50mm cage)
COTS FOR LAP FORMER			
1	Rieter E2/4 & Lakshmi Rieter E2/4 (Sliver lap)	32.3 x 44 x 306	
		28.3 x 37 x 306	
2	Rieter E4/1 & Lakshmi Rieter E4/1A (Ribbon Lap)	32.3 x 41 x 306	
		32.3 x 41 x 306	
3	Rieter E5/3, E30 (Unilap)	26 x 40 x 300	
4	Vouk RD-300	30 x 45 x 324	
		23.4 x 38 x 327	
5	Cherry Hara HL-100	27 x 37 x 280	
		22 x 34 x 180	
6	Cherry Hara SL-100 / Toyoda TS-100	21 x 31 x 300	
7	Zinser Hara - Lap Center 820	21 x 27 x 280	
		27 x 37 x 280	
		22 x 34 x 180	
8	Howa Fine Lap	27 x 37 x 275	
		21 x 27 x 275	
DETACHING ROLLER COTS			
1	Rieter E7, E7/2, E7/4	18 x 24 x 324	
2	Rieter E7/5	15.92 x 24.5 x 338	Alucore

Continued...

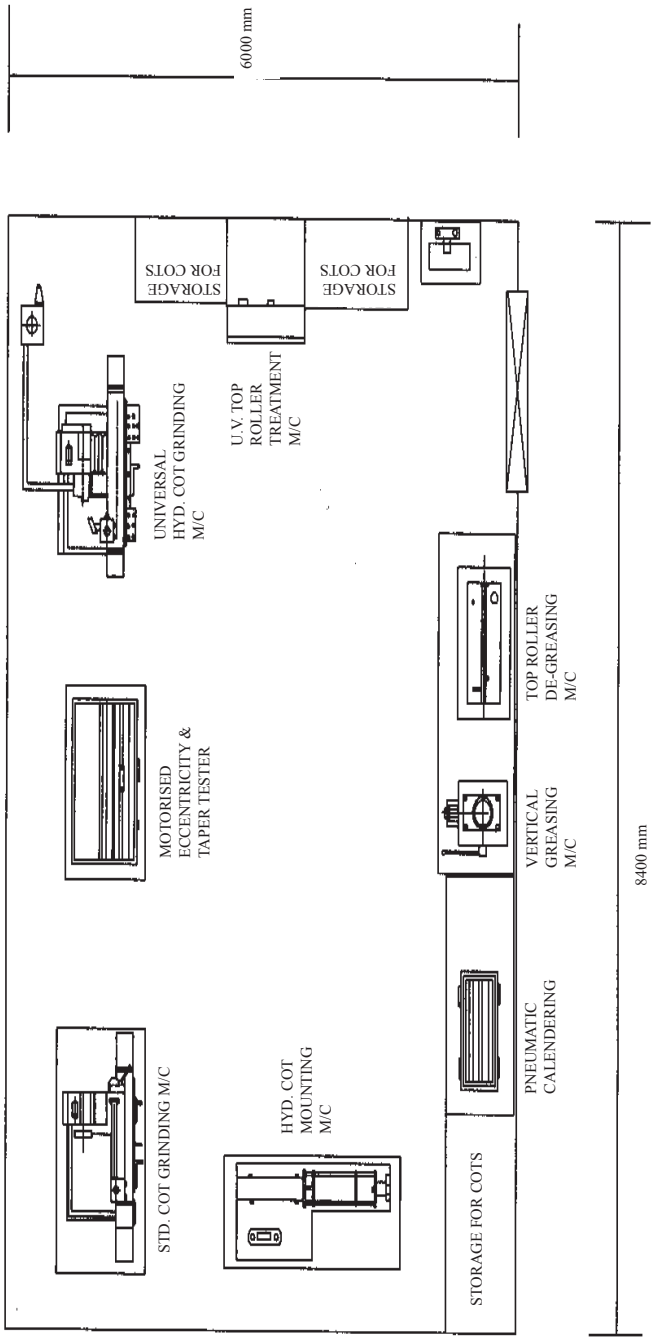
3	Rieter E7/5A, E7/6, E60H, E61, E62, E70R	15.92 x 24.5 x 348	Alucore
4	Vouk CM-400	16 x 24.5 x 340	
5	Cherry Hara / Toyoda VC-250, VC-300, CM-100/Zinser-830 / CM-110A / VC-5	16 x 23 x 340	
6	Howa HZ	16 x 24 x 340	
7	LMW LK 250	18.1 x 24 x 326	
8	LMW LK 54	15.92 x 24.5 x 335	Alucore
9	Toyoda CM 8/CM10	16 x 24 x 339	
DRAW BOX & TAKE OFF ROLLER COTS			
1	LMW LK 54	30 x 45 x 210	Drafting Top Roller Alucore
2	LMW LK 54	30 x 45 x 335	Take Off Roller Alucore
3	Rieter E61 / E62	29.95 x 45 x 200	Drafting Top Roller Alucore
4	Rieter E61 / E62	29.95 x 45 x 336	Take Off Roller Alucore
5	E 74	32.3 x 44 x 223	
		28.3 x 37 x 223	
6	E7/5 E7/5A & E7/6 E60 H	30 x 45 x 200.5	
		30 x 45 x 200.5	
		30 x 45 x 200.5	
7	Cheeery Hara/ Toyoda vc-250/vc-300/ cm100/cm110A/ VC5	22 x 31 x 210	
8	Vouk CM-400	30 x 45 x 175	
		23.1 x 38 x 175	
9	Howa HZ	24 x 34 x 215	

Continued...

TEXTURISING COTS			
1	Himson	51 x 64 x 38	
		51 x 65 x 38	
2	Alidhara Machine	51 x 63 x 38	
3	Alidhara Textools	54 x 68 x 38	
		54 x 68 x 35	
TEXTURISING APRONS			
1	Murata	100.3 x 30 x 1.1	
2	Barmag	104 x 30 x 1.1	
3	ARCT AIKI	90 x 29 x 2	
4	Toshiba	92 x 29 x 1.2	
5	Teijin	84 x 29 x 1.3	
6	Mitsubishi	87.5 x 30 x 1.2	
7	RPR	85.7 x 29 x 1.2	
8	Alidhara Machines	104 x 30 x 1.27	
9	Alidhara Textools	90 x 30 x 1.27	
		100.3 x 30 x 1.27	
		100.4 x 30 x 1.27	
Murata Jet Spinning - Aprons			
1	MTS -TOP	43.8 x 60 x 1 / 1.1	Knurled Inner
2	MTS - BOTTOM	45.4 x 64 x 1 / 1.1	Knurled Inner
3	MVS TOP	37 x 32 x 1	Knurled Inner
4	MVS BOTTOM	38 X 34 X 1	Knurled Inner
Murata Jet Spinning - Cots			
1	MVS	19 x 30 x 32	Alucore Recessed
2	MVS	22 x 30 x 32	Alucore Recessed
3	MTS	19 x 28.5 x 64	Alucore
4	MTS	25 x 32 x 64	Alucore

Note: -
Above dimensions are as per data available with us. However, for more accurate information please refer the machinery manufacturer's catalogue.

Layout Plan for Roll Shop Equipment for Spinning Mill



Drawing not to the scale.

Yarn Count Conversions

	tex	dtex	den	Nm	Ne_c	Ne_w	Ne_L	Grains/yd
tex =		detex/10	den/9	1000/Nm	$590.54/Ne_c$	$885.8/Ne_w$	$1653.5/Ne_L$	gr/yd. 70.86
dtex =	tex .10		den/0.9	10000/Nm	$5905.4/Ne_c$	$8858/Ne_w$	$16536/Ne_L$	gr/yd. 708.6
den =	tex.9	dtex.09		9000/Nm	$5314.9/Ne_c$	$7972.3/Ne_w$	$14882/Ne_L$	gr/yd. 637.7
Nm =	1000/tex	10000/dtex	9000/den		Ne_c1.6934	Ne_w1.13	Ne_L 0.6048	14.1/gr/yd
NeC =	590.54/tex	5905.4/dtex	5314.9/den	Nm/0.5905		Ne_w 1.5	Ne_L 2.8	8.33/gr/yd
NeW =	885.8/tex	8858/dtex	7972.3/den	Nm/0.8858	Ne_c1.5		Ne_L 1.87	12.5/gr/yd
NeL =	1653/tex	16535/detex	14882/den	Nm/1.6535	Ne_c2.8	Ne_w1.87		23.33/gr/yd
grains/yd =	tex/70.86	dtex/708.6	den/637.7	14.1/Nm	$8.33/Ne_c$	$12.5/Ne_w$	$23.33/Ne_L$	

Nm = metric Count Ne_c = cotton Ne_w = worsted count Ne_L = linen count

Some Important Definitions & Details of Cotton

SPAN LENGTH

Span length parameters are based on the length of fibre measured at any random point on the fibre. Only partial length of the fibres is considered while computing span length.
Span lengths are fibre extension distances, not fibre lengths.

2.5 % Span Length

2.5 % span length is the distance 2.5 % of the fibres extend from the clamp where they are caught at random along their lengths. This length closely agrees with the staple length as determined by the American Classers. Figures in Table 1 may be used as a guideline for classifying Indian Cottons.

TABLE – 1
Classification of Cotton Based on
2.5 % Span Length Values

Class	2.5 % Span Length (mm)
Extra long staple	32.5 and above
Long staple	27.5 to 32.0
Medium long staple	25.0 to 27.0
Medium staple	20.5 to 24.5
Short staple	20.0 and below

50 % Span Length

50 % span length is the distance 50 % of the fibres caught at random extend from the clamp along their lengths.

Uniformity Ratio

Uniformity ratio is defined as the ratio of 50 % span length to 2.5 % span length expressed as a percentage. This ratio is a measure of the length variability of the cotton. The ratings for uniformity ratio are as follows:

Continued...

UNIFORMITY RATIO		RATING
50 %	:	Good
45 %	:	Average
43 %	:	Poor

Mean Length

The average length of all the fibres in the test sample based on mass-length data.

Upper-Half-Mean Length

The mean length by number of the longer one half of the fibres by weight, as determined by HVI. Upper-half-mean length is nearly equal to 2.5 % span length.

Uniformity Index (UI)

The ratio between the mean length and the upper half mean length expressed as a percentage.

$$UI = \frac{\text{Mean Length}}{\text{Upper Half Mean Length}} \times 100$$

Rating of Uniformity Index

UNIFORMITY INDEX		RATING
85 %	:	Good
82 %	:	Average
80 %	:	Poor

Micronaire and Maturity

The ratings for the micronaire and maturity values given below can be used as a guideline

Micronaire Value		Maturity Coefficient	
µg / inch	Rating	Value	Rating
3	Fine	0.80	Good
4	Average	0.75	Average
5	Coarse	0.65	Poor

Continued...

Fibre Strength

The tenacity of the cotton obtained at 3 mm. guage length can be rated on the following basis.

Rating	Pressley *(1000 lb./ sq.in)*	Stelometer *(g./tex)*
High	75	30
Average	60	24
Low	45	18

Fibre Properties of Some Major Indian Cottons

(Measured by HVI Test System Using ICC Mode)

Cotton	2.5% Span Length (mm)	Micronaire Value (µg. / inch)	Tenacity (g./tex)
Short Staple			
Bengal Deshi	16.5 – 19.0	7.7 – 8.0	15.5 – 17.5
Comillas	17.0 – 19.5	5.3 – 8.2	14.0 – 17.5
LD 491	19.1 – 21.5	7.3 – 8.0	17.0 – 18.0
LD 327	17.0 – 19.5	4.9 – 7.6	16.5 – 19.5
Kalagin	18.0 – 19.5	6.7 – 7.0	15.0 – 16.0
Arogya	19.0 – 21.0	5.0 – 5.9	19.0 – 21.0
Medium Staple			
Wagad	20.5 – 22.5	5.5 – 7.0	12.5 – 18.5
G.Cot.12	21.0 – 25.5	4.2 – 5.5	14.5 – 20.0
G.Cot. 15	22.5 – 25.5	3.5 – 4.7	18.0 – 22.5
Jayadhar	22.0 – 24.5	4.5 – 5.3	15.5 – 18.5
Digvijay	21.0 – 25.0	3.5 – 4.0	14.5 – 22.0
RST 9	23.0 – 25.5	4.5 – 5.4	22.0 – 24.0
LH 900	22.5 – 26.5	3.9 – 5.3	19.0 – 22.5
G Cot 17	22.0 – 25.5	4.2 – 4.6	18.0 – 24.0
V 797	22.5 – 25.0	4.2 – 5.3	15.0 – 18.0
J 34	22.5 – 26.5	3.8 – 5.6	18.5 - 23.5
H777	23.0 – 25.5	3.8 – 5.4	17.0 – 22.5
G Cot 13	22.0 – 25.5	4.5 – 6.5	17.0 – 19.0
NHH 44	24.0 – 27.5	2.9 – 3.7	18.0 – 23.5

Continued...

HS 6	22.5 – 26.5	4.2 – 5.9	19.0 – 22.5
AK 235	22.5 – 24.0	5.0 – 5.5	17.5 – 19.5
H 1098	23.0 – 26.5	4.3 – 5.1	18.5 – 23.5
AHH 468	24.0 – 25.5	3.5 – 3.8	18.5 – 20.0
Medium Long Staple			
Hybrid 6	25.5 – 28.0	3.2 – 3.9	19.0 – 25.0
DHY 286	25.5 – 26.0	3.6 – 3.9	20.0 – 23.0
G Cot HY 10	25.0 – 28.0	3.4 – 4.0	21.0 – 23.5
MCU 7	26.0 – 28.0	3.7 – 4.2	20.5 – 22.5
LRA 5166	23.5 – 30.0	2.5 – 4.6	18.5 – 26.0
RS 873	25.5 – 26.8	4.7 – 55	20.5 – 22.5
MDCH 201	25.0 – 26.5	4.2 – 5.0	22.0 – 23.5
AKH 4	24.5 – 26.5	4.2 – 4.5	20.0 – 22.5
Ganga	26.0 – 27.5	3.2 – 3.9	20.5 – 21.5
Dhanlaxmi	26.0 – 27.5	4.0 – 4.5	22.0 – 25.0
H 10	24.5 – 29.0	3.1 – 4.8	19.5 – 24.5
LHH 144	26.5 – 27.5	3.9 – 4.8	23.0 – 25.5
LH 1556	24.0 – 28.0	3.9 – 4.9	21.0 – 24.5
RAH 100	24.5 – 26.0	3.6 – 3.8	17.0 – 19.0
Sikander-puri	25.0 – 26.0	4.6 – 4.7	21.0 – 22.0
G Cot 16	23.0 – 28.0	3.3 – 4.9	19.0 – 22.5
PCO 2	24.5 – 28.5	3.8 -5.5	20.0 – 23.5
Long Staple			
Sankar 6	25.0 – 30.5	3.3 – 4.6	18.5 – 25.0
MCU 5	28.0 – 34.0	2.3 – 4.4	21.5 – 27.5
G Cot DH 9	29.0 – 30.5	3.8 – 4.5	20.5 – 25.5
Deviraj	28.5 – 32.0	3.5 – 4.5	19.5 – 21.5
MECH	26.0 – 31.5	2.9 – 3.9	21.5 – 27.0
JKHY1	25.5 – 31.5	3.1 – 4.4	19.5 – 26.5

Continued...

Sankar 4	28.0 – 32.0	3.6 – 4.0	20.0 – 24.0
Extra Long Staple			
DCH 32	31.5 – 36.0	2.6 – 3.1	25.0 – 30.5
Suvin	33.0 – 36.5	2.7 – 3.1	24.0 – 29.5
MCU 9	31.5 – 33.5	2.5 – 3.0	22.0 – 29.5
Varalaxmi	35.8 – 37.0	2.7 – 3.3	28.0 – 31.0

Cottons Commonly used to Spin Warp Yarns of Different Count Ranges	
Count Range (Ne)	**Cottons**
1s – 10s	V 797 , Jayadhar, Comillas,LD 327, RG 8
11s – 20s	NHH 44, G COT 17, RST 9, Digvijay
21s – 30s	J 34, DHY 286, AKH 4 , H 10, HS 6, H 777, LRA 5166
31s – 40s	Hybrid 6 , MCU 7, LRA, Sankar 6, LHH 144, JKHY 1
41s – 60s	Sankar 4, MCU 5
61s – 80s	MCU 5, DCH 32
81s – 120s	DCH 32, Suvin

References

1. 'Notes on Roller Lapping' by Dr. N. Balasubramanian, *Retired Joint Director, BTRA.*
2. SITRA norms.
3. Machinery catalogues of Kirloskar Toyada, Zinser, Perfect Equipments, and Hind Sagar.
4. Specification for Synthetic Rubber Aprons (Reinforced) for Drafting Systems - Ref: Doc. TDC 30 (1733) issued by the Bureau of Indian Standards.

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