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Journey of Cotton from Fibre to Yarn - Part 1

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Introduction :

The cotton plant is endowed with seeds covered with seed hairs. These seed hairs/fibres evolved from single epidermal cells located on the seed surface. The use of these fibres in a refined form has been well documented in earlier existing diverse civilizations like Indus, Egyptian and Inca in Peru. Handspun processing of cotton fibres was more prevalent in the early history of cotton manufacture. This skill prevailed for long in the ancient Indian cotton manufacture. The ancient rulers from Europe and Middle East explored the art and skill of Indian cotton preparation, traded and imported Indian cotton goods and learnt the Indian skills.

GUEST COLUMN

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The invention of different machines to deal with different stages of the preparation of the cotton fibre hastened and eased the conversion of raw fibre into ordered and usable form. Initially, this happened in England and the journey of the manufacture of the yarn to fabric was accelerated. The basic processes involved in the manufacture of textile fibre are all inter-connected. This article focuses mainly on the basic processes along with the devices involved in ordering the fibres, thus facilitating the process of spinning.

Spinning

Spinning as a craft has been carried on from ancient times. The spinning and weaving of goat's hair and flax are mentioned in the book of "Exodus" in Greek mythology. However, it is presumed that spinning and weaving were being done long before this period. Historians are not clear about how spinning was done - presumably by two persons, with the resultant twine being wound on a twig.

Again, it is presumed that it was known that twisting would bind the fibres together; thus enabling a long thread to be made from comparatively short fibres. This binding together of fibres by twisting is the basis of spinning. The physical structure of the fibre determines the ease with which this twisting is performed. Hence of the many natural fibres available, some are more suitable for spinning than others. The main requisites of a fibre for textile purposes are that the fibres possess tensile strength, and either length

or natural cohesion to enable them to be bound together by twist. Tensile strength and natural cohesion are present in cotton as well as wool.

Historical Perspective

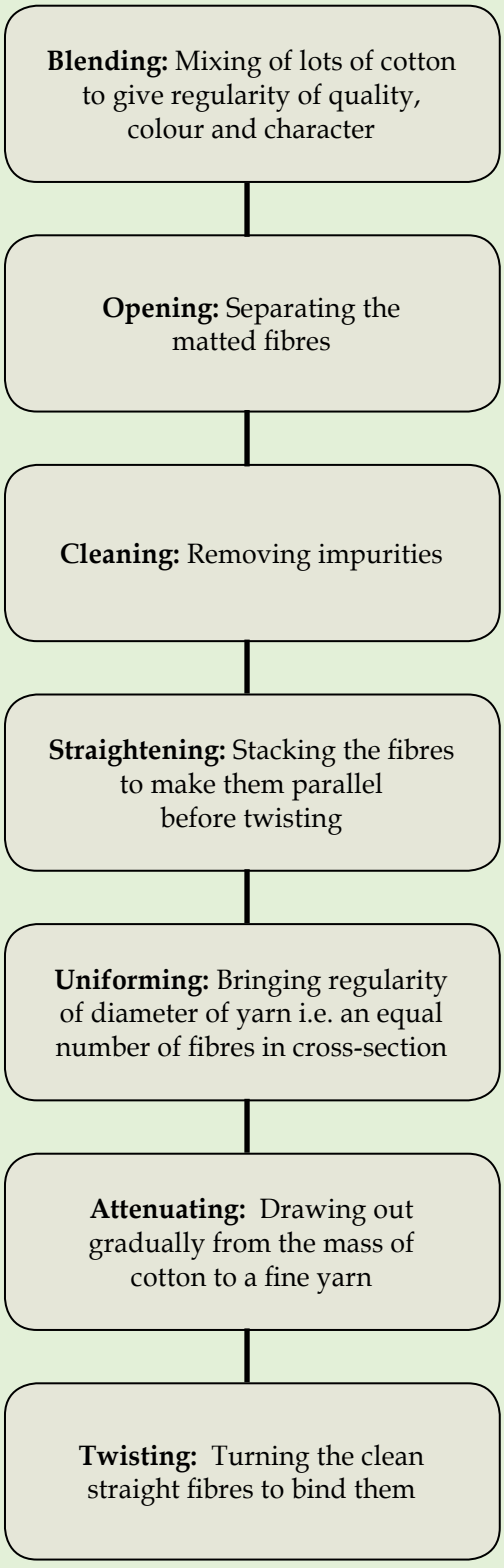
There is evidence that very simple processes were employed for the spinning of cotton in India before 1000 B.C. And in the western hemisphere, until 200 years ago, very simple methods were employed to twist textile fibres together as represented by the spindle and distaff and the Saxony wheel. Even then, it was known that cleaning and carding the raw materials, would result in better quality and quantity of yarn. Most of the early spinning of yarn was from wool, flax or similar long fibres. During the last two centuries, rapid strides have been made in adapting mechanical means for performing these spinning processes so that what the spinner once performed he now only directs. Thus, the cotton spinner has emerged as a leader in the modern textile development.

Principles of Spinning:

The principles of spinning have been very well documented in two books – 'Cotton Spinning Machinery and Its Uses' by William F. Scott Taggart, 1923 and 'Textiles' by A.F. Barker, 1922. Spinning may be defined as throwing a number of short fibres together in such a way, that when drawn out to form a comparatively fine filament, they grip one another by reason of the surface friction and twist inserted, then forming a comparatively firm strong strand. Thus, spinning primarily consists of "drawing out" or "drafting" and "twisting". Three varying factors are involved in drafting - length of the fibre to be drawn, size of the roller to give the best conditions of wearing surface, and exact condition of the gripping of the fibre desired.

The development of drafting rollers by Lewis Paul hastened the ease of spinning. The combination of rollers plays a key role in the drafting process. The principles underlying the twisting of a yarn from raw cotton yarn are very simple and remain fundamental to what they were in the beginning. The knowledge of modern spinning process requires the study of machines that automatically perform the simple actions. The simple principles of spinning should be clearly understood by responsible persons who carry out this work. On examining a bale of cotton, if the fibres are found to be matted and entangled and accompanied by the presence of impurities within the mass, it is essential to subject the raw cotton to various processes, in order to obtain clean, strong and uniform yarn. These processes have been sequentially depicted in the book, 'Cotton World' by Dr. John Todd and schematically represented in Fig. 1. These processes primarily address specific issues.

Figure 1



In the modern spinning process, raw cotton is subjected to these actions by a series of machines introduced for specific purposes. During these processes, the cotton is changed from the slab masses of the bale to open fluffy cotton, taken together into a soft thick fleece and rolled up into a lap, further opened into a wide and very thin web which can be gathered together into a rope form called sliver. The sliver is drawn into a gradually decreasing thickness called a roving. This roving is finally drawn sufficiently fine which can be twisted and spun into a yarn. Variations in the sequencing of the machines have to be done as per the required taste or special qualities of yarn or special cottons. These machines and processes in various stages are described below, emphasising their required roles.

1. Bale breaking:

Cotton after picking and ginning is stacked in compressed bales. It is essential to loosen these matted fibres present in a compressed state. The machine used for this purpose is the hopper bale opener which subjects the cotton to a rough combing action. The following devices like the lattices (transport of cotton), rollers (carrying cotton forward in various machines), pneumatic conveyers (using current of air to allow cotton to enter the trunk, facilitating movement and reducing time and labour when done manually), opening and cleaning (two closely connected processes), mechanical methods of opening (softening the practically opened hard tufts), opening by blades or beaters, opening by Rotary beaters alone, vertical conical opener make the cotton ready for stacking.

Cotton is never uniform in colour, staple, cleanliness, etc. Cotton is mixed thoroughly, stacked after being opened from the bale to obtain a desirable uniform product before processing further. Different varieties of cotton could be combined to obtain tints, strength, cheaper or dearer yarn. An endless lattice carrying stray steel spikes is designed to rotate within a hopper box. The spikes take hold of lumps of matted cotton and carry them upward until they are arrested by a spiked roller revolving in the opposite direction and set a definite distance from the lattice spikes. Pieces of cotton larger than the distance between the lattice and roller spikes are knocked back into the hopper. This continues, till the flakes of cotton are small enough to carry forward. The raw material in this open flake is available subsequently for the mixing process.

2. Mixing

The object of this process is to optimise variation in colour, length, grade and character of staple that occurs even in the same lot of cotton, but more specifically in different quantities and growth. It is customary for spinners to mix quite different styles of cotton to get a particular type of yarn. Mixing is practiced even when quality of a single growth is available to achieve uniformity. The loose cotton from the bale opener is spread in horizontal layers in open stacks, one bale on the top of another, and after standing in the open condition for a few days, it is removed from the side of the stack in vertical slices.

The distribution of cotton from the bale opener to the stacks is performed by an arrangement of pneumatic trunks, which help to condition the cotton and remove liberated dust. In America, many spinners discard the “stack” and mix the material by opening a number of bales round the bale opener and feeding the cotton from these bales in sequence.

3. Opening

The cotton is passed forward from the mixing stack to the opening process which involves the exact treatment of separating the fibres and extracting the impurities. Opening machines not only clean and open the cotton, but also collect it into a uniform sheet convenient to be handled in the subsequent processes.

The cotton is usually fed to the opener by an automatic hopper feeder, similar in construction to the hopper bale opener. But the object of the feeder is to give a uniform supply of the material to the lattices that feed the opener beaters. These are large cylinders covered with coarse combing spikes. These operate in a box partially surrounded by a specially constructed grid. As the cotton is fed into the beater box, it receives a rough combing and is dashed against the grid boxes. Much of the broken seed, leaf and sand are freed by opening the cotton and escape through the grid. They are separated from good cotton. The opened fibres are removed from the beater box by an air current and collected by this means on to a revolving cage, which delivers the material to a lap machine. Here it is pressed by rollers and delivered in a sheet, 37 to 45 inches in width, and rolled into a compact lap.

4. Scutching

Scutching is a continuation of the opening process, but in the scutcher, cotton is subjected to a batting action in the beater box instead of rough cylindrical comb treatment. Slide bars in a beater box detach the cotton from feed rollers and dash the fibres against the grid bars similar to the opener. The bladed beater is a more effective cleaner than the comb beater, but the cotton must be fairly open before this treatment is given.

Both openers and scutchers are provided with special automatic mechanism to feed a definite weight per yard into the beater box, so that the resultant sheet of cotton delivered is fairly uniform in density throughout its length and weighs above 12 oz. per yard. In the same manner as the opener, the sheet from the scutcher is rolled out into a compact lap, which is automatically measured.

5. Carding

This process is the most important one in the entire process of spinning, since its primary object is to complete the separation of cotton fibres which has been only partially accomplished by opening and scutching. The machine used for this operation is still known as a Carding Engine, and in addition to separating the fibres, it extracts much of the finer impurities and also reduces the lap, which weighs about 12 oz. per yard, to a sliver of cotton weighing approximately 50 grains per yard and three-quarters of an inch in diameter. This sliver is a group of clean separated fibres held together by cohesion and is the first beginning of a yarn. The sliver is coiled into a can 9 inch x 36 inch deep, and it is in a convenient form for passing forward to the next process.

There is a variation in the carding or disentangling process. For certain yarns, a combing process may be inserted after carding, and this not only reduces the carded fibres to a highly parallel state, but it also rejects the short fibres.

Most cotton comes to the spinning mill in masses of tufts of entangled fibres. The masses may be reduced by various breaking machines, but before the fibres can be spun into yarn, they have to be disentangled from their tufts and arranged so as to present uniformity of density and thickness.

The original method of separating and attenuating the tufts of fibres was to use a special type of thistle known as teazle, from which presumably comes the term "to teaze out" and then "to tease out", both of which mean to disentangle. The naturally teasing device was eventually replaced by larger areas of thick fabric through which project wire bristles or staples inclined at an angle. These wires are not straight but bent like a dog's hind leg. This assembly is called "card clothing". The number of these wires, the angle of inclination, the position of the bend and the arrangement in the fabric may be determined by the fibre with which they have to deal and the state of division in which fibrous mass is presented. The arrangement of the two faces for carding or for stripping, forms the principle of the carding engine.

At the front of the carding engine is another small cylinder, about half the diameter of the main cylinder, but also clothed with card wire. The doffer collects the cotton from the main cylinder in a fine uniform fleece. The directions of the rotation of the cylinder and the doffer are opposite. But where the two are set together, both surfaces are moving in an upward direction. The web of fibres is removed from the doffer by a reciprocating comb, with the fine teeth of the comb both pointing downwards, hence a stripping effect is produced. The fine web or fleece is drawn forward to the centre of the front of the carding engine and through a tapered hole of a funnel, where the light and flimsy web is collected into a round sliver of fibres about an inch in diameter. The sliver passes through rollers into a rotating can. Thus, the carding action progressively attains an even web of uniform thickness. Cotton is only carded once.

The processes mentioned above, aim to address the issue of straightening of the fibres from the raw fibre to a desired uniform web. The further treatments of cotton leading to the final structure of the yarn, will be addressed in the next article.

(The views expressed in this column are of the author and not that of Cotton Association of India)

Since 1921,
we are dedicated to the cause of Indian cotton.

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The Cotton Association of India (CAI) is respected as the chief trade body in the hierarchy of the Indian cotton economy. Since its origin in 1921, CAI's contribution has been unparalleled in the development of cotton across India.

The CAI is setting benchmarks across a wide spectrum of services targeting the entire cotton value chain. These range from research and development at the grass root level to education, providing an arbitration mechanism, maintaining Indian cotton grade standards, issuing Certificates of Origin to collecting and disseminating statistics and information. Moreover, CAI is an autonomous organization portraying professionalism and reliability in cotton testing.

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- HVI test mode with trash% tested gravimetrically

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COTTON ASSOCIATION OF INDIA
Established 1921

COTTON ASSOCIATION OF INDIA

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Stocks in China Expected to Decrease While Stocks Outside of China Increase

In 2017/18, world cotton production is estimated at 26.6 million tonnes while world mill use is projected at 25.5 million tonnes, which represents the third consecutive season of growth in demand for cotton. As a result, world ending stocks are forecasted to decrease to 18.3 million tonnes representing the fourth consecutive season of diminishing global reserves. However, the decline occurs within China where stocks at the end the 2017/18 season are projected down to 8 million tonnes. Stocks held outside of China are projected up to 10.3 million tonnes, a continuous increase over the past four consecutive seasons. Despite growth in reserves held outside of China, international cotton prices as measured by the Cotlook A Index have averaged 85.8 cents per pound, rising to a season high of 95.9. With the current estimates of supply and demand, the Secretariat forecasts that the season-average Cotlook A index in 2017/18 will be 83.3 cents per pound and forecasts that in 2018/19 the international cotton price will range between 63 and 102 cents per pound.

China's reserve auctions have continued to sell 56% of daily offered quantities, with 100% of higher quality Xinjiang quantities being sold. Lower grade quantities have been selling 25% of daily offered quantities since mid-March, but the most recent daily sales activity have indicated that 100% all offered quantities have begun to be sold. At the current pace, an estimated 160,000 tonnes of cotton will come out of the reserve stocks. Along with weather issues in the Xinjiang region which represents 75% of China's cotton area and potential drought conditions in West Texas affecting 25% of the US crop, there may be concern of quality supply gaps which may affect next seasons supply.

World cotton consumption is projected to increase to 26.7 million tonnes in 2018/19, which would represent four years of continued growth, while world cotton production is estimated at 25.7 million tonnes. Production in China is projected to decrease to 5.6 million tonnes in 2018/19 based on reduced planting area, while consumption is forecasted to increase to 8.4 million tonnes. The projection for Chinese import needs in 2018/19 is expected to rise to 1.5 million tonnes, a 3% growth over the previous season's estimate.

Among leading exporters, US production is projected to decrease to 4.2 million tonnes with exports projected to increase 3% to 3.3 million tonnes in 2018/19. Despite an expected decrease in production for

India in 2017/18, exports are expected to increase to 1.1 million tonnes. Reduced yields in 2017/18 in India are contributing to lowered planted area for 2018/19 with exports projected at 840,000 tonnes representing a 24% decrease from the previous season. The Australia 2017/18 crop is expected to be 995,000 tonnes with a projected 887,000 tonnes exported. Water availability in Australia remains a factor for increases in production and forecasts for the 2018/19 season. Production in Brazil for the 2017/18 season is estimated to be 1.9 million tonnes, a 26% increase from 2016/17, with 900,000 tonnes projected for export. Production for the West Africa region in 2017/18 is projected at 1.2 million tonnes, representing a 13% growth from the previous season, with exports for the region expected at 1.04 million

tonnes. With the exception of Burkina Faso, West African production projections have risen due to increased planting areas with corresponding yield improvements in Benin, Cameroon, Cote d'Ivoire and Mali. Burkina Faso, the regions previous top producer, is expected to produce 273,000 tonnes, a 2% decrease from the previous season. Despite increased planted area in 2017/18, weather and pest issues, are expected to lower the final production estimate. Production in Mali in 2017/18 is expected to reach 321,000 tonnes, a 21% increase from the previous season, based on a 7% increase in planted area.

Source : ICAC Cotton This Month, June 1, 2018.

Supply and Distribution of Cotton

June 1, 2018

Seasons begin on August 1 — Million Metric Tons

	2013/14	2014/15	2015/16	2016/17 Est.	2017/18 Proj.	2018/19 Proj.
BEGINNING STOCKS						
WORLD TOTAL	**19.428**	**21.331**	**22.967**	**20.312**	**18.80**	**18.33**
China	10.811	13.280	14.118	12.650	10.63	7.99
USA	0.827	0.512	0.795	0.827	0.60	1.19
PRODUCTION						
WORLD TOTAL	**26.225**	**26.235**	**21.476**	**23.075**	**26.57**	**25.75**
India	6.766	6.562	5.746	5.865	6.15	6.06
China	7.000	6.600	5.200	4.900	5.89	5.60
USA	2.811	3.553	2.806	3.738	4.55	4.25
Pakistan	2.076	2.305	1.537	1.663	1.80	2.00
Brazil	1.734	1.563	1.289	1.530	1.94	1.62
Uzbekistan	0.910	0.885	0.832	0.789	0.80	0.80
Others	4.928	4.767	4.066	4.590	5.44	5.42
CONSUMPTION						
WORLD TOTAL	**24.101**	**24.587**	**24.139**	**24.516**	**25.49**	**26.72**
China	7.600	7.550	7.600	8.000	8.22	8.43
India	5.087	5.377	5.296	5.148	5.30	5.57
Pakistan	2.470	2.467	2.147	2.147	2.35	2.46
Europe & Turkey	1.611	1.692	1.687	1.612	1.63	1.85
Bangladesh	1.129	1.197	1.316	1.409	1.44	1.66
Vietnam	0.673	0.875	1.007	1.168	1.31	1.44
USA	0.773	0.778	0.751	0.708	0.73	0.74
Brazil	0.862	0.797	0.660	0.690	0.72	0.73
Others	3.896	3.854	3.675	3.635	3.77	3.83
EXPORTS						
WORLD TOTAL	**9.015**	**7.764**	**7.532**	**8.185**	**8.77**	**9.19**
USA	2.293	2.449	1.993	3.248	3.24	3.34
India	2.015	0.914	1.258	0.991	1.10	0.84
CFA Zone	0.973	0.966	0.963	0.972	1.04	1.30
Brazil	0.485	0.851	0.939	0.607	0.90	0.90
Uzbekistan	0.615	0.550	0.500	0.403	0.34	0.44
Australia	1.058	0.527	0.616	0.812	0.89	0.89
IMPORTS						
WORLD TOTAL	**8.858**	**7.800**	**7.575**	**8.125**	**8.77**	**9.19**
Bangladesh	1.112	1.183	1.378	1.412	1.64	1.74
Vietnam	0.687	0.934	1.001	1.198	1.51	1.51
China	3.075	1.804	0.959	1.096	1.24	1.54
Turkey	0.924	0.800	0.918	0.801	0.82	0.83
Indonesia	0.651	0.728	0.640	0.746	0.83	0.85
TRADE IMBALANCE 1/	-0.157	0.036	0.042	-0.060	0.00	0.00
STOCKS ADJUSTMENT 2/	-0.063	-0.047	-0.034	-0.013	-1.55	0.00
ENDING STOCKS						
WORLD TOTAL	**21.331**	**22.967**	**20.312**	**18.798**	**18.33**	**17.37**
China	13.280	14.118	12.650	10.632	7.99	6.69
USA	0.512	0.795	0.827	0.599	1.19	1.35
ENDING STOCKS/MILL USE (%)						
WORLD-LESS-CHINA 3/	**49**	**52**	**46**	**49**	**60**	**58**
CHINA 4/	**175**	**187**	**166**	**133**	**97**	**79**
COTLOOK A INDEX 5/	**91**	**71**	**70**	**83**	**86**	

1/ The inclusion of linters and waste, changes in weight during transit, differences in reporting periods and measurement error account for differences between world imports and exports.
2/ Difference between calculated stocks and actual; amounts for forward seasons are anticipated.
3/ World-less-China's ending stocks divided by World-less-China's mill use, multiplied by 100.
4/ China's ending stocks divided by China's mill use, multiplied by 100.
5/ U.S. Cents per pound

Source : ICAC Cotton This Month, June 1, 2018

UPCOUNTRY SPOT RATES

(Rs./Qtl)

Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Strength /GPT	Spot Rate (Upcountry) 2017-18 Crop JUNE 2018 4th	5th	6th	7th	8th	9th
	Standard Descriptions with Basic Grade & Staple in Millimetres based on Upper Half Mean Length [By law 66 (A) (a) (4)]											
1	P/H/R	ICS-101	Fine	Below 22mm	5.0-7.0	15	12148 (43200)	12148 (43200)	12148 (43200)	12148 (43200)	12148 (43200)	12148 (43200)
2	P/H/R	ICS-201	Fine	Below 22mm	5.0-7.0	15	12288 (43700)	12288 (43700)	12288 (43700)	12288 (43700)	12288 (43700)	12288 (43700)
3	GUJ	ICS-102	Fine	22mm	4.0-6.0	20	8014 (28500)	8014 (28500)	8155 (29000)	8239 (29300)	8323 (29600)	8323 (29600)
4	KAR	ICS-103	Fine	23mm	4.0-5.5	21	9617 (34200)	9617 (34200)	9673 (34400)	9758 (34700)	9842 (35000)	9842 (35000)
5	M/M	ICS-104	Fine	24mm	4.0-5.0	23	10404 (37000)	10404 (37000)	10489 (37300)	10545 (37500)	10686 (38000)	10686 (38000)
6	P/H/R	ICS-202	Fine	26mm	3.5-4.9	26	12485 (44400)	12457 (44300)	12457 (44300)	12513 (44500)	12682 (45100)	12766 (45400)
7	M/M/A	ICS-105	Fine	26mm	3.0-3.4	25	9561 (34000)	9561 (34000)	9645 (34300)	9701 (34500)	9842 (35000)	9842 (35000)
8	M/M/A	ICS-105	Fine	26mm	3.5-4.9	25	10404 (37000)	10404 (37000)	10404 (37000)	10461 (37200)	10742 (38200)	10742 (38200)
9	P/H/R	ICS-105	Fine	27mm	3.5.4.9	26	12598 (44800)	12570 (44700)	12570 (44700)	12626 (44900)	12795 (45500)	12879 (45800)
10	M/M/A	ICS-105	Fine	27mm	3.0-3.4	26	10123 (36000)	10123 (36000)	10123 (36000)	10208 (36300)	10348 (36800)	10348 (36800)
11	M/M/A	ICS-105	Fine	27mm	3.5-4.9	26	10826 (38500)	10826 (38500)	10826 (38500)	10882 (38700)	11164 (39700)	11164 (39700)
12	P/H/R	ICS-105	Fine	28mm	3.5-4.9	27	12654 (45000)	12626 (44900)	12626 (44900)	12682 (45100)	12851 (45700)	12935 (46000)
13	M/M/A	ICS-105	Fine	28mm	3.5-4.9	27	11867 (42200)	11867 (42200)	11726 (41700)	11782 (41900)	11923 (42400)	11923 (42400)
14	GUJ	ICS-105	Fine	28mm	3.5-4.9	27	12317 (43800)	12317 (43800)	12176 (43300)	12232 (43500)	12513 (44500)	12513 (44500)
15	M/M/A/K	ICS-105	Fine	29mm	3.5-4.9	28	12429 (44200)	12429 (44200)	12317 (43800)	12373 (44000)	12654 (45000)	12654 (45000)
16	GUJ	ICS-105	Fine	29mm	3.5-4.9	28	12654 (45000)	12654 (45000)	12570 (44700)	12626 (44900)	12907 (45900)	12907 (45900)
17	M/M/A/K	ICS-105	Fine	30mm	3.5-4.9	29	12654 (45000)	12654 (45000)	12598 (44800)	12654 (45000)	12935 (46000)	12935 (46000)
18	M/M/A/K/T/O	ICS-105	Fine	31mm	3.5-4.9	30	12879 (45800)	12879 (45800)	12823 (45600)	12879 (45800)	13160 (46800)	13160 (46800)
19	A/K/T/O	ICS-106	Fine	32mm	3.5-4.9	31	13104 (46600)	13104 (46600)	13048 (46400)	13104 (46600)	13385 (47600)	13385 (47600)
20	M(P)/K/T	ICS-107	Fine	34mm	3.0-3.8	33	16338 (58100)	16338 (58100)	16197 (57600)	16281 (57900)	16563 (58900)	16563 (58900)

(Note: Figures in bracket indicate prices in Rs./Candy)