Textures Yarn Technology
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Lecture – 27
Interlacement: need and jet design

So, we been talking about air jet texturing and today we will go little further and talk about something called Interlacement the need of such type of a process and anything to do with the jet.

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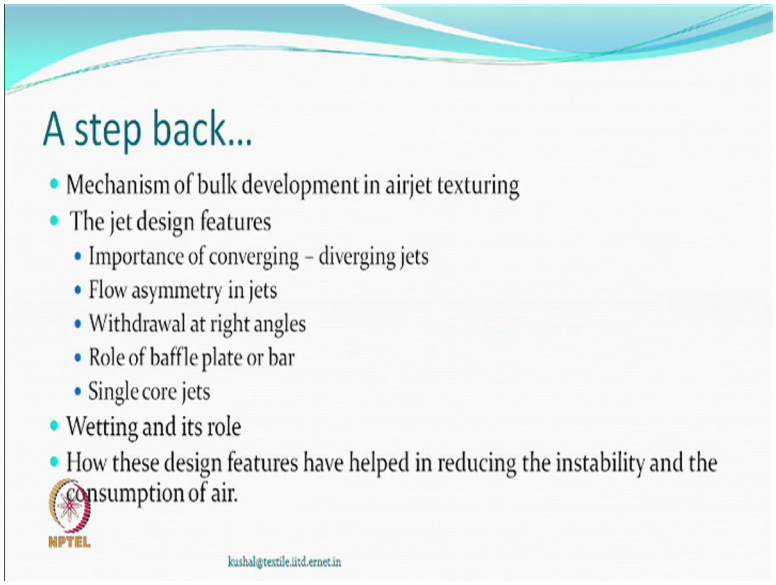

So, if we look back what we have done we understood the mechanism of bulk development in air jet texturing. The design of the jet, the features for example, converging, diverging type of jets, flow, asymmetry, withdrawing the yarn at right angles, role of a baffle plate or bar and also single core jets. We also learnt about wetting, so air jet texturing and it is role and also how some of the design features have helped in reducing the instability and maybe the consumption of air.

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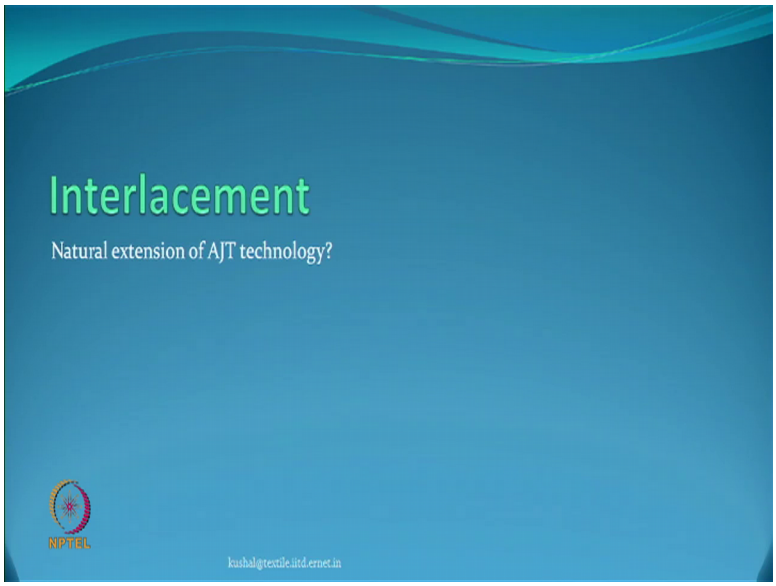

So, the interlacement is another process which in some sense can be considered then offshoot of the air jet texturing, what exactly and how exactly it is different we will like to understand today.

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So, sometime the terms could be entanglement or interlacement they mean the same thing, what it means is the filaments have entangled or they have interlaced. The yarn that have been subjected to this process could be entangled yarn or interlaced yarn or the

jets which are also used for this process are called interlacement jets or entanglement jets.

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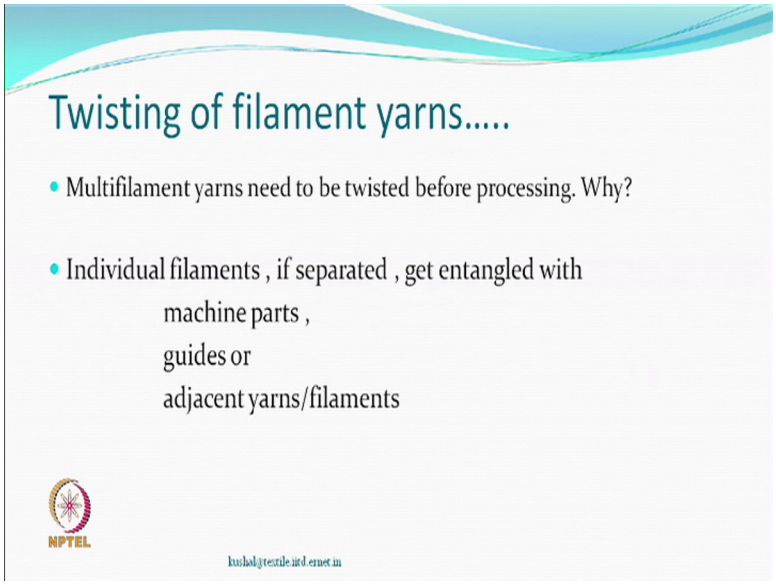

In general twisting of the filaments is done, a parallel bundle of filament in general is not processed because if individual filaments get separated, then they can get entangled with machine parts or guides or adjacent yarn and filaments which obviously, is not a good idea. Therefore, filament yarn industry believes in giving some amount of pre twist very very small just to ensure that the filaments do not get separated and that is a norm.

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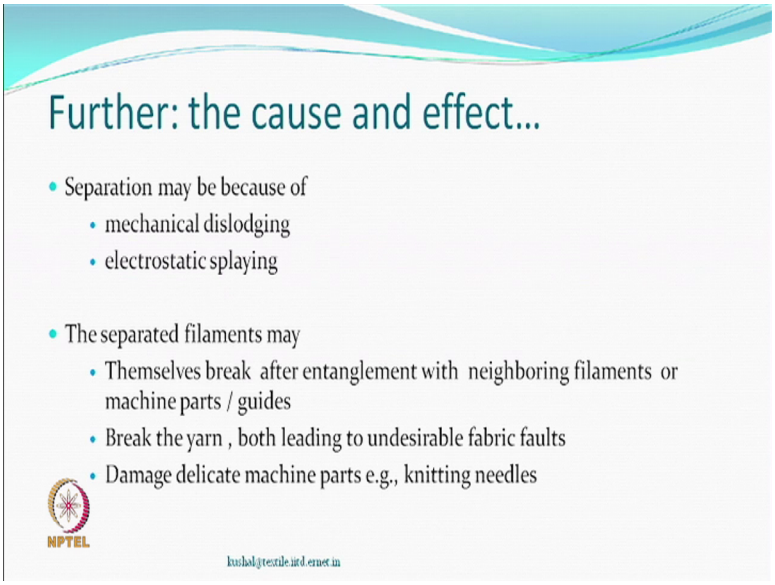

The separation could be because of mechanical dislodging, remember we apply a spin finish and one of the aim of the spin finish is reduction of the friction of course, reduction or elimination of static charge generation and also hopefully keeping the filaments together, some type of a cohesive bonding should be there. But it may not happen because your processing winding, unwinding, passing through guides and it can happen that the filaments can get separated.

Let us say 36 filaments and multi filament yarn they get separated, then one of them can be really behaving in a different way and so it can cause more problems. The other could be that though we believe that the spin finish should be working the way to supposed to work, but it is quite possible that it may have been removed or is not as effective if there is any electrostatic charge generation doing this process and they can also get separated not necessarily in every filament is different, but from wherever they are the portions of the yarn can get separated and then they can get entangled.

So, these separated filaments because of these two reasons dislodging mechanical or electro splaying, can break after entanglement with neighboring filaments or machine parts and knitting machine for that matter. Can break the yarn, so there can be faults in the fabric or knitting needles for that matter can also be damaged and so all these things are something which people would not like to have it and therefore, you may like to give pre twist.

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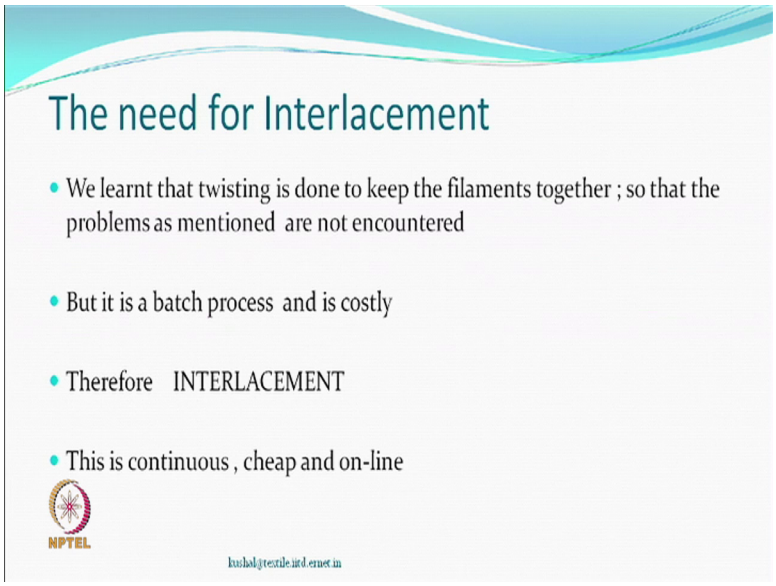

So, this need that the filament should not get separated was the real need and therefore, people thought about another process which we call now as interlacement, it is for multifilament yarns this is not a problem with span yarns so, that the above problems are not there they do twisting, but twisting as we know is a batch process. So, what you have you have whatever material in which have a type of a package you have; you have to take trough a twister and make another package. And this is a costly process batch process and costly process, but if there is no alternative then you do it.

Therefore the need for the interlacement came that can we avoid the twisting process and get the same effect, same result meet the same objectives. This is a continuous process in general expected to be cheap and can be fitted on attachments could be put on any other machine any machine and so online work can be done and monitoring can also be done. So, that is how we come to a process called interlacement.

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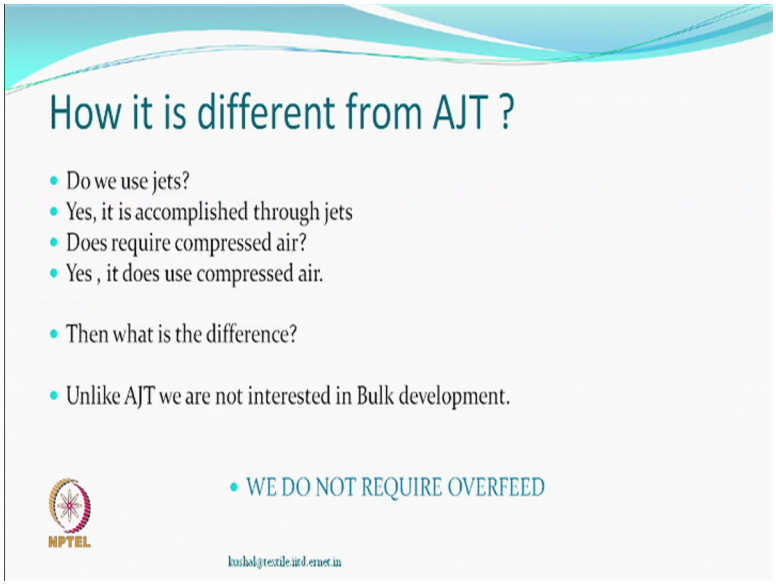

So, we did mention that as if you working on air jet texturing where entanglement was one of the parts of detection in process itself. So, how is it different from air jet texturing? Do we use jets? Yes we use jets. So, this process of interlacement is accomplished through the jets. Do we need a compressed air?

Student: Yes.

Yes we do require compressed air. So, how is it different? So, you required jets and you have compressed air. So, how is it different? So, we are not interested in development of bulk that is one difference with our aim is not to develop bulk and why was the bulk developing?

Student: Overfeed.

In air jet textured yarn

Student: Overfeed.

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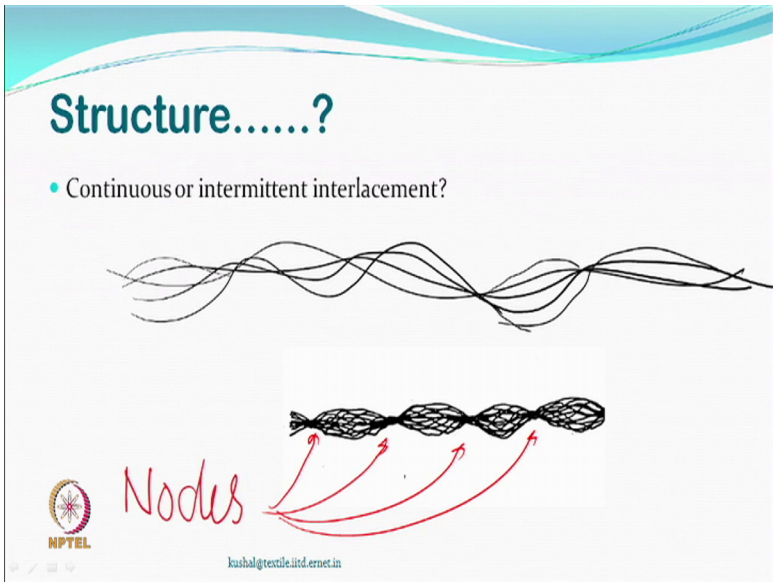

Because we are giving overfeed. So, one important difference that we have is we do not want to give any overfeed, if we do not given any overfeed than bulk may not be developed because your just interested that the filaments somehow stay together. So, this so called interlacement is it a continuous interlacement or is intermittent interlacement. So, that is in some way defining the interlaced yarn structure. So, theoretically we are not interested that every part of the yarn is interlaced; if some parts are interlaced we could be happy.

So, if something have this happens at some place is there together will be still happy, other is that we continuously a very smalls little millimeter of a yarn is interlace can be done, but should we need it or not. So, if you take some yarn like this and actually

subjected to electrostatic charge. So, you might see that there are portion which are not interlaced and there are portion which are interlaced.

This yarn in normal condition may not look like this because you are not given any overfeed it is only when you have tried to separate them out alright. But what is important is that you do generate what we called as nodes, so you have these nodes. So, in general some simple structure like this is required.

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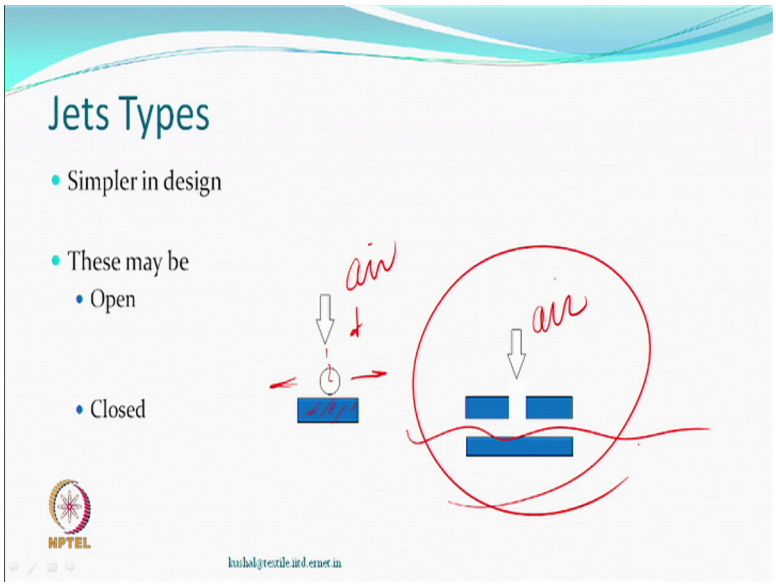

So; obviously, maybe do not require high turbulence, maybe do not require high pressure that actually people thought that they would like to make these jets as simple as possible because this is just suppose some work, to expected the design would be simpler and the jets could be completely open or close, so they it tried everything.

Open means what? Open means that there is a plate and there is a yarn and direct impingement is taking place on the yarn itself just in sometime something should happen. So, it is not closed; closed one would be something similar where the yarn is passing it is inside a channel or a orifice which have a cylindrical hole just closed and the compressed air is being impinged.

So, the two thing which tried; obviously, people very easily understood that in an open system which can be done, but you consume more air, get less affect the yarn can have a

tendency to go away from the impinging point, then so it may not at all come into play may have to give tension.

You can appreciate if give more tension then interlacement will be difficult and so said it may be a better idea to have some close system where there is a control yarn is inside something, and impingement takes place and whatever effect that we are hoping would be there.

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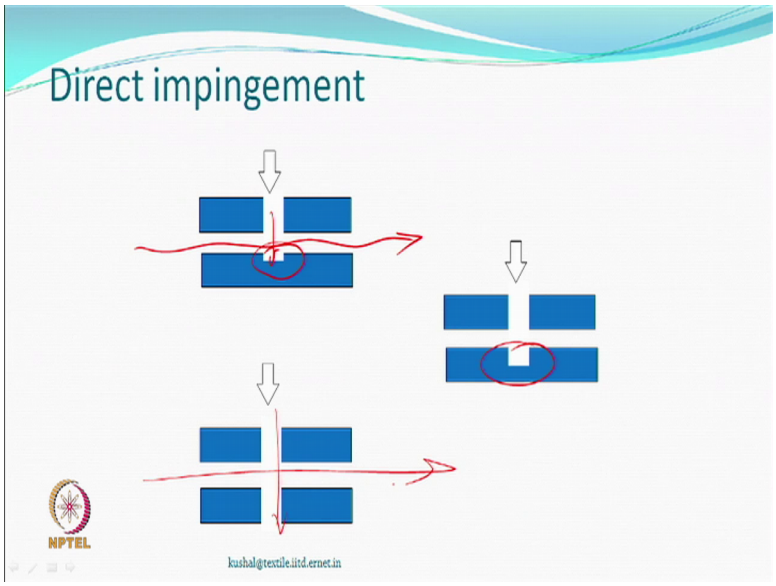

So, actually people tried many types of designs on one gets wonders as to something which you wanted to be very simple also people want to have more design. So, one is the design where there is a little notch out there. So, if the yarn come to like this is going to be pushed in, the notch could be very small, notch could be larger, so people want the effect to happen there.

In some cases they had through one through whole for the air while the yarn is moving like this. All of them would have a different impact on the impingement during the impingement part where they tried, they called direct impingement direct impingement, but the air is directly almost perpendicularly impinging, so that whatever happens should happen there.

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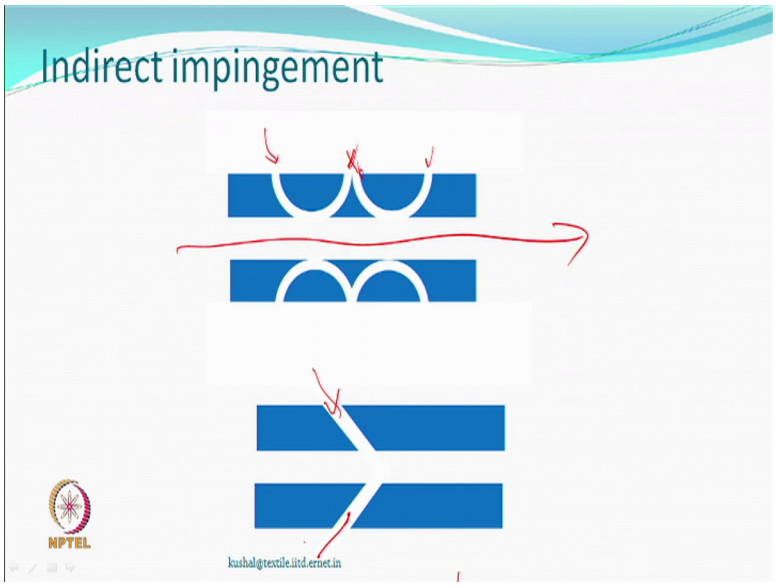

Indirect impingement where the air is directly not impinging, but is being fed in different ways and causing some effect while the yarn may moving. So, coming think of it appear people were interested in this process so much, they were looking at some result which were probably not coming as easily.

One of thing they were; obviously, interested that you are interested in intermittent interlacement and not continuous interlacement, we were looking into various kinds of thing, almost similar to the air jet single core design also were tried for this. So, what you reduce? You reduce your pressure and do not give overfeed or if it all somebody say there is no overfeed, then maybe effective less give little bit overfeed. So, directly it is not impinging on the yarn, it directly coming in one way or the other and then trying to work.

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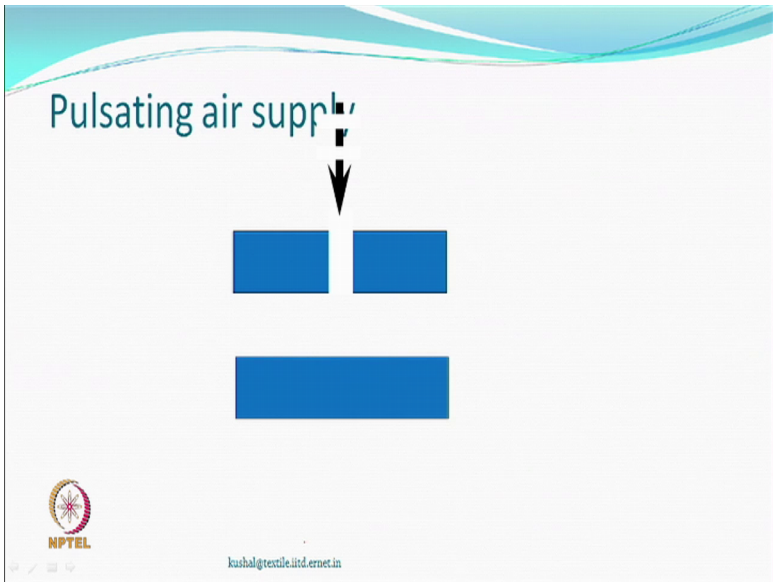

This whole process people thought that you can actually have an actuator where the air is being impinged directly onto the yarn in this manner, but is pulsating. So, you have a control, when the air is there is interlacement there is no air there is no interlacement. So, if we see that so many people wanted to type so many types of designs.

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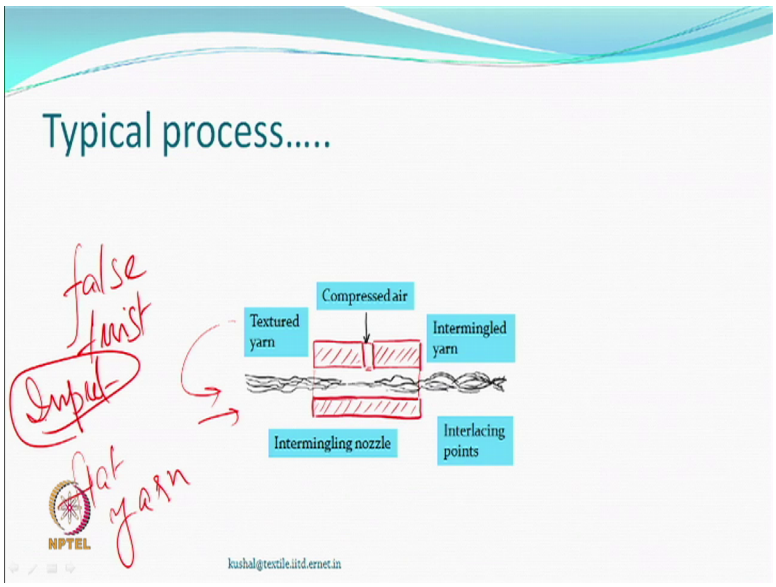

So, that you get what you want to get and then they tried things like this; so, typical process maybe where air is impinging in this manner very simply in a close system maybe by pulsating, compressed air. So, you have let us say this is the textured yarn, you

could have called at a flat yarn also. Now this textured yarn would be which one, air jet false twist?

Student: False twist.

False twist; why not air jet? We know the need. So, why not air jet? There is a input. Why not air jet? Because the air jet yarn is already entangled, it does not need any support, it is only such type of filament yarns where the filaments can get separated.

Those type of yarns are the only one which you required this additional either pre twisting before processing into a detailed a woven material or a flat yarn which is either textured or a flat yarn. And of course, this is compressed air and then you hope that there are interlacement points and so this is the way you expected this typical process people will be expecting. What is also expected is that can you change the speed of the machine based on the requirement of this jet.

Let us say I run it very fast and run it very slow and air pressure is same, that the time required within this jet will be based on the speed. So, effect can be different that is a common normal logic. The question is can we change to speed based on the need of this interlacement jet? We would not be able to do that because this is a supplement an attachment to the main machine.

Let us say you are producing a fully drawn filament yarn. So, you do drawing or you do heating if you need to, but that will be decided on the drawing machine, but you want some interlacement to happen also. So, this will be an attachment put in the machine let us say just before winding.

So, you can play around with compressed air as long as you know what is the design; design is fixed, but you will not be able to play around with speed, this time is not something in your hand and over feed anyways did not want it, so this is only one parameter. And therefore, they also thought can design becomes an important thing in what to do?

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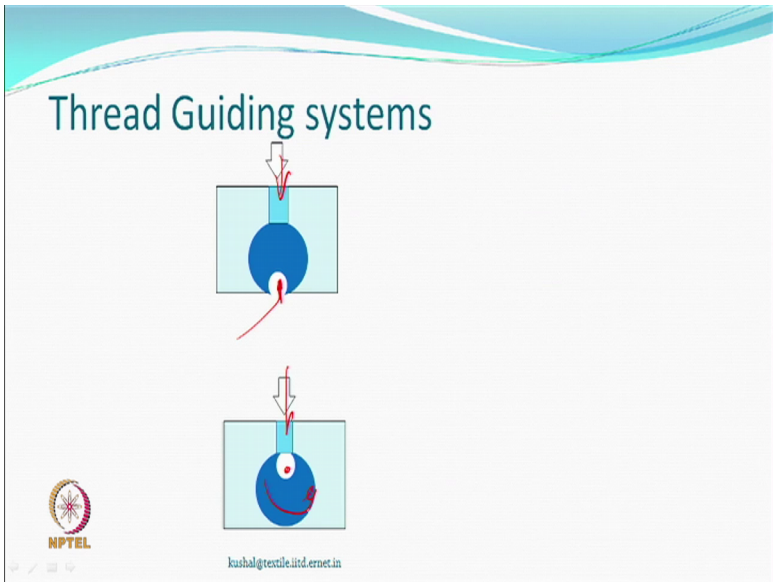

People also thought about method how to feed the yarn, so, if there is a cylindrical thing air is coming; can come from this side. So, if you should be if you can rotate this portion which is inside a block, then the yarn can be fed from the side let us say vertically going in and then you rotate it back and so the air comes from air the yarn is somewhere here. So, people designed these things also, but in the mind there was only one thing which were important that we are interested in very less amount of interlacement and also intermittent.

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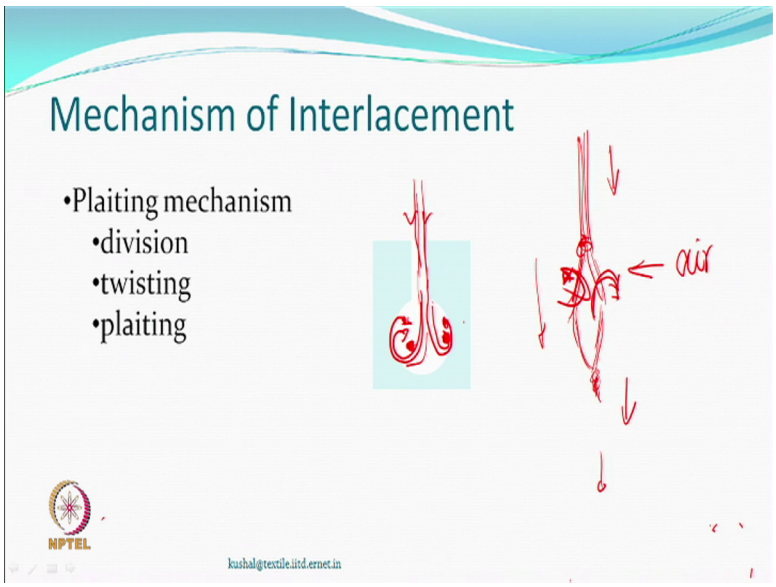

After various kinds of designs done people who are wanting to understand, what would be the mechanism of interlacement. So, one of the mechanism which they thought should work is called a plating mechanism plating mechanism is you divide the whole bundle into proximately two parts and separate them out, do a bit of a twisting and then bring them together. So, these bundles can twist over each other and is like a plating. So, it is different then the air jet texturing there you wanted every filaments must separate, they say may not be required as long as they remain in (Refer Time: 22:28).

So, let us say you have a multifilament yarn and it gets impinged by air let us say this is passing down and when it gets impinged that time let us say you get separation of filaments and if you have some mechanism with which these two things could be twisted in opposite directions.

And then the filaments anyway going down and they come together and then they plate come together and the yarn is going down. So, what happens when you twist one portion and the other portion. So, wherever they are together close they would like to make a node or a plate or a twist. So, the twist can from here, the twist can from here because they close they can overlap intertwine.

So, when the yarn is coming down this portion anyway goes out, this portion is now little more compact as it moves into the zone it does not open the way you like to open, when it comes to this zone this portion when it comes to this point it cannot open because now it is interlaced, but as it passes down, then you have filaments which are parallel bundle they are not, then they will get separated and again twisted in two different directions. So, you have one node being generated below, one node being generate above and then it passes.

So, what they find if at all if you can make a jet which will do this thing, separate the bundle into two portion approximately, twist them in opposite direction and then bring them close with anyway will happen. Then if this happens, then you will get nodes intermittently, it is passing at a particular speed whenever a portion which is like a node passes it does not open it just passes, when bundle un interlaced bundle comes into this area it get separated may be get twisted.

And then, a node on the top and the node the bottom is being made and it called continuously passing. So, what it says is without any sophistication pulsating jets or any

other thing you can create an intermittent interlacement if something like this happens. And this period of interlacement would depend on the pressure, would depend on the vertex being generated and would depend on the speed of the yarn it is moving although you have control, but will depend.

So, the question that remain was can what would happen? A simple design which looks like here of a jet it is expected; is expected maybe the air stream is coming as it comes into an expanded zone, then it make some kind of a swirl this one goes there and make some kind of a swirl and the portion of the yarn which is separated if it is here one portion here other portion here, then there will be twisted in different direction if this is true right.

So, airstream enters the jet and then goes like this and so you have a portion of a yarn which may have been separated and brought into this vertex and the other vertex. And then where it goes in and comes out it will again have this mechanism with which they can make nodes intermittently, but what was important is that they must separate and twist it is like a false twist this is no real twist, but when they come there twist over each other because they just come together.

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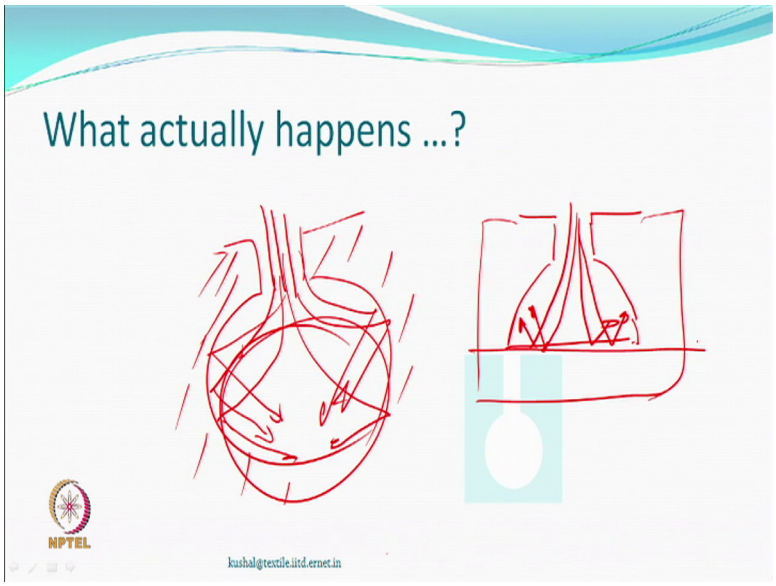

So, it is a very simple so less have this design. So, this design the tried to do did not really find very nice intermittent nodes being found something was happening, but maybe it was known as go to appears to be continuous change or was not good enough.

So, what they found was happening? So, this is your simple jet, so expected was that this would happen something as it would happen, it did not happen; why?

Because expansion of air was not dependent on the desire it just would happen the weight has to happen. So, well stream let us say coming they go and they a strike wall and they can get reflected. So, instead of going they have expecting they go like this it may actually happen this goes and like this. So, instead of having separate swirl winds, they would get reflected in different ways and so turbulence gets created, so it is not helping. They may get separated, but there is a turbulence so it can happen all kinds it can happen. So, that condition that they should get separated and get twisted different direction would happen.

So, somebody then thought of same design, a semicircular or a part of circular cross section; part of a circular cross section now the whole circle cross section. Then what they found is this can work and how it work? This goes before it strikes the other wall and goes like this. So, this goes like this if it is expanding then this goes like this and not like this. So, if it is on this direction it will go this way, if it is here it goes like this. So, what people found that if you just reduce this you can actually get this swirling action in opposite direction.

So, someone thinks this is just a design very simple you can always do it when it took good number of years and good number of people who were already making jets to understand requirement is different, we want different thing maybe this finally, today a jet of interlacement jet would be something similar, that you want to separate the filaments, twist them in opposite direction as it comes out.

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So, the design is like this, semicircular and you see a different color so this is a plate. So, instead of the threading becomes easy, so there is some kind of a plate we just remove it can be moved on one side hinged or pivoted and then you can pass your thread and then closes.

So, finally, the design is very simple, started with all kinds of hypothesis, then trying to say what do we want and then trying to get to this most simple design which works. So, you can appreciate then whenever somebody is trying to design small thing or a big thing there is the science behind the whole design process this cannot be less do it. So, it may start with less do it, but finally, it will not.

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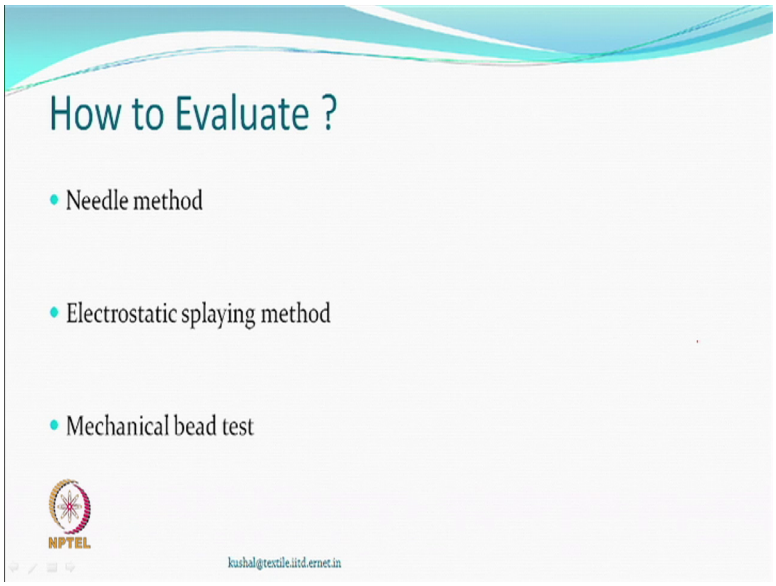

So, now that you have done let us say some design which can produce intermittent nodes it evaluation after and characterization, so there methods I mean suggested how do we find how many nodes are there. So, one of the method is called the needle method, other needle method as says there may be a needle which is moving to check it out. Electrostatic splaying that you actually charge them, so that whenever there is no node they will go further optically you can find out.

A mechanical bead test it expected there if you put a bit of load on to the yarn, the nodes will be more denser compared to the un interlaced area. So, it is like a bead being formed that if there is a sensor it will probably move up or down based on whether there is a node on there is no node, you did have ways in which you could do that.

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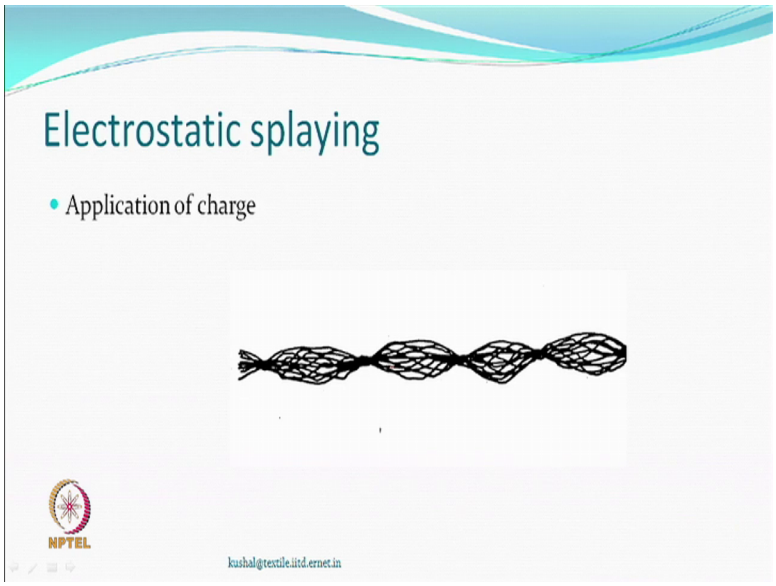

So, needle means that there is a needle which may be here when it is impinging needle go with others, so there is open area goes down, a closed area comes up. So, this motion would you monitor by this l d l v d t type of a transducer and then you can count how much down how much up is happening.

So, just a needle, the yarn is continuously moving at a certain speed and needle just resting on it, so goes up goes down. So, difficulty; obviously, is that based on what actually the yarn structure is the needle might actually get a stuck also, goes deep and then suddenly something happens or you cannot increase the speed very much because needle has to go in and come out alright.

So, although at a slow speed this method would give the same results at higher speeds needle may get damaged, because much before the needle could go the yarn would be going fast and may bend it although is a very very low pressure tap situation, but still it has to get on.

So, electro static splaying was; obviously, optical method. So, you have to have your system which can optically see there is expanded portion and non expanded portion and count it. So, it can also be done very slow speed or it can go fast speed depending on how quickly your system is analyzing a data of course, record then analyze, but there has to be a process, this is one which people a made machine zone.

You can appreciate that somebody wants to make machines to evaluate something called the interlaced yarn, so interlacing must be an important process also. If it was such an unimportant process why would people work around this and find yes that it is an important thing we are replacing twisting.

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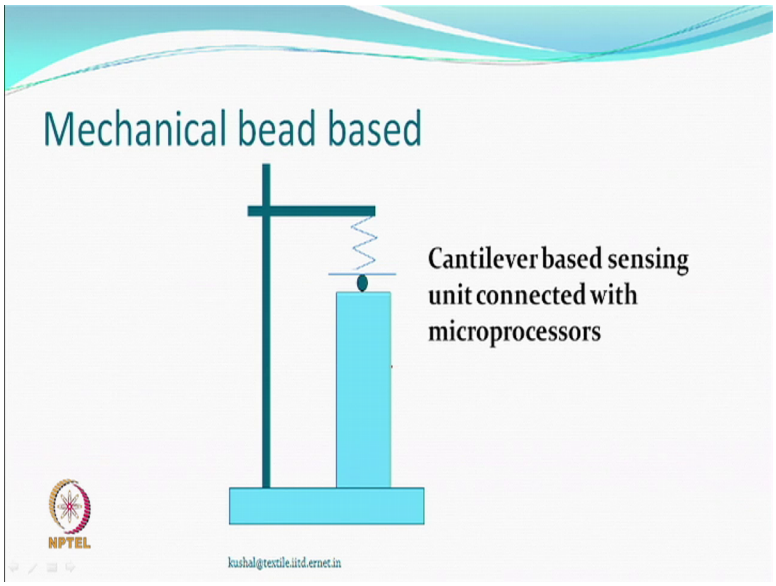

Mechanical bead based testing equipment could be kind of a cantilever with the spring where if node is there, diameter the distance will be different. So, it is not this plate which is this plate is not going inside only compressing, so there is no entanglement here. So, just there with this under pressure, goes up and down as goes move down and you can measure this.

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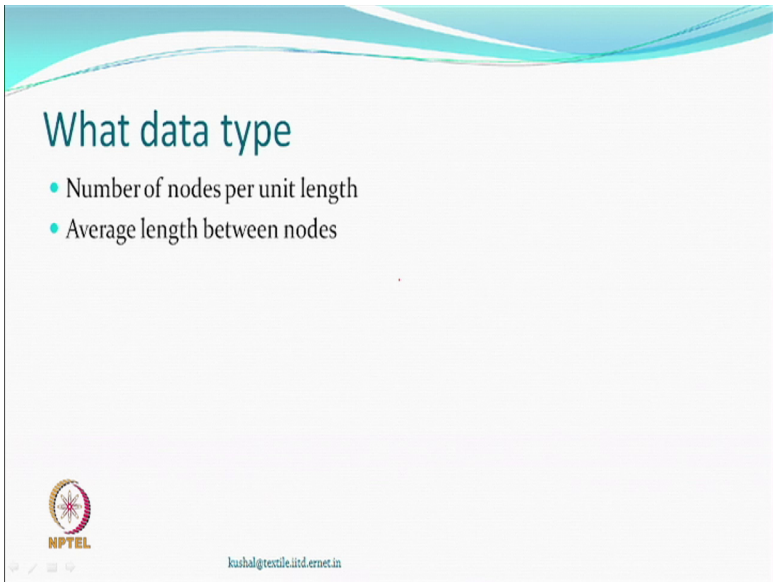

What you measure? Number of nodes per unit length and also average length between the nodes so the same thing you can calculate this and give the data. Stability how much stability of these so called entanglement do you want to. When we are looking at the air jet textured yarn you are very very sure that should be very very stable. Now, it should also be stable, how much? You see like you have crimps in the fibers, so that you can make a twisted yarn.

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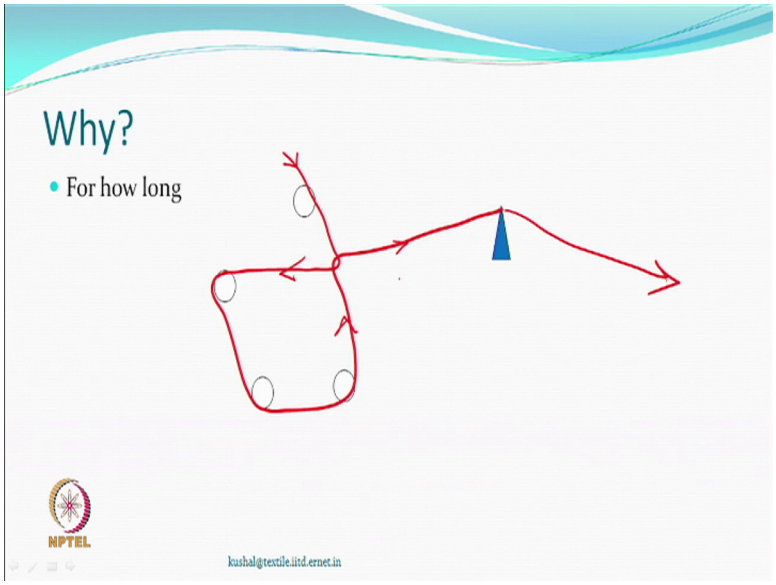

So, the role of crimp is known, but does anyone interested is someone interested that the crimp should be permanent very strong or they said give after I have bead the yarn if the crimps go I have no problem, it was only in the intermediate process that you are interested that is what happens. Here also you are interested in the stability to an extent that should be able to make a knitted fabric or a woven fabric, after you have made the woven fabric now you have many ways of binding these yarns all courses wails you know.

So, the interlacement takes place in woven fabric anyway, then the filaments can just cannot run away and you have transferred the fabric already. So, purpose of this is served as long as you are able to after that some of them open you do not mind. So, people would do some testing where yarn our yarn friction, under tension you pass over a wedge and see the previous figures how many nodes are now left and what is the average length between the nodes.

So, what would happen is that you pass the yarn under tension which would be let us say weaving tension or tension at machine whatever. So, based on those kind values you pass this yarn and if they open it will know how much have they opened.

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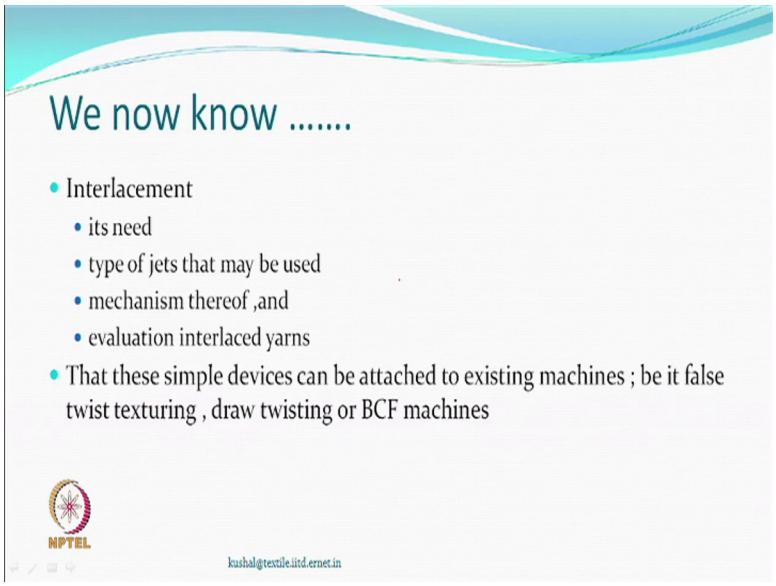

So, what have we done? We have done what is interlacement it is a need, type of a jet that may be used, mechanism interlacement, evaluation because you must be remember that these are the devices which will be added, attached to the main machine whether you

are producing a draw twisting false twist or bulk continuous filament yarn because there filaments are supposed to be free. So, you do not want the filament to the so free let difficult to control there we are.