POLYESTER FIBRE manufacturing process

POLYESTER FIBRE:

Fibre manufacturing process:

Today over 70 to 75% of polyester is produced by CP(continuous polymerisation) process using PTA(purified Terephthalic Acid) and MEG. The old process is called Batch process using DMT(Dimethy Terephthalate) and MEG(Mono Ethylene Glycol).

Catalysts like 5b3O3 (ANTIMONY TRIOXIDE) are used to start and control the reaction.

TiO2 (Titanium di oxide) is added to make the polyester fibre / filament dull. Spin finishes are added at melt spinning and draw machine to provide static protection and have cohesion and certain frictional properties to enable fibre get processed through textile spinning machinery without any problem. PTA which is a white powder is fed by a screw conveyor into hot MEG to dissolve it. Then catalysts and TiO 2 are added. After that Esterification takes place at high temperature. Then monomer is formed . Polymerisation is carried out at high temperature (290 to 300 degree centigrade) and in almost total vacuum. Monomer gets polymerised into the final product, PET (Poly ethylene Terephthalate).

This is in the form of thick viscous liquid. This liquid is them pumped to melt spinning machines. These machines may be single sided or double sided and can have 36/48/64 spinning positions. At each position , the polymer is pumped by a metering pump-which discharges an accurate quantity of polymer per revolution (to control the denier of the fibre) through a pack which has sand or stainless steel particles as filter media and a spinnerette which could be circular or rectangular and will have a specific number of holes depending on the technology used and the final denier being produced. Polymer comes out of each hole of the spinnerette and is instantly solidified by the flow of cool dry air. This process is called quenching. The filaments from each spinnerette are collected together to form a small ribbon, passed over a wheel which rotates in a bath of spin finish: and this ribbon is then mixed with ribbon coming from other spinning positions, this combined ribbon is a tow and is coiled in cans. The material is called undrawn TOW and has no textile properties.

At the next machine (the draw machine), undrawn tows from severl cans are collected in the form of a sheet and passed through a trough of hot water to raise the temperature of polymer to 70 degrees C which is the glass transition temperature of this polymer so that the polymer can be drawn. In the next two zones, the polymer is drawn approximately 4 times and the actual draw or the pull takes place either in a steam chamber or in a hot water trough. After the drawing is complete, each filament has the required denier, and has all its sub microscopic chains aligned parallel to the fibre axis, thereby improving the crystallinity of the fibre structure and imparting certain strength.

Next step is to set the strength by annealing the filaments by passing them under tension on several steam heated cylinders at temperatures 180 to 220 degrees C. Also the filaments may be shrunk on the first zone of annealer by over feeding and imparting higher strength by stretching 2% or so on the final zone of the annealer. Next the fibre is quenched in a hot water bath, then passed through a steam chest to again heat up the tow to 100 degree C so that the crimping process which takes place in the stuffer box proceeds smoothly and the crimps have a good stability. Textile spin finish is applied either before crimping by kiss roll technique or after crimping by a bank of hollow cone sprays mounted on both sides of the tow. The next step is to set the crimps and dry the tow fully which is carried out by laying the tow on a lattice which passes through a hot air chamber at 85degree C or so.

The two is guided to a cutter and the cut fibres are baled for despatch. The cutter is a reel having slots at intervals equal to the cut length desired 32 or 38 or 44 or 51mm. Each slot has a sharp stainless steel or tungsten carbide blade placed in it. The tow is wound on a cutter reel, at one side of the reel is a presser wheel which presses the tow on to the blades and the tow is cut. The cut fibre falls down by gravity and is usually partially opened by several air jets and finally the fibre is baled. Some, balers have a preweighting arrangement which enables the baler to produce all bales of a pre determined weight.

The bale is transported to a ware house where it is "matured" for a minimum of 8/10 days before it is permitted to be despatched to the spinning mill.

FIBRE SPECIFICATION:

DENIER: Usually the actual denier is a little on the finer side i.e for 1.2 D, it will be 1.16 and for 1.4 , it could be 1.35. The tolerance normally is +- 0.05 and C.V% of denier should be 4 to 5%. Denier specifies the fineness of fibre and in a way controls the spinning limit. Theory tells us that in order to form yarn on ring spinning (and also in air jet) there must be minimum of 60 to 62 ifbres in the yarn cross section. Therefor the safe upper spinning limit with different denier is

DENIER	COUNT(Ne)
1.0	90
1.2	80
1.4	62
2.0	40
3.0	32

The limit is for 38 mm fibre. The limit rises for a longer fibres.

When spinning on open end system, the minimum no of fibres in the yarn cross section is 110. So all the fibre producers recommend finer denier fibres for OE spining . Here the safe upper spinning limit is

DENIER	COUNT(Ne)
1.0	50
1.2	40
1.4	30
2.0	24
3.0	16

However in actual practice, 30s is an upper limit with OE AND 1.2 Denier is being used, in USA and other countries, even for 10s count in OE.

Deniers finer than 1.0 are called micro-denier and commercially the finest polyester stple fibre that can be worked in a mill is 0.7 D.

CUT LENGTH: Cut lengths available are 32, 38, 44, 51 and 64mm for cotton type spinning and a blend of 76, 88 and 102 mm - average cut length of 88m for worsted spinning. The most common cut length is 38 mm.

For blending with other manmade fibres, spinners preferred 51mm to get higher productivity, because T.M. will be as low as 2.7 to 2.8 as against 3.4 to 3.5 for 38mm fibre. If the fibre legnth is more, the nepping tendency is also more , so a crompromise cutlength is 44 mm. With this cut length the T.M. will be around 2.9 to 3.0 and yarns with 35 to 40% lower imprfections can be achieved compared a to similar yarn with 51 mm fibre. In the future spinners will standardise for 38 mm fibre when the ringspinning speed reaches 25000 rpm for synthetic yarns.

For OE spinning, 32 mm fibre is preferred as it enables smaller dia rotor (of 38mm) to be used which can be run at 80000 to 100000 rpm.

Air jet system uses 38 mm fibre.
TENSILE PROPERTIES: Polyester fibres are available in 4 tenacity levels.
Low pill fibres- usuall in 2.0 / 3.0 D for suiting enduse with tenacities of 3.0 to 3.5 gpd(grams per denier). These fibres are generally used on worsted system and 1.4D for knitting
Medium Tenacity - 4.8 to 5.0 gpd
High tenacity 6.0 to 6.4 gpd range and
Super high tenacity 7.0 gpd and above
Both medium and high tenacity fibres are used for apparel enduse. Currently most fibre producers offer only high tenacity fibres. Spinners prefer them since their use enables ring frames to run at high speeds, but then the dyeablity of these fibres is 20 to 25% poorer, also have lower yield on wet processing, have tendency to form pills and generally give harsher feel.
The super high tenacity fibres are used essentially for spinning 100% polyester sewing threads and other industrial yarns. The higher tenacities are obtained by using higher draw ratios and higher annealer temperatures upto 225 to 230 degree C and a slight additional pull of 2% or so at the last zone in annealing. Elongation is inversely proportional to tenacity e.g

	TENACITY	ELONGATION AT BREAK	T10 VALUES
LOW PILL	3.0 - 3.5	45 - 55%	1.0 - 1.5
MEDIUM	4.8 - 5.0	25 - 30%	3.5 - 4.0
HIGH	6.0 - 6.4	16 - 20%	5.2 - 5.5
SUPER HIGH	7.0 plus	12 - 14%	6.0 plus

All the above values of single fibre. Testing polyester fiber on Stelometer @ 3mm guage is not recommended.
The T10 or tenacity @ 10% elongation is important in blend spinning and is directly related to blend yarn strength. While spinning 100% polyester yarns it has no significance. Tenacity at break is the deciding factor.

CRIMP PROPERTIES: Crimps are introduced to give cohesion to the fibre assembly and apart from crimps/cm. Crimp stability is more important criterion and this value should be above 80% to provide trouble free working. A simple check of crimp stability is crimps/inch in finisher drawing sliver. This value should be around 10 to 11, if lower, the fibre will give high fly leading to lappings and higher breaks at winding. Spin finish also gives cohesion, but cohesion due to crimp is far superior to the one obtained by finish. To give a concrete example, one fibre producer was having a serious problem of fly with mill dyed trilobal fibre. Trilobal fibre is difficult to crimp as such, so it was with great difficulty that the plant could put in crimps per inch of 10 to 11. Dyeing at 130 degrees C in HTHP dying machine reduced the cpi to 6 to 8. Mills oversprayed upto 0.8% did not help. Card loading took place yet fly was uncontrolled, ultimately the fibre producer added a steam chest to take the two temperature to 100degrees plus before crimping and then could put in normal cpcm and good crimp stability. Then the dyed fibre ran well with normal 0.15 to 0.18 % added spin finish.
SPIN FINISH: Several types of spin finishes are available. There are only few spin finish manufacturers - Takemoto, Matsumoto, Kao from Japan, Henkel, Schill &Scheilacher, Zimmer & Schwarz and Hoechst from Germany and George A.Goulston from USA. It is only by a mill trial that the effectiveness of a spin finish can be established. A spin finish is supposed to give high fibre to fibre friction of 0.4 to 0.45, so as to control fibre movement particularly at selvedges , low fibre-metal friction of 0.2 to 0.15 to enable lower tensions in ring spinning and provide adequate static protection at whatever speed the textile machine are running and provide enough cohesion to control fly and lapping tendencies and lubrication to enable smoother drafting.
Spin finish as used normally consists of 2 components - one that gives lubrication / cohesion and other that gives static protection. Each of these components have upto 18 different components to give desired properties plus anti fungus, antibacterial anti foaming and stabilisers.
Most fibre producers offer 2 levels of spin finishes. Lower level finish for cotton blends and 100% polyester processing and the higher level finish for viscose blend. The reason being that viscose has a tendecy to rob polyester of its finish. However in most of the mills even lower spin finish works better for low production levels and if the production level is high, high level spin finish is required if it is mixed with viscose.
For OE spinning where rotor speeds are around 55000 to 60000 rpm standard spin finish is ok, but if a mill has new OE spinning machines having rotors running @80000 rpm, then a totally different spin finish which has a significantly lower fibre - fibre and fibre - metal friction gave very good results. The need to clean rotors was extended from 8 hours to 24 hours and breaks dropped to 1/3rd. In conclusion it must be stated that though the amount of spin finish on the fibre is only in the range 0.105 to 0.160, it decides the fate of the fibre as the runnability of the fibre is controlled by spin finish, so it is the most important component of the fibre. Effectiveness of spin finish is not easy to measure in a fibre plant. Dupont uses an instrument to measure static behaviour and measures Log R which gives a good idea of static cover. Also, there is s Japanese instrument Honest Staticmeter, where a bundle of well conditioned fibre is rotated at high speed in a static field of 10000 volts. The instrument measures the charge picked up by the fibre sample, when the charge reaches its maximum value, same is recorded and machine switched off. Then the time required for the charge to leak to half of its maximum value is noted. In general with this instrument , for fibre to work well, maximum charge should be around 2000 volts and half life decay time less than 40 sec. If the maximum charge of 5000 and half life decay time of 3 min is used , it would be difficult to card the fibre , especially on a high production card.
DRY HEAT SHRINKAGE: Normally measured at 180 degree C for 30 min. Values range from 5 to 8 %. With DHS around 5%, finished fabric realisation will be around 97% of grey fabric fed and with DHS around 8% this value goes down to 95%. Therefore it makes commercial sense to hold DHS around 5%. L and B colour: L colour for most fibres record values between 88 to 92. "b" colour is a measure of yellowness/blueness. b colour for semidull fibre fluctuates between 1 to 2.8 with different fibre producers. Lower the value, less is the chemicals degradation of the polymer. Optically brightened fibres give b colour values around 3 to 3.5. This with 180 ppm of optical brightner.
DYE TAKE UP: Each fibre producer has limits of 100 +- 3 to 100+-8. Even with 100+-3 dye limits streaks do occur in knitted fabrics. The only remedy is to blend bales from different days in a despatch and insist on spinning mills taking bales from more than one truck load.
FUSED FIBRES: The right way to measure is to card 10 kgs of fibre. Collect all the flat strips(95% of fused fibres get collected in flat strips). Spread it out on a dark plush, pick up fused and undrawn fibres and weigh them. The upper acceptable limit is 30mgm /10kgs. The ideal limit should be around 15mgm/10kgs. DUpont calls fused/undrawn fibres as DDD or Deep Dyeing Defect.
LUSTRE: Polyester fibres are available in
bright : 0.05 to 0.10 % TiO_2
Semil dull : 0.2 to 0.3 % TiO_2
dull : 0.5 % TiO_2
extra dull : 0.7% TiO_2 and
in optically brightened with normally 180 ppm of OB, OB is available in reddish , greenish and bluish shades. Semi dull is the most popular lustre followed by OB (100 % in USA) and bright.
PHYSICAL AND CHEMICAL PROPERTIES OF POLYESTER FIBRE:
DENIER: 0.5 - 15

TENACITY : dry 3.5 - 7.0 : wet 3.5 - 7.0
%ELONGATION at break : dry 15 - 45 : wet 15 45
%MOISTURE REGAIN: 0.4
SHRINKAGE IN BOILING WATER: 0 - 3
CRIMPS PER INCH: 12 -14
%DRY HEAT SHRINKAGE: 5 - 8 (at 180 C for 20 min)
SPECIFI GRAVITY: 1.36 - 1.41
% ELASTIC RECOVERY; @2% =98 : @5% = 65
GLASS TRANSITION TEMP: 80 degree C
Softening temp : 230 - 240 degree C
Melting point : 260 - 270 degree C
Effect of Sunlight : turns yellow, retains 70 - 80 % tenacity at long exposure
RESISTANCE TO WEATHERING: good
ROT RESISTENCE: high
ALKALI RESISTENCE: damaged by CON alkali
ACID RESISTENCE: excellent
ORGANIC CHEMICAL RESISTENCE: good

PROBLEMS WHICH OCCUR DURING MANUFACTURE OF POLYESTER STAPLE FIBRE:

The manufacture of polyester fibre consists of 4 stps:

Polymerisation:Using PTA/DMT and MEG on either batch or continuous polymerisation (cp_ - forming final polymer

Melt spinning :Here molten polymer is forced thorough spinnerette holes to form undrawn filaments, to which spin finish is applied and coiled in can Drawings: in which several million undrawn filaments are drawn or pulled approximately 4 times in 2 steps, annealed, quenched, crimped and crimp set and final textile spin finish applied and

Cutting: in which the drawn crimped tow is cut to a desired 32/38/44/51 mm length and then baled to be transported to a blend spinning mill.

1.PROBLEMS FACED IN POLYMERISATION:

properties of Polymer: The polymer formed is tested mainly for intrinsic viscosity (i.v), DEG content, % oligeomers and L and b colours.

Intrinsic viscosity is an indirect measure of degree of polymerisation and this value is around 0.63 for polymer meant for apparel fibres. DEG or Di Ethylene Glycol gets formed during polymerisation and varies from 1.2 to 1.8%. Oligomers are polymers of lower molecular weight and vary in quantity from 1.2 to 1.8 %. L and b are measures of colour. L colour signifies whiteness as a value of 100 for L is a perfect value. Most fibres have L colour values around 88 to 92. b colour denotes yellowness/blueness of polymer. the positive sign for b colour indicates yellowness whilst negative sign shows blueness, only polymer which contain optical brightener has b of 3 - 3.5 whilst all semil dull polymers show b values of 1.0 to 2.4. Higher values indicate more yellowness, which indirectly shows chemical degradation of the polymer. Running a CP @ lower / higher throughput: Every CP is designed for a certain throughput per day. Like say 180 tons/day or 240 tons/day. Sometimes due to commercial constraints like high buildup of fibre stocks etc. , the CP may have to be operated at lower capacityies. In that case the polymer that is produced has a higher "b" colour and a lower DEG content. Higher "b" colour of say 1.5 against normal value of 1.0 will show fibre to be yellowish and has a little more chemical degradation; which gives higher fluorescence under UV light. Most spinning mills have a practice of checking every cone wound under UV lamp to find out whether there has been any mixup . However if a mill is consistently receiving fibre with a "b"colour of say 1.0 and then if one despatch comes of "b"colour of say 1.5 then in winding, ring bobbins of both "b" colours will be received, and when cones are wound and checked under UV lamp, then higher "b" colour material will give higher fluorescence compared to that of lower "b" colour materials, and will cause rings under UV lamp. Fortunately a minor difference in "b" colour of 0.4 to 0.5 does not give variation in dyeability.

What can spinning mills do to overcome this problem:

One way is to use a Uster Glow meter which measures the reflectance of fibre samples under UV light. We understand that these values lie between 80 and 120 for samples from different bales. so then divide bales with reflectance values of say 80 to 90 , another 91 to 100, third 101 to 110 and fourth 111 to 120. Then while issuing bales to blow room, issue first group say 80 to 90 then issue the enxt group and so on. Bales from different groups should not be mixed. Second is to use bales from each truck separately. Third is to mix up bales from 4/5 trucks to do blending Changes in DEG: The amount of DEG in fibre is directly proportional to dye pick up or dye ability of the fibre. Higher the DEG, higher is the dye ability, so much so that some filament producers add DEG, but then higher DEG will lower tensile properties. So this practice is not followed for fibre, where tensile properties are critical. So if the CP is run at lower throughout, DEG drops down, so the dyeablity of the fibre goes down. Since fibre production group is keen on maintaining merge, they resort to lowering of annealer temperatures to maintain dye ability but in the process tensile properties suffer, and mills will notice thread strength falling by 5-7% if annealer temperature is lowered from say 210 degree C to 180 Degree C. If fibre production group does not do this, then they will produce fibre with a different merge - which normally accumulates in the warehouse and so is not appreciated by both marketing and top management. Also when CP is run at higher than rated, then higher temperatures have to be used to compensate lower residence time, here "b" colour actually improves It must be emphasized that the "b"colour changes occur not only due to higher / lower thorugh put but there are several other factors such as air leakags in valves / polymer lines, failure of pumps to remove product from one reaction vessel to another etc. There is yet one more problem in CP. It is a sudden increase in oligomer content. When the amount of oligomers increase, it manifests itself in excessive white powder formation on rings and ring rail. Oligomers cause problems in spinning of dyed fibres. The surface oligomer content almost doubles on dying dark and extra dark shades. The only way to control oligomers is to use LEOMIN OR in 1 - 1.5 gms/litre in reduction clearing bath. All oligomers will go into suspension in reduction clearing liquor and get removed when the liquor is drained.

Higher annealer temperature also cause higher surface oligomers

2.PROBLEMS FACED IN MELT SPINNING: Control of C.V% of Denier: A good international value of C.V.% of denier is 4 to 5. However some fibre manufacturers get value as high as 10 to 12. Denier is controlled by having uniform flow of polymer through each spinnerette hole. However if a hole is dirty or has polymer sticking to it, its effective diameter is reduced; and the filament that comes out becomes finer. IF the spinneretters have been used for more than say 6 to 7 years , then some of the holes would be worn out more than others and filament emerging out would be coarser Currently sophisticated instruments are available to check the cleanliness and actual hole diametrs of each and every hole automatically, but few producers have them. Fused Fibres: These are caused mainly at melt spinning either due to breaks of individual filaments or breakages of all the filaments(ribbon break) and polymer and block temperatures are too high. Tying of broken position in the running thread line should be as near to the broken position as possible, failure to do this will result in trailing end leading to fused fibres. Other reasons could be impurities, choking of polymer filters and non-uniform quenching or cooling of filaments. The only way to control is to ensure that breaks at melt spinning are held at the minimum.

3.PROBLEMS FACED AT DRAW LINE: Draw line is the place where the fibre is born. All its major properties denier, tenacity , elongation at break , crimp properties, spin finish, shrinkage and dye ability are all imparted here. For obtaining excellent runnability of the fibre in a blend spinning mill, the two most important properties are - spin finish and crimp. Spin finish: Finish is applied to the undrawn tow at melt spinning stage essentially to provide cohesion and static protection. On the draw line, a major portion of this finish is washed away, and a textile spin finish is put on the tow by either kiss roll or a spray station. This textile finish consists of two components, one that gives cohesion and lubrication and the other confers static protection, usually these 2 components are used in 70/30 ratio. These spin finishes are complex and each may contain some 18 chemicals to not only control inter fibre friction (should be high at 0.35 to 0.40), fibre metal friction (should be low at 0.15-0.20), anti bacterial components, anti foaming compund etc. Finish is made in hot demineralise water and is sprayed on to tow after the crimper by a series of spray nozzles mounted on both sides of the tow. The finish is pumped to the spray unit by a motor driven metering pump, which is linked to the draw machine such that when the machine stops, the pump motor stops. The percentage of finish on the fibre is based on spin finish manufacturers recommendations and fine tuned by tech service. Once set, the finish and its percentages are normally not changed.The percentage spin finish is decided by the end use of the fibre. Mills blending polyester with viscose need higher amount of spin finish and also mills running their equipment at high speeds. 60 to 65% of problems faced in mills are due to uneven % of spin finish on the fibre. IF a fibre producer desires to put say 0.120% spin finish on fibre, then ideally the %finish should be maintained @ 0.120 +- 0.005 i.e from 0.115 to 0.125 only; then the fibre will run smoothly.If the finish is on the lower side, card web will show high static, web will lap around doffing rolls, sliver will not pass smoothly through coiler tube - causing coiler choking. Sliver could be bulky and will cause high fly generation during drafting. On the other hand if spin finish is on the higher side, fibres will become sticky and lap around the top rollers, slivers will become very compact and could cause undrafted. Thus it is extremely important to hold finish level absolutely constant. The reasons for non uniformity is concentration of spin finish varies; sprayer holes are choked ; the tow path has altered and so the spray does not reach it. Normally fibre producers check spin finish% on the fibre quite frequently- even then in actual practice considerable variations occur.

Crimp: It is the most important to spin finish for smooth running of fibre. There are 3 aspects of crimp.

no of crimps per inch or per cm - usually 12 - 14 crimps per inch

crimp stability - be 80% plus and

crimp take up - be 27% on tow

crimps per inch can be measured by keeping a fibre in relaxed state next to a foot ruler and counting the no of crimps or arcs.

Crimp stability refers to % retention of crimps after subjecting fibre to oscillating straightening and relaxing. We can get an indication on how good crimp stability is in a spinning mill by measuring crimps per inch in fibre from finisher drawing sliver. The crimps per inch of drawing sliver should be atleast 10 to 11, if below this, then the crimps stability is poor , so to compensate may be a cohesive compound like Nopcostatt2151 P or Leomin CH be used in the overspary. Fibres like trilobal and super h igh tenacity fibres are difficult to crimp. Trilobal because of its shape and super high tenacity due to very high annealer temperature (220 degree C) used which makes the fibre difficult to bend. Also fibre dyeing particularly dark and extra dark shades reduces crimps per inch from 14 to 10 - 11 and in trilobal, as it is crimps per inch in fibre is 11 to 12, after dyeing it goes further down to 8 to 9. In dyed trilobal fibre, crimps per inch in fibre at finisher drawing may be around 6 to 7 so necessitating using almost 50% of cohesive compound in the overspray. Crimp take up is % difference between relaxed length and straightened length of fibre in fibre stage. Normally this difference is around 18 to 20%. If the difference is much smaller, then it means the crimps are shallow and would have lower cohesion. After the tow is crimped , the crimps are set by passing tow through a hot air chamber. If crimp per inch is low, then that could be due to lower stuffer box pressure, but if crimp stability and/or crimp take up is low, it means the steam supply to crimper steam box is low. Undrawn fibre: As the draw line, 1.6 to 3.0 million filaments are drawn or pulled, if a filament had a break at spinning and this is fed as a trailing end to the drawing, then that end cannot be drawn fully, and causes plasticises and fused fibres. Undrawn fibres are generated if the draw point is not uniform i.e not in a straight line. Plasticised fibre: When drawline is running and if some filaments breaks then these broken filaments wrap themselves around a rotating cylinder, since most of these cylinders are steam heated, the wrapped portion solidifes. The operator then cuts out the solid sheet and throws it away as waste but then usually picks up the plastic end and uses it to thread the material and so a small piece of plastic material goes into the cutter and falls into the baler. Tenacity / Dye ability: Both these properties are controlled by acutal draw ratio and annealer temperature. Draw ratio does not change in running, but annealer temperature can fall due to problem of condensate water removal. Most drawlines have temperature indicators - but then some buttons have to be pressed to see the temperatures so if the annealer temperature falls, tenaciy will fall and dye ability will increase which could lead to a change in merge.

PROBLEMS FACED IN CUTTING / BALING: Nail Head / Tip Fusion: In the cutting process, a highly tensioned tow is first laid over sharp blades and the pressed down by a Pressure Roll, resulting in filaments being cut. However if some blades become blunt, then the pressing of tow on to those blades creates high temperature and so tips of neighbouring fibres stick to each other and so separating this cluster becomes impossible. If it is not getting removed in Lickerin it will go into the yarn and cause a yarn fault. The tip fusion occurs when the blade is fully blunt. If the blade is not very sharp, it does not give a straight edge, there could be some rounding at the cut edge. Such fibres are called nail heads. Tungsten carbide blades give sharp cut Opening of fibre cluster after opening: When fibres are cut, they fall down by gravity into the baler. Because of crimping clusters get formed; and so those need to be opened out; otherwise these can cause choking either in blowrrom pipes or in chute feed. This opening is obtained by having a ring of nozzles below the cutter through which high pressure air jets are pointed up; and these jets open up fibre clusters. Over length / Multilength: Over length fibres are those whose length is greater than the cut length plus 10mm and are casued by broken filaments which being broken cannot be straightened by tensioning at the cutter. Multilength are fibre whose length is exactly 2 or 3 times the cut length and are caused by nicks in neighbouring blades.

SPECIALITY FIBRES IN POLYESTER:

HIGH/LOW SHRINK FIBRES: The high shrink fibre shrinks upto 50% at 100 degree C while that of low shrinkage is 1%. The high shrink fibre enable fabrics with high density to be produced and is particularly used in artificaial leather and high density felt. Low shrinkage fibre is recommended for air filters used in hot air, furniture, shoes etc.

MICRO DENIER: Available in 0.5/0.7/0.8 deniers in cutlengths 32/38 mm. Ideal for high class shirts, suitings, ladies dress material because of its exceptional soft feel. It is also available in siliconised finish for pillows. To get the best results, it is suggested that the blend be polyester rich and the reed/pick of the fabric be heavy.

FLAME RETARDANT: Has to be used by law in furnishings / curtains, etc where a large number of people gather - like in cinema theatres, buses, cars etc in Europe and USA. It is recommended for curtains, seat covers, car mats, automotive interior, aircraft interiors etc.

CATIONIC DYEABLE: Gives very brilliant shades with acid colours in dyeing / printing. Ideal for ladies wear

EASY DYEABLE: Can be dyed with disperse Dyes @98 degrees C without the need for HTHP equipment. Ideal for village handicrafts etc.

LOW PILL: In 2 and 3 deniers, for suiting end use and knitwear fibre with low tenacity of 3 to 3.5 gm/denier, so that pills which forms during use fall away easily.

ANTIBACTERIAL: It is antibacterial throughout the wear life of the garment inspite repeated washing. Suggested uses are underwears, socks, sports, blankets and air conditioning filters

SUPER HIGH TENACITY: It is above 7 g/denier and it is mainly used for sewing threads. Low dry heat shrinkage is also recommended for this purpose. Standard denier recommended is 1.2 and today 0.8 is also available.

MODIFIED CROSS SECTION: In this there are TRILOBAL, TRIANGULAR, FLAT, DOG BONE and HOLLOW FIBRES with single and multiple hollows. Trilobal fibre gives good feel. Triangular fibre gives excellent lustre. Flat and dog bone fibres are recommended for furnishings, while hollow fibres are used as filling fibres in pillows, quilts, beddings and padding. For pillows silicoised fibres is required. Some fibre producers offer hollow fibre with built in perfumes.

CONDUCTING FIBRE: This fibre has fine powder of stainless steel in it to make fibre conductive. Recommended as carpets for computer rooms.

LOW MELT FIBRE: It is a bi-component fibre with a modified polyester on the surface which softens at low temperature like 110 degree C while the core is standard polyester polymer. This fibre is used for binding non woven webs.