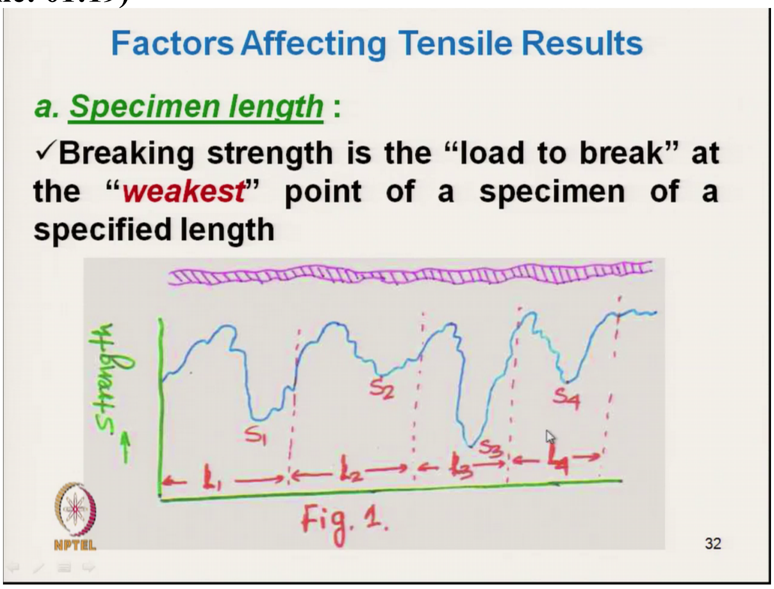
Evaluation of Textile Materials
By Prof. ApurbaDas
Department Of Textile Technology
Indian Institute of Technology- Delhi

Lecture No 22
Evaluation of Tensile Properties of Textile Materials

Hello everyone we will revisit the different factors which affect the tensile results once again because now what we will try to solve few numerical which are practical in sense how the different factors affect the tensile results that will try to see try to understand by practical exam ok. Now a factor which we are discussed earlier was first the specimen length, specimen length which directly affects the tensile results.

For the same yarn if we increase the specimen length the tensile result tensile strength apparent tensile strength remains actually become lower.

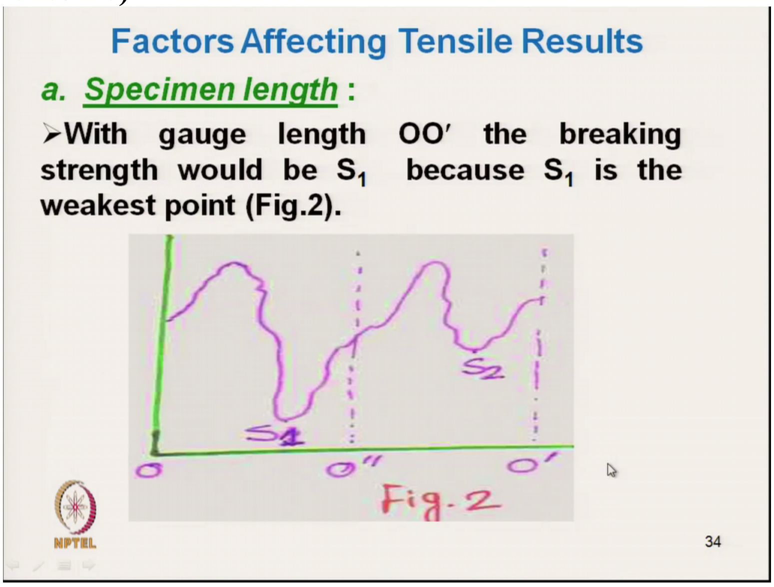
(Refer Slide Time: 01:19)



That we have seen so basic thing is the quick link theory that we have discussed earlier. The yarn that any material as a matter of fact breaks actually at its weakest point ok, so if we keep on increasing the test length that the weakest point it will reach at certain point it will break. Now suppose in this figure the yarn length is S1+S2+S3+S4 that is the yarn length sorry L1+L2+L3+L4 is the length of the yarn and the breaking strength of the yarn with L1 portion is S1, L2 portion is S2, L3 portion is S3, L4 portion is S4.

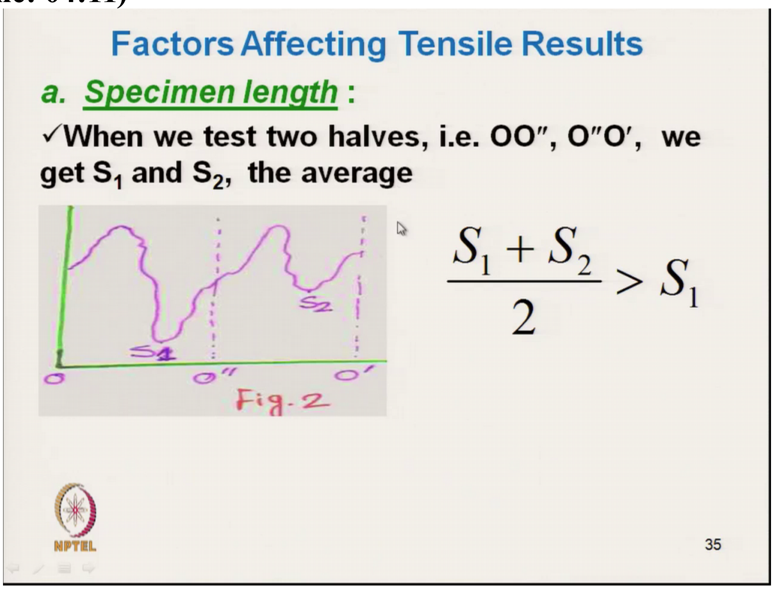
Now if you see the S3 is the least followed by S1 then S4 and S2, S2 is the highest. Now if we take the total yarn length it will show a result of breaking strength as S3 which is least. Now if we keep on reducing then the mean value if you say the total yarn it breaks in four different test L1, L2, L3, L4 section in the same length we are just breaking in to 4 different, divided into 4 section in that case the yarn strength will be S1+S2+S3+S4 / 4 is the mean and which is any way more than S3. That shows that the reduction in test length increases the apparent strength of the yarn.

(Refer Slide Time: 03:28)



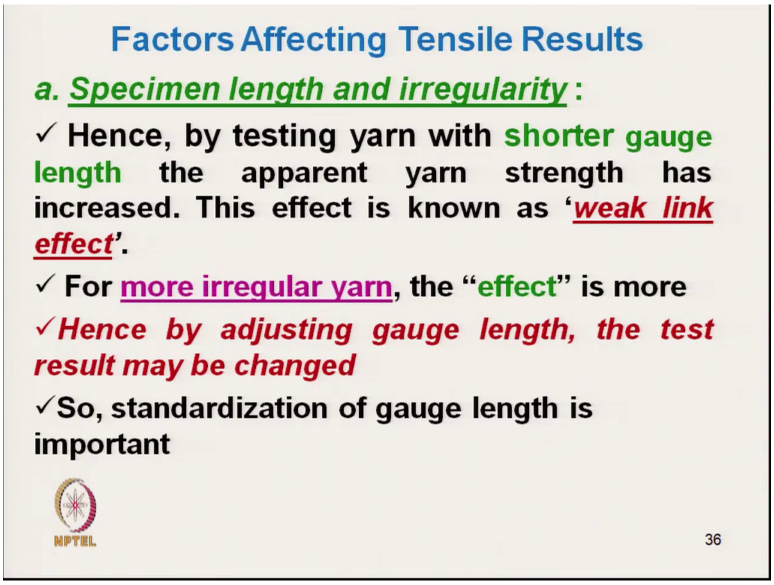
Now if we see that in this example S1+S2 two segment if we take then the mean value if we take S1 as first portion as a result S1 and the second portion as a result S2 then mean will be S1+S2/2 ok this is mean. But if we take the total length of the yarn then the yarn strength will be S1 which is basically less that the mean yarn strength with the two segments O dash O double dash and O double dash O dash so this two segments if we take it will be higher.

(Refer Slide Time: 04:11)



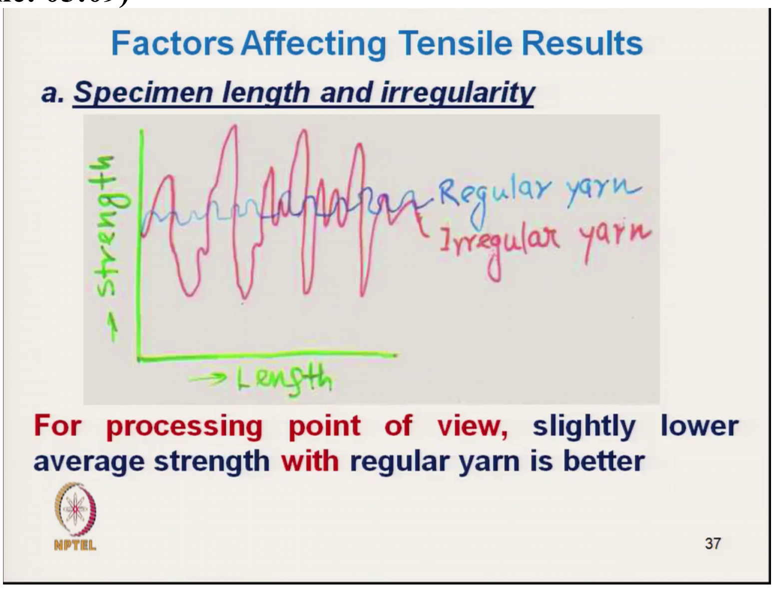
So it shows S1+S2/2 always higher then S1 in that way of we think that we total yarn if we reduce the length with the smaller segment in that case then the mean strength will always consistently will increase.

(Refer Slide Time: 04:26)



Now if we take this effect is known as quick link effect and also in addition to the length the irregular more the irregularity of the yarn higher will be the effect so that higher irregularity this quick link effect will be more. Hence adjusting the gauge length the test result may be actually varied if you can change the test result of a particular yarn by changing the gauge length ok. So it is important to specify the standard gauge length it is important

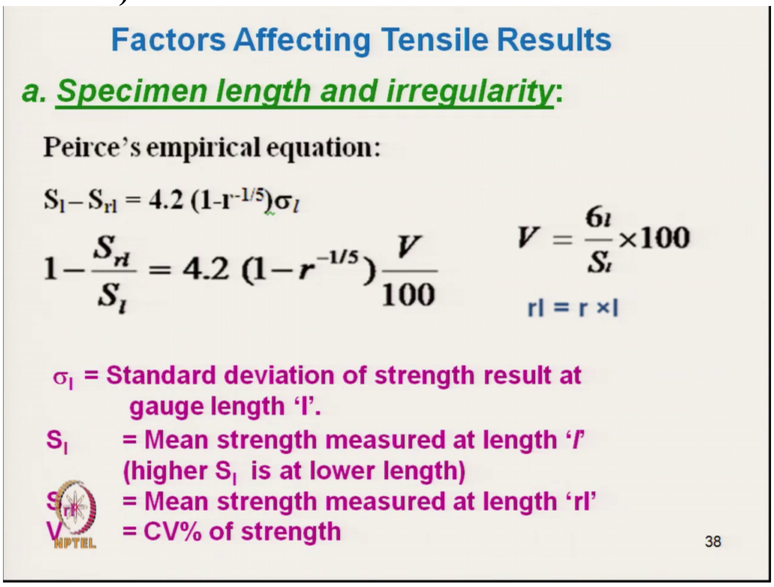
(Refer Slide Time: 05:09)



Now in this picture we can see more irregular yarn rate card is highly irregular yarn in that case that weaker point more and more weaker point will be there ok. And the other hand blue colour shows the almost regular yarn although may be the mean strength is lower than the regular yarn in that case if you see it is breaking strength breaking point will be higher than the irregular yarn.

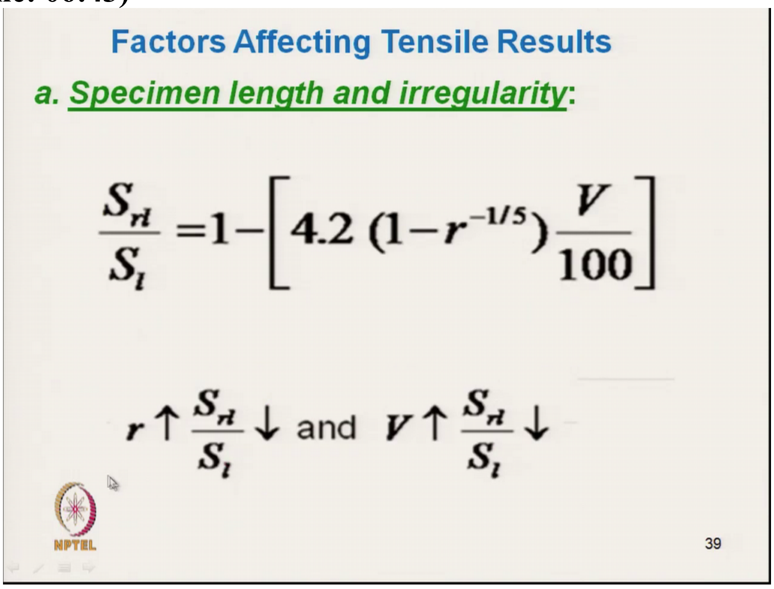
So, for processing point of view slightly lower average strength is ok with it but the yarn regularity should be better.

(Refer Slide Time: 05:54)



Now this Pierce's empirical equation which shows that the; this r ratio, ratio r means the number of times increases. So, that the Sl is the length with the l gauge length and Srl is the mean strength with the rl gauge length r times of l is that the time that increases and V is the CV% of the yarn. Now if we see, if we increase the yarn R that means that yarn strength mean strength will reduce and also at the same time also V, CV% if it increases the strength will be lower.

(Refer Slide Time: 06:43)

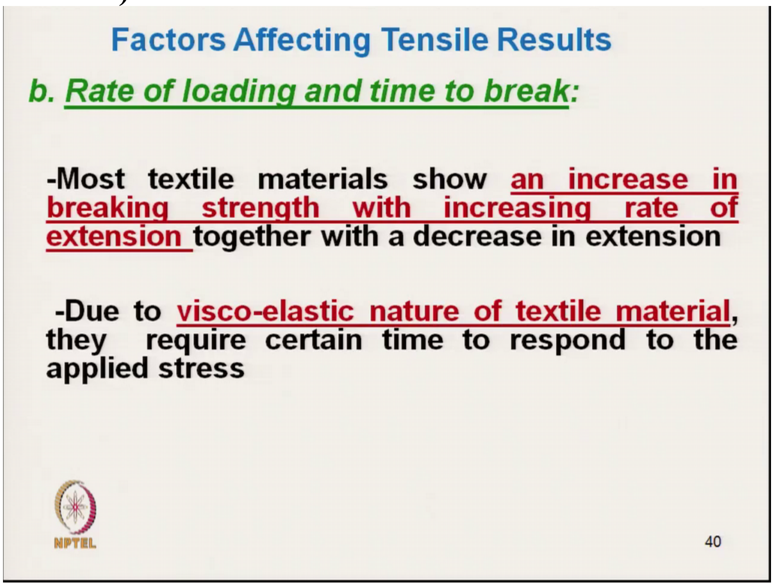


Now if r increases the ratio is rl/l, rl is the longer length strength with the higher length r times of l length. Suppose it is a; if we test gauge length is the 10 cm and r is say 5 if we test 50 gauge length it will be that; we can check how many times it reduce ok the strength and similarly the higher the irregularity V is the CV% of the strength higher the irregularity will show lower the value of Srl/Sl.

So, that means if we take the irregular yarn same length the keeping same gauge length if we take the irregular yarn in that case it will be totally it will add irregularity strength will drop in this equation it shows; if we keep the gauge length same in that case the effect of CV we cannot see from this equation because in that case r will be 1 if it take the same gauge length only changing the variability in that situation this equation is not valid because r will be 1 then total this segment will be 0 then it will be same it will show same.

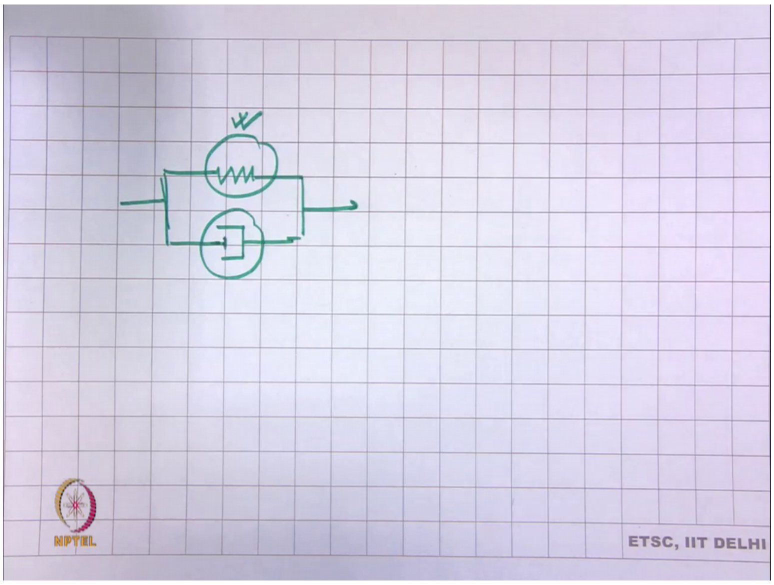
In that case impact from the yarn irregularity is not there so yarn irregularity impact only comes if we change the gauge length so, according to this equation ok.

(Refer Slide Time: 06:43)



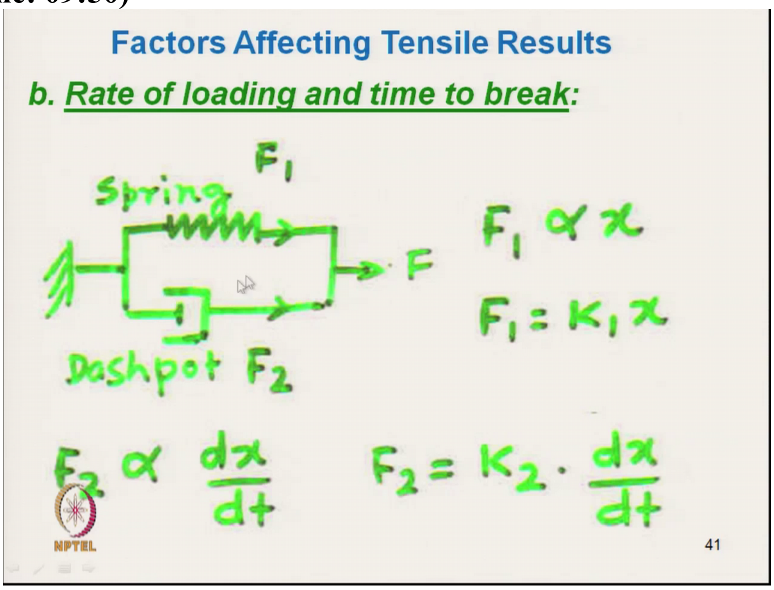
The rate of load yarn or time to break so in that case most textile materials shows an increase in breaking strength with the increasing in rate of extension that we have discussed already. This is mainly due to the viscose elastic nature of the material and it has got two component viscose component and elastic component. In the elastic component actually it is shown by the spring model.

(Refer Slide Time: 09:10)



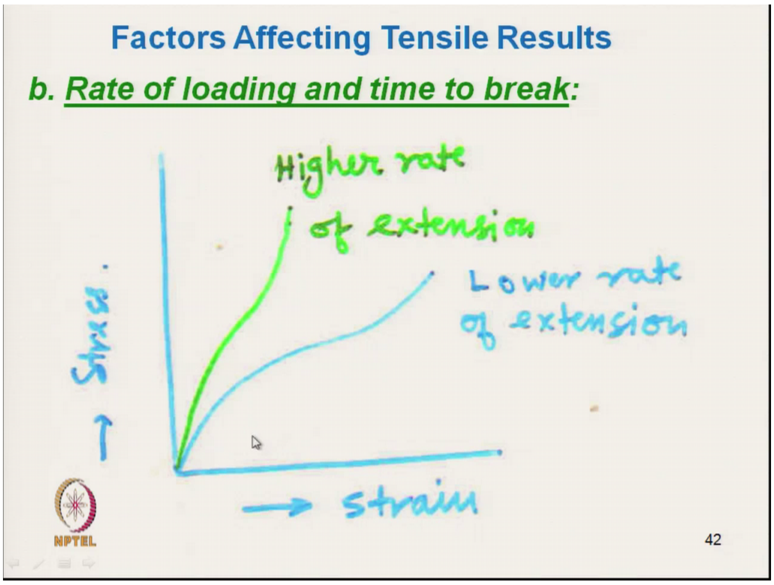
So, we can see here any textile material we can represent with the mean and viscose model. This is the viscose model in that we can show here spring section it basically it changes with extension the load changes with the extension but this viscose segment the load changes with the rate of extension. So, if we increase the rate of extension in that case the load actually the strength of the material will increase.

(Refer Slide Time: 09:50)



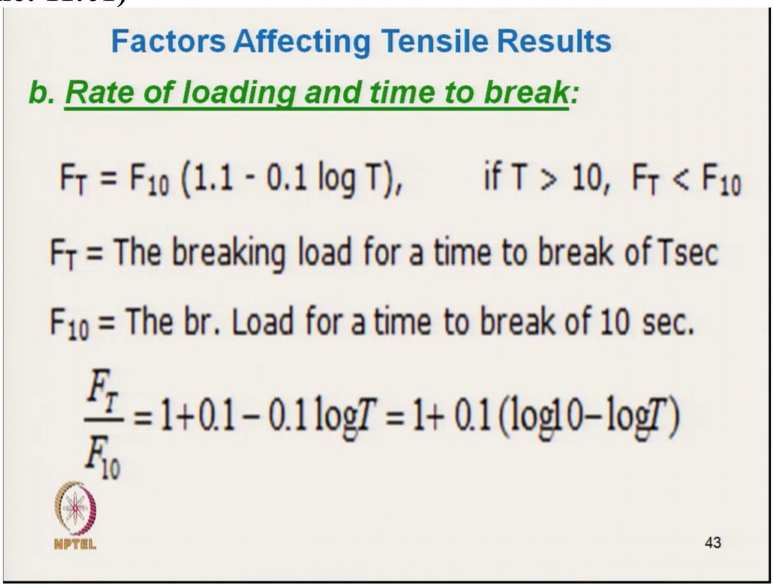
This the spring model and this is the dashpot model, viscose model and here if we apply force, the force has been divided in to two components F1 which is by spring and F2 by spring dashpot model and F1 increases propositionally with the that is the extension. As the extension increases it F1 also increase. But in the dashpot the F2 increases with the rate of extension ok.

(Refer Slide Time: 10:30)



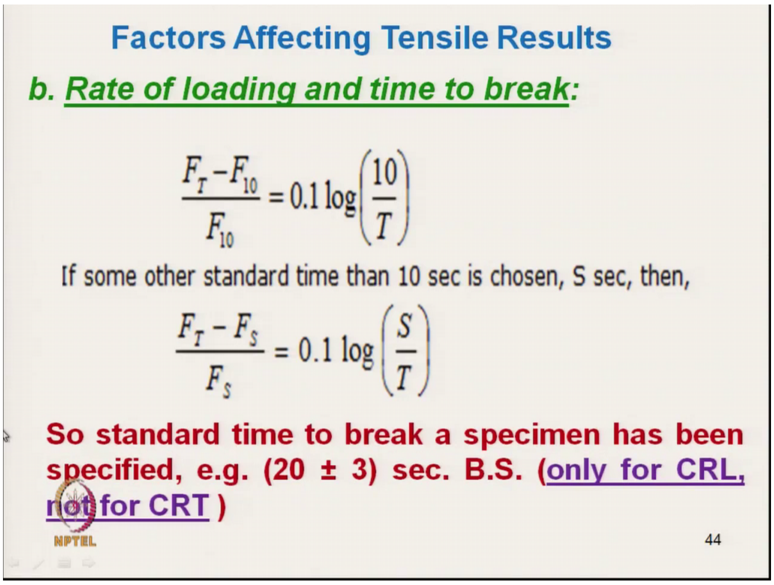
And also we have seen as we increase the rate of extension the stress exerted by the material increases. So, at high rate of extension this is the nature of curve shown by the green line and at low rate extension is a blue line. Now based on this basic understanding now we will try to solve few numerical ok;

(Refer Slide Time: 11:01)



Before that the rate of loading and time to break this formula we have already discussed FT is the load exerted by material stress or load of the material when the breaking time is T and F10 is breaking time.

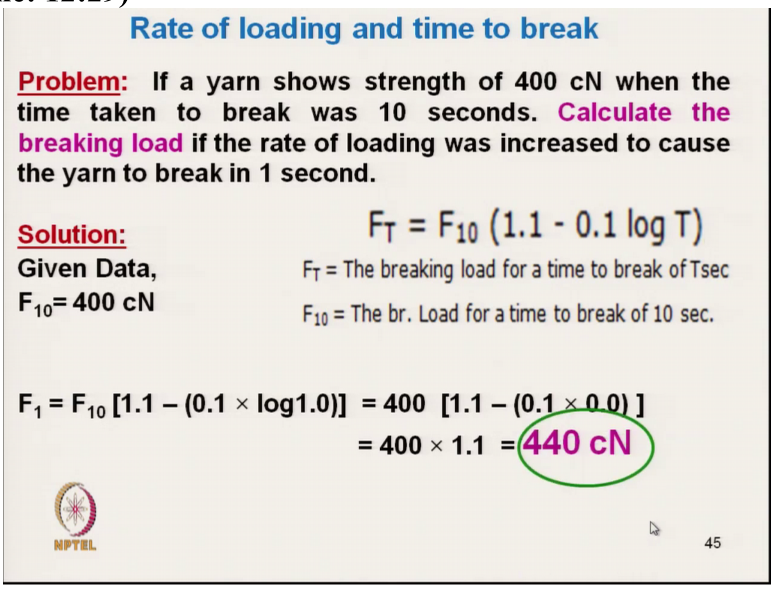
(Refer Slide Time: 11:31)



This is the general equation if we just rearrange the equation will reach to the general standard equation F3-FS/FS=0.1log10S/T where T is the breaking time for the force at breaking time T, S is the breaking load at the breaking time S and s is the time. So, that from this; using this equation we can solve different practical problem ok. Now try to see the problem. So, the standard time to break the specimen as per the BS standards it is 20+-3.

We have decide we have to select the trend at such a fashion the standard time is typically it is 20 sec accordingly we can decide.

(Refer Slide Time: 12:29)

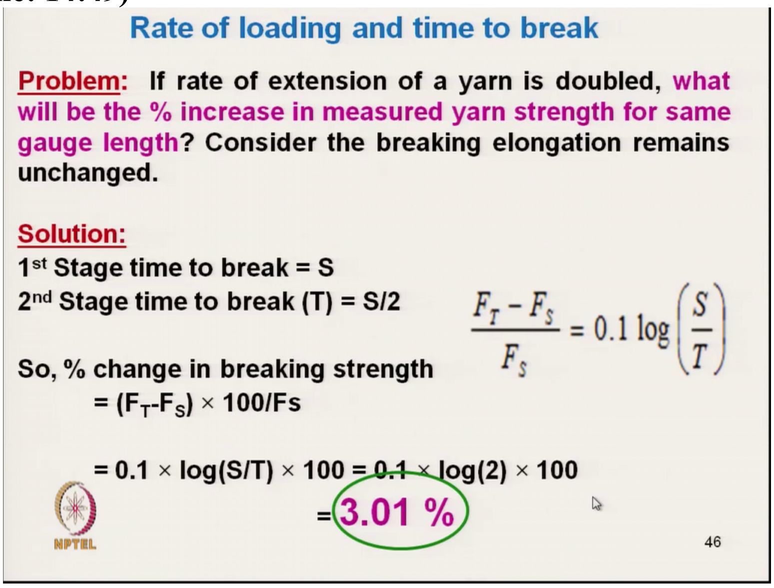


Now if the yarn shows the strength length 400 cN when time taken to break was 14 sec ok this we have discussed earlier also. At the 10 sec time to break the strength is 400 cN. Calculated the breaking load if the rate of loading was the yarn breaks in 1 second, so we have increased the break load that means breaking rate. Rate of extension we have increased that means here the dashpot it is coming into picture.

So in that case if you increase the load the yarn to break in 1 sec we have increase the breaking rate that means here the viscose dashpot is coming in to the picture. So, in that case if we increase the rate. So, this is the formula we have seen earlier equation FT is the breaking load for the material to time to break T second. And F10 is the breaking load for a time to break 10 sec and this is the; here10 sec, F10 is 10 second, at 10 second this F10 become 400 cN it is given.

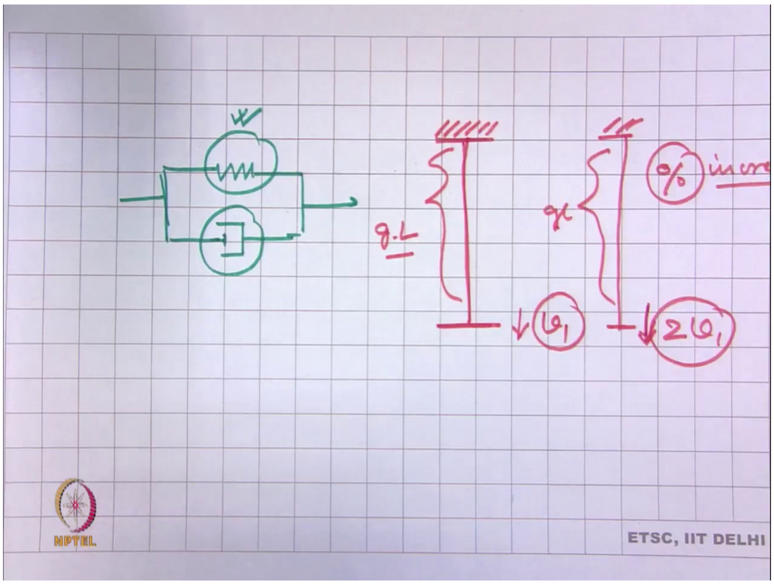
Now what you want? F1 we want now F1=F10* this1.1-0.1log1 this log T log 1 this is the; and that gives log 1 it gives 0 it becomes 1.1*4 so 440 cN so, here it shows just we can see as we increase the rate of extension by 10 times. The load breaking load increases by 10% so that is the thing it is not the in general 10 times increase in breaking extension rate of extension increases the 10% of breaking strength from 400 it becomes 440.

(Refer Slide Time: 14:49)



Now next numerical we can see now if the rate of extension of a yarn is double. So we have made the rate of extension changed in such a fashion the rate of extension has become double ok what will be the percentage change percentage increase in measured yarn strength of measured yarn strength. What we are doing here we are not changing the gauge length.

(Refer Slide Time: 15:16)



So, the problem is like this is yarn this is moving jaw this gauge length we are not changing ok at certain; this gauge length suppose it was V the rate of extension was V now here makes time what we are doing next sample we are keeping the gauge length same, same gauge length but we have 2V1 this is the second condition and here what we are given and what we are trying to known that the rate of extension is double.

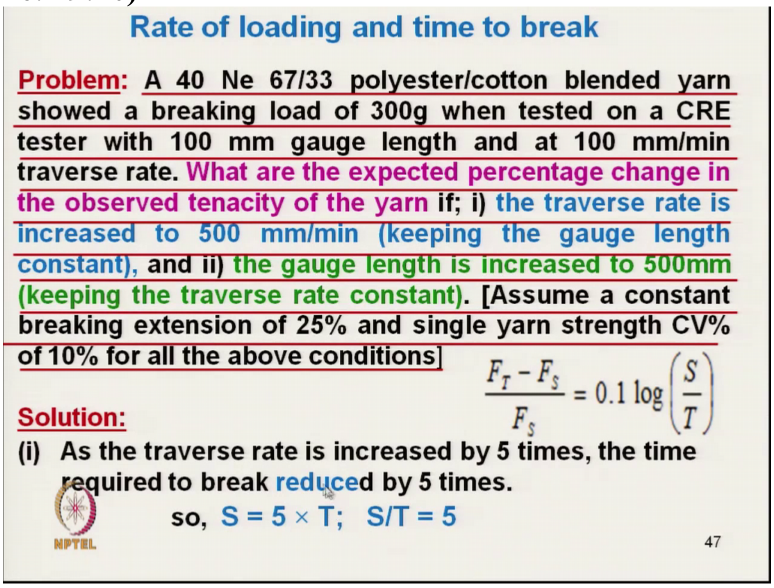
So, the rate of extension increasing what will be the percentage changing in percentage increase definitely it will increase, increase in strength breaking strength that we are trying to understand. Now here the condition is that breaking elongation remains same ok, so we are not changing the breaking elongation. But we want know the breaking strength. So, in first stage the time to break is S ok.

And the second stage time to break is T as we have doubled the speed so time to break because you are breaking with extension so time to break will be half of the S/2 is time to break. So, S and then T=S/2 so using the earlier formula. So, this is the formula here S/T. So, S/T becomes 2 so this is the FT-FS/FS and percentage change in breaking strength or percentage increase in breaking strength means FT-FS/FS*100 that is what you want to measure.

FT-FS/FS*100 so, if we multiply the right hand side by 0.1 log 1/T that will give as the percentage change in the yarn strength so that is the way we have to do. So, this point 0.1 log S/T *100 this is the percentage change S/T from our condition it is 2, S/T become 2 so 0.1 log 2*100 that is the percentage change in breaking strength and it is coming out be 3%, 3.01%. So, that is the; So, we can; keeping the breaking elongation.

Suppose by changing the elongation we are changing the breaking rate. The rate of extension considering the breaking elongation is not changed strength ok in that case if we double the rate and the percentage change in strength will be 3.01% that is the thing. Now if we know the breaking extension then also we can do; we can solve the problem in the same fashion. If you know the breaking elongation for the both the cases, in that case we can calculate; we have to first calculate the time to break so in the first stage and then time to break in the second stage. So that we can do in different way we can solve the problem.

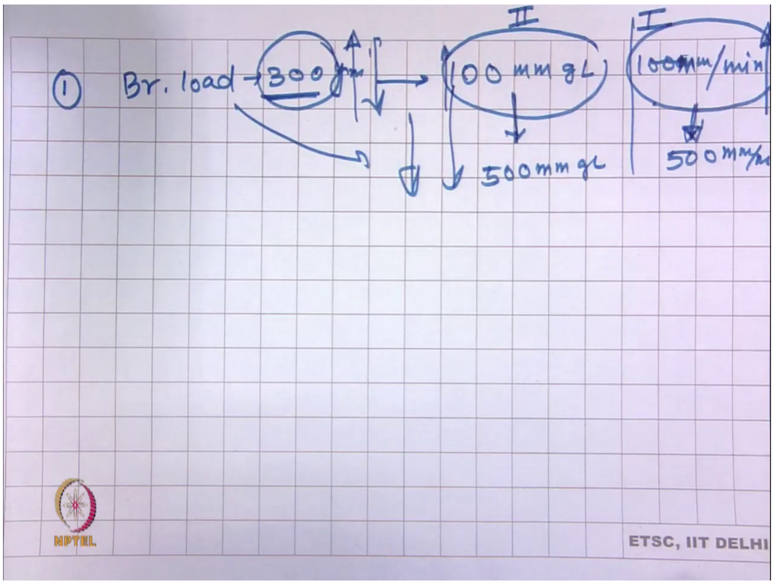
(Refer Slide Time: 19:10)



Next problem is that this problem we have to understand this is the very practical problem and this is the; this type of problem actually study in research ok. Now 40Ne 67 33 polyester cotton blended yarn breaking load of 300gram when tested in CRE constant rate of elongation tester with 100mm of gauge length 100mm per hour minute traverse rate. So effective this Ne 40 67 33 in this numerical in this problem does not mean anything.

This is the yarn ok one should not get confused here this is the specification of yarn. Here we are trying to understand the effect of rate of loading and time to break. The situation is that problem here is problem is that the condition here.

(Refer Slide Time: 20:19)



First case or breaking load 300g with what condition 100mm gauge length and 100 mm per minute speed. Now what we have seen earlier both this gauge length and speed they have effect ok. If we increase the gauge length then the breaking load, if we increase the guage length breaking load reduces ok that we have seen. If we increase the traverse set, traverse set increases then breaking load increases.

Here what we are doing that initially that the speed was 100mm per minute gauge length was 100mm. Now what are the expected percentage change in absorb tenacity of the yarn if the traverse length is increased from 100 to 500mm per minute. So, 100 to 500 mm per minute we are trying to; so 100 to 500 mm per minute if we increase the traverse rate definitely there will be increase in this breaking load and also from 100; this is 1 and situation 2 is from 100 mm gauge length we are making to 500 mm gauge length.

Now we want to know the percentage decrease in the strength breaking strength percentage increase in this case ok. So, situation 1 is traverse length is increased to 500mm keeping the gauge length is constant. So, from 100 mm per minute to 500 mm per minute we are doing keeping the gauge length. And in the next case gauge length will be increased to 500 mm keeping the traverse length rate constant ok.

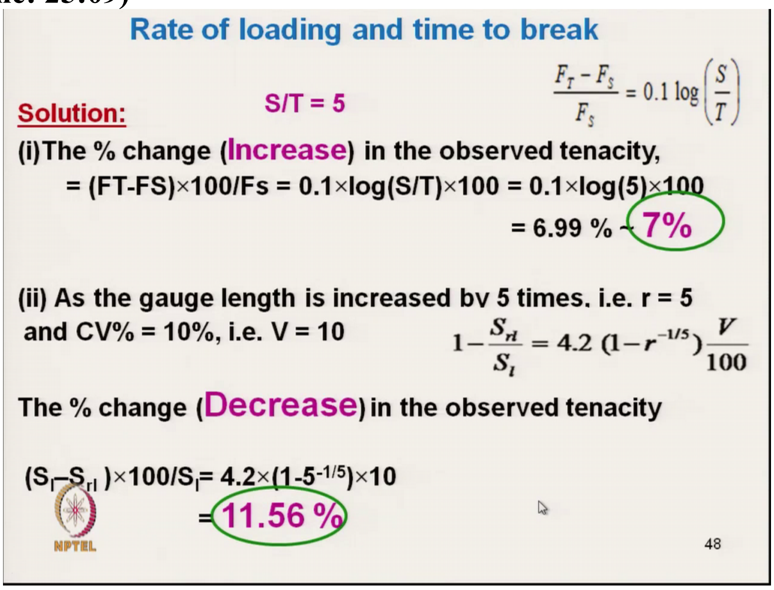
And the assumption is here is that assuming a constant breaking extension of 25% in both the cases all the cases initially after changing the gauge length and after changing the rate always in every situation breaking extension will be 25% we are not changing it make it simple and single yarn strength CV remain 10% for all the above condition there are three conditions. This if we change this thing that also very simple, that we have to get the data.

Here it is 25% it is given that means there is no change in the breaking extension. Now the solution is that we know that this is the formula for actually this formula will be used when we change the rate of extension. So, rate of extension keeping the breaking extension same if we increase the rate of extension same that means time to break will be reduced so that is how we will calculate here.

Such that the traverse set in the first condition traverse rate is increased 5 times so from100 to 500 we are making the time required to break is reduce by 5 times that is the straight forward situation because our breaking extension is same. So in that situation it is becoming very simple but if we know the breaking extension that also we can calculate if you the gauge length we can calculate.

But it is simple so the T ratio is 5, S is 5 times of T ok so S/T becomes 5 then the things are simple so 0.1 log 5 * 100 that is the percentage increase in strength.

(Refer Slide Time: 25:09)



If you see S/T is 5 the percentage change here you can definitely say it is increased ok percentage increase in observed tenacity it is basically FT – FS /FS * 100 0.1 log S/T is 0.1 log T * 100 so it will become 7% so from 100 mm/minute to say 500 mm/minute keeping everything constant. So, we will get the result apparent increase in strength of yarn by 7% that we cannot do because we have to follow standard method.

But for research purpose one must know how to calculate this extension that is absorbed result and how to get the predicted result one has to do this type of numerical. So, one can predict if you increase the extension what will be my increased strength percentage increase in strength. This is actually important in many technical application where suddenly increase in breaking stress rate of stress rate of extension is very high that impact.

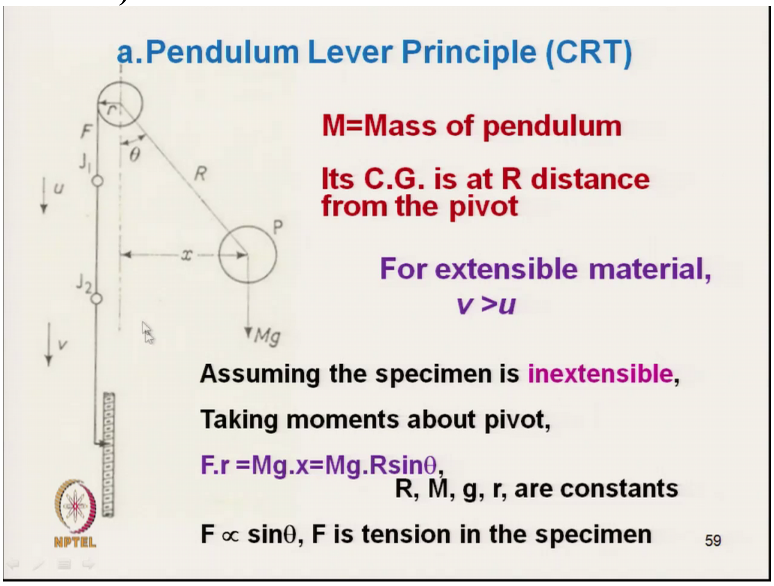
Say impact type of condition we can predict the percentage increase in strength ok. Next is that situation 2 Show the gauge length is increased by 5% so we will use another equation this is the equation here 1- Srl/Sl=4.2* 1-r to the power -1.5 * CV% and by 10, 100 ok. So, here for r means how many times the gauge length has increased 5 times it has increased 5 ok and which one is unknown here V is unknown.

But V is given Show the numerical a single yarn length CV is 10 value is given so is 10 year he is CV percent the 10 is given so we is 10 we simply use this formula and this is nothing but if you multiply this with 100 is nothing but percentage change in strength because Sl - Srl / Sl and this 100 will come in the left hand side simply it will go it will give us the direct value of percentage increase in; percentage decrease in strength SL1 is more than Srl definitely in that case we can directly calculate.

So, the percentage here the percentage it will be decreased because Srl is less than Sl then percentage decrease in observed tenacity will be Sl-Srl * 100 this 100 will come to the left hand side then 4.2 – 1.5 to the power 1/5 * 10 this 10 is the CV percentage and if we get this value this will come out to be 11.5 6% that means if we change the gauge length by 5 times our expected decrease in strength will be 11.5% that is the basic.

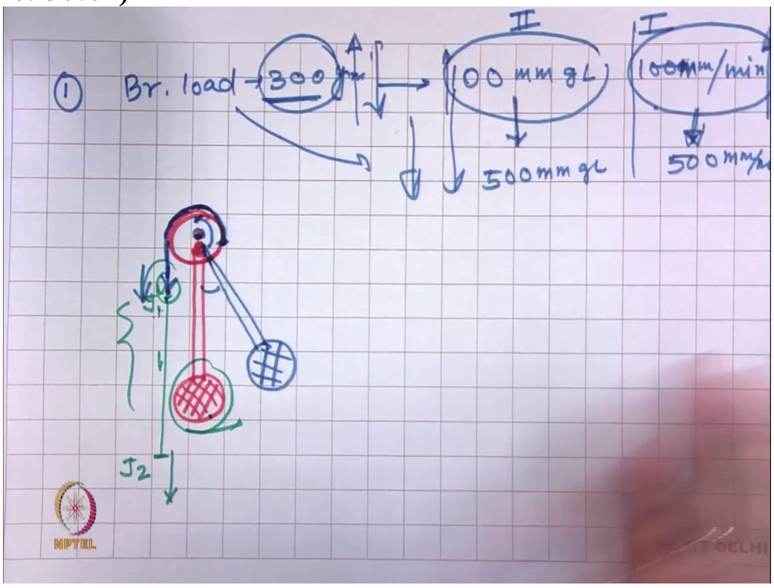
Now whatever problem whatever data is given we must be able to calculate the expected change in strength ok

(Refer Slide Time: 29:26)



And then we will now see pendulum Lever principle ok now we will see one numerical what will be the time to break that we will try to calculate the principal let us just revisit the once again. This is the pendulum ok this one is the pendulum with a Bob which is there and this pendulum principle is ring is there Pulley is fixed with this pulley it is a single unit. This is the single unit.

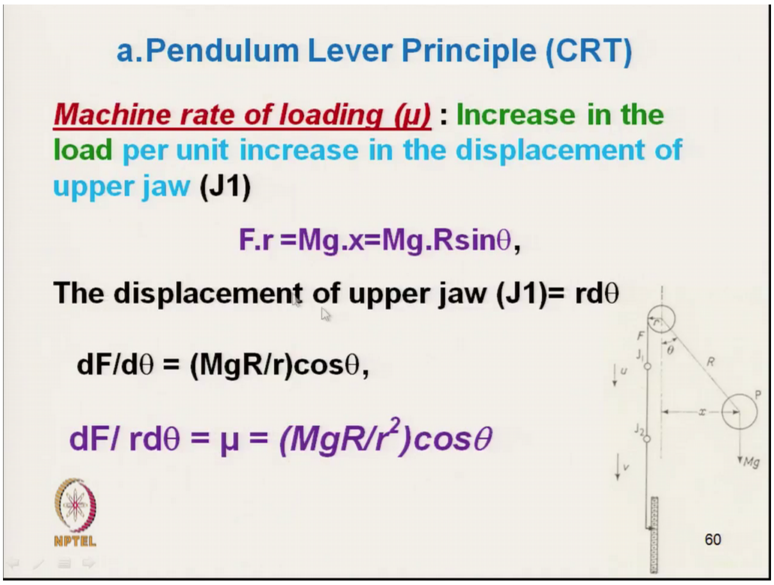
(Refer Slide Time: 30:01)



As we can see here this is the bob of pendulum certain mass this is exactly same single unit ok it is rigidly fixed here it is nothing. Now if we and this the fulcrum at the centre, this is the centre now if we pull by some rope in extensible rope or metal strip fixed somewhere here if we pull and this is the centre this will try to rotate suppose if you try to pull in the downward side it will rotate anticlockwise so this will get deflected this position this will rotate anticlockwise and this will get deflected at certain angle.

This we have seen already in last class and also we have seen how to calculate all the different parameters like the machine rate of loading and time rate of loading. And here for extensible material this is the bottom jaw. Bottom jaw moves at constant speed B. Top jaw moves but it is not at constant speed it depends on the extensibility of the material between Jaw J1 and J2 and the movement of these J1 actually get signal give a signal to the load measuring arrangement. It basically excites the load measuring arrangement deflect and we have seen the calculation.

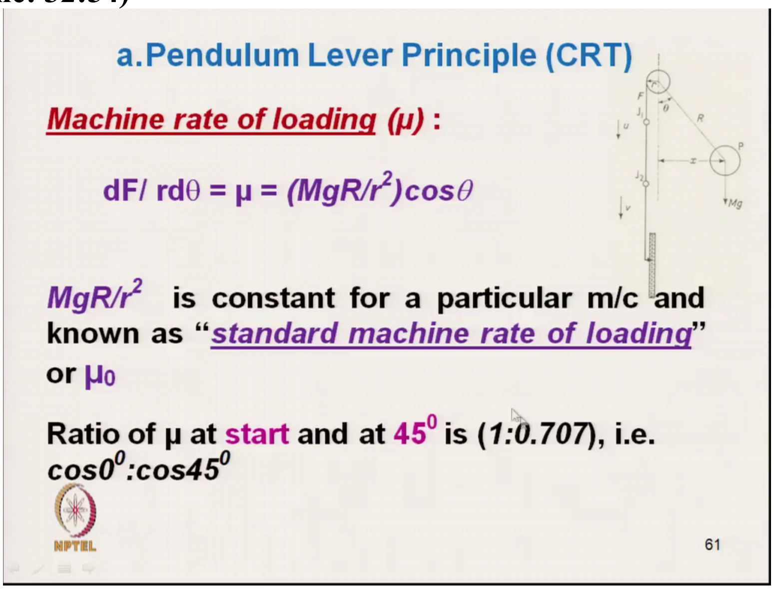
(Refer Slide Time: 31:58)



So there are two types of parameters one is called rate of loading denoted by Mu that is increase in the load increase in load per unit in increase in the displacement of upper jaw J1 that you must remember. Here what is the load increase here with the increase in load per unit deflection, unit movement of the upper jaw that means dF/rd theta, theta is the angle of deflection of this ring of this pulley and that rd theta is the radius of the pulley.

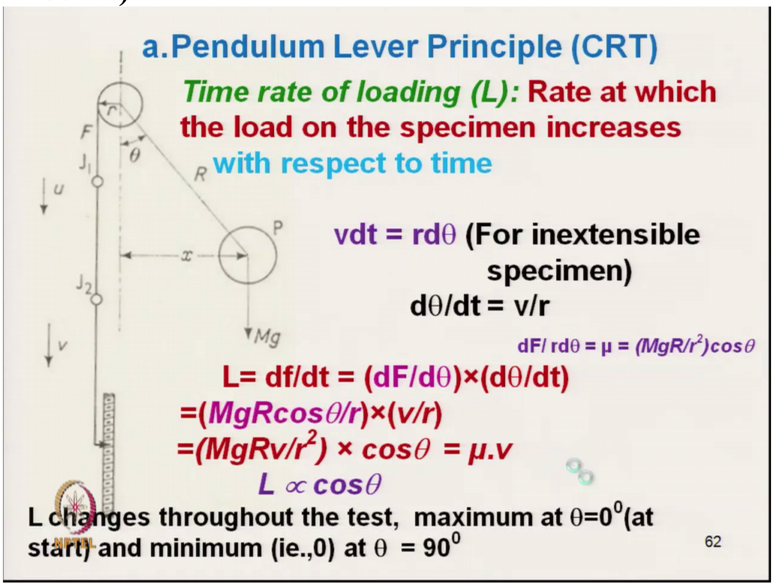
So, dF/rd theta which is nothing but the machine rate of loading and that is proportional to cos theta that means at the starting point it is the maximum and gradually it reduces the machine rate of loading reduces with the deflection.

(Refer Slide Time: 32:54)



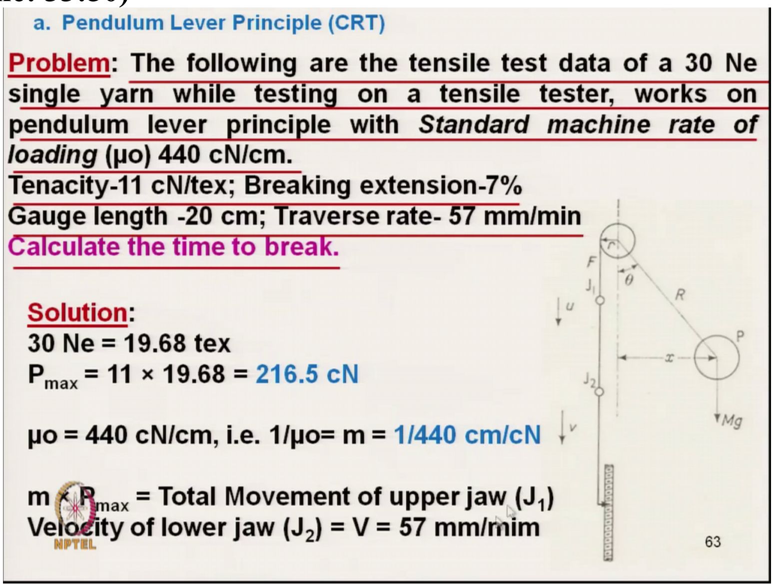
Similarly that at the start and at the 45 degree deflection it is ratio is 1 : 0.707 that is the ratio od cos theta ok and standard machine rate of loading means this constant part is the standard machine rate of loading and that is denoted by Mu 0 ok. So, standard machine rate of loading unit will be the say it is the Newton per centimetre ok this is the force per centimeter, so, Newton per centimetre that is the force plus any displacement that is the unit of the standard machine rate of loading. So, if one asks what is the unit of the standard machine rate of loading that is the centre Newton per centimetre any similar unit should be there.

(Refer Slide Time: 33:50)



Another term it is called rate of loading rate at which the load of the specimen increases that we have seen the derivation and it is nothing but the Mu*v so if you multiply the machine rate of loading with the velocity of the bottom jaw then we will come we will reach the time rate of loading. That we have seen now we will see l is proportional to the cos theta and maximum at 0 and minimum at 90 degree deflection.

(Refer Slide Time: 33:50)



Next we will try to solve one numerical here the following are the tensile test data of 30 Newton 30 Ne 30 English count single yarn single basically cotton yarn while testing on tensile tester. So we are this is there single yarn is tested in a pendulum type tensile tester what's in a pendulum Lever principle with standard machine rate of loading it is given new zero it is 440 Centre Newton per centimetre that is the standard machine rate of loading which is given here and the tenacity breaking tenacity of the yarn tenacity of the yarn is given 11 Centre Newton per tex.

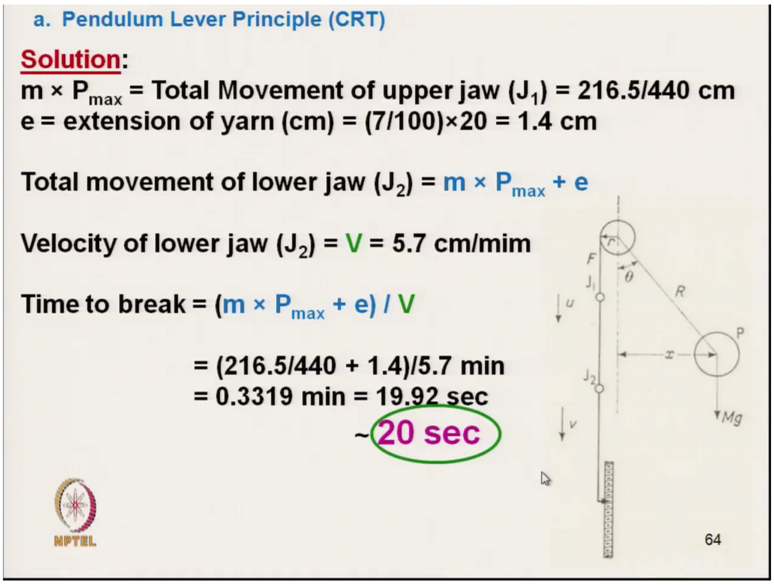
And breaking extension is given 7%, 7% breaking extension and guage length is given the gauge length is 20 CM the distance between upper jaw and lower jaw and the traverse rate is given 57 ml per minute calculate the time to break. Now if you see this picture the traverse rate which one should we take should we take the top jaw or bottom jaw it is better basically bottom jaw. Top Gear is almost moving but it is not driving driver is the bottom Ja so it moves at the constant speed v and breaking extension of the yarn is given. So we can calculate the total extension or gauge length is given gauge length is 20 CM 7% of the 20 cm is the total extension 1.4 CM is the total extension of the yarn before It Breaks ok from there we can calculate.

30 Newton 30 Ne is given and here that a necessity is given is Centre Newton per tex. So we must convert this centi newton to any tex that becomes 19.68 tex. so 590.5/ 30 it comes out to be 19.68 tex and maximum breaking load. What is the maximum breaking load? Hundred is the tenacity if we multiply with the tex then it will get 216.5 cN this is the breaking load P max also you know that Mu0, what is Mu 0 is standard machine rate of loading that is the constant standard 440 CM Newton per centimetre and if we take the reciprocal which is we can do not by m.

That means 1/440 Symphony service centre cN/CM/cN this is the this is the reciprocal of machine standard machine rate of loading then if we multiply reciprocal of standard machine rate of loading which is 1 by 440 cN/cm with P max what does it mean hear this top Jaw means it is the gives the standard machine rate of loading because per unit moment of the top jaw. Rate of loading per unit moment I unit moment is the M and if we multiply by P max that means it will give the total moment of the upper jaw ok m * P max is coming out be centimetre.

So 216.5/440 it will become the total moment of the upper jaw and velocity of the lower jaw it is the 57 mm per minute

(Refer Slide Time: 38:52)

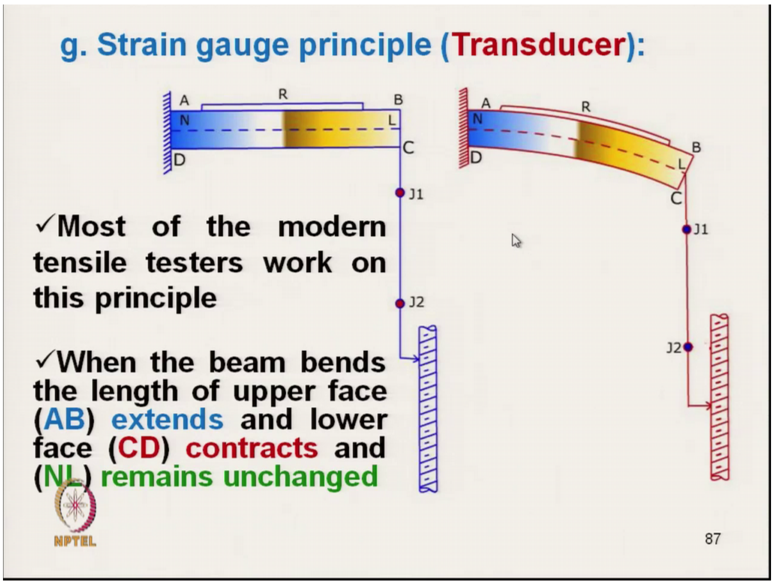


So, in this way we can calculate total movement of the upper jaw is 216.5/440 cm this is the total movement of the jaw J1 and e is the extension of yarn that we know extension of is the 7% of 20 that means 1.5cm. So, this the total movement of upper jaw and extends during this process extension 1.5cm now what is the total movement of bottom jaw then if we add m P max + e it gives the total movement of bottom jaw.

So the total movement of the lower jaw J2 will be m * P max this is the movement of the upper jaw plus extension of the material, total movement of the bottom jaw is we can calculate and then velocity of the lower jaw is known, the total velocity of the lower jaw is 5.7cm/min and then we can calculate everything we can calculate the time to break. So, total time to break is m P max + e bracket whole bracket/ V so you just replace this data 216.5/440 that means m and + e this; the value m P max.

What is the m P max 216.5/440 + e value e is 1.4/ 5.7 cm/min it will give us the total time to break is approximately 20sec. This if we know if we can practice this type of numerical then our total principle of this instrument will be very clear. So, this is giving us the value 20 sec.

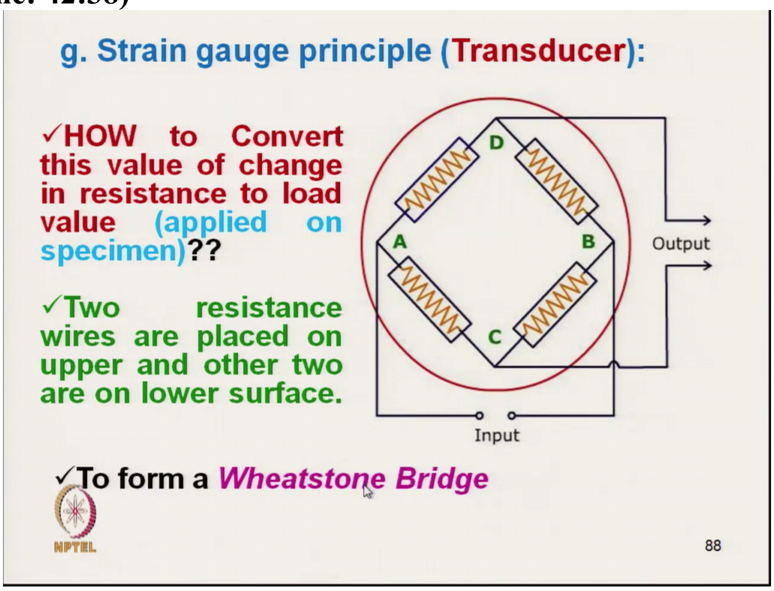
(Refer Slide Time: 41:12)



So, we will continue with this now we have discussed different test instrument earlier so we have discussed the different principals like inclined plane principle or we have discussed stelometer, we have discussed Pressely strength tester and we will now discuss the strain gauge principle. In last class we have started this principle in strain gauge principle it gives idea about that most of the modern instrument it works in this principle.

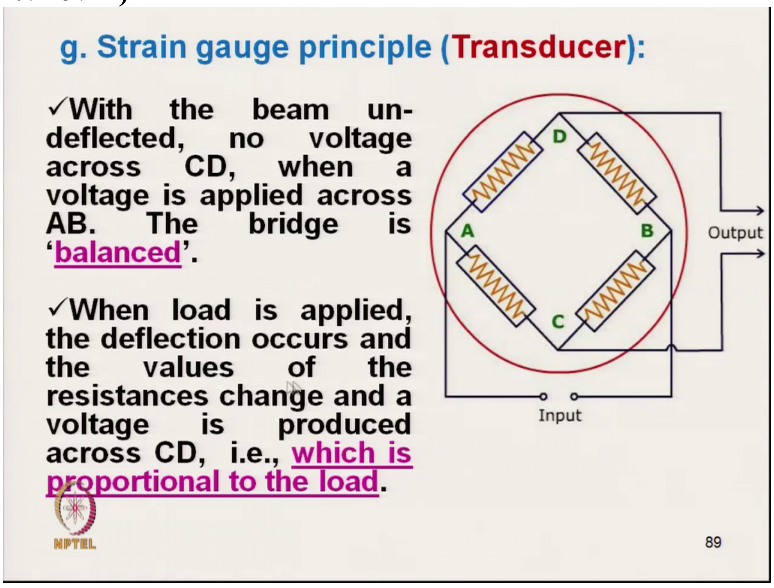
Here the advantage is that instrument works in CRE principle constant rate of elongation principal because of the deflection of the upper jaw here it is negligible as compared to the movement of the lower jaw most of the modern tensile testers works on this principle. When the beam bends the length of the upper phase AB get extended CD gets extended and NL remains changed.

(Refer Slide Time: 42:38)



So, in that case that we have discussed that we can actually fix some resistance wire here so then how to convert this value change in resistance we have seen that we can two resistance put in upper surface and two in the bottom surface so that upper surface get extended and bottom surface get contracted. So, accordingly this resistance changed, so then we can form a Wheatestone bridge ok from their two resistance wire are placed on upper surface and other two on the lower surface and it forms the wheatstone bridge.

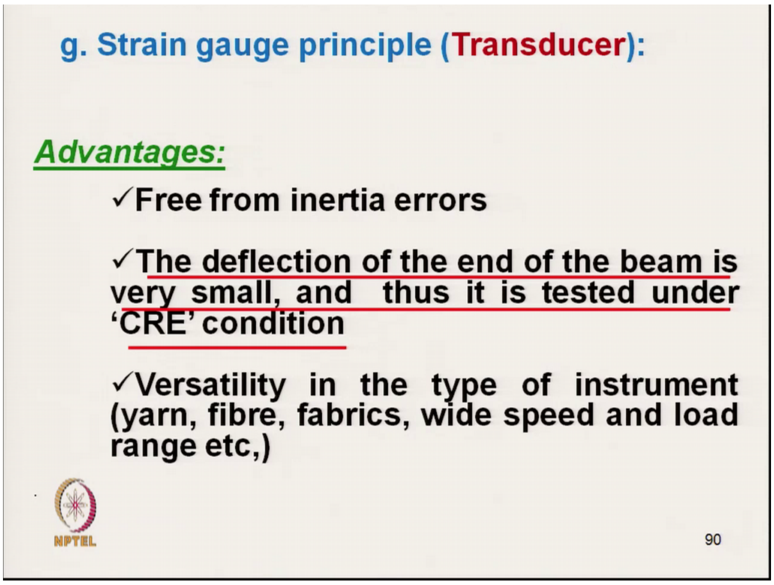
(Refer Slide Time: 43:21)



Now in normal case what happens when this no load with the beam undeflected ok no voltage across CD, so there is no voltage across this why means voltage is applied across AB input voltage across output no voltage because it is balanced. But when deflected the values of the resistance will get changed so deflection occurs and the value of the resistance changes and the voltage is produced across CD.

This voltage output voltage is proportional to the applied load that means the deflection, due to the deflection the resistance changes minute changes in the resistance actually record in a form of voltage ok we can get mechanically it is negligible there is no voltage across the ab but when reflected the values of this resistance get changed

(Refer Slide Time: 44:31)



So, the advantage is that it is free from inertia that we seen from earlier instruments like say pendulum it is actually problem is that inertia problem is there. in pendulum if you see suppose this is the material this is jaw 1 and this is jaw 2 once is started the extension is taking place the deflection also taking place here but due to the inertia heavy load it will not move immediately that inertia effect gives us the wrong result initially.

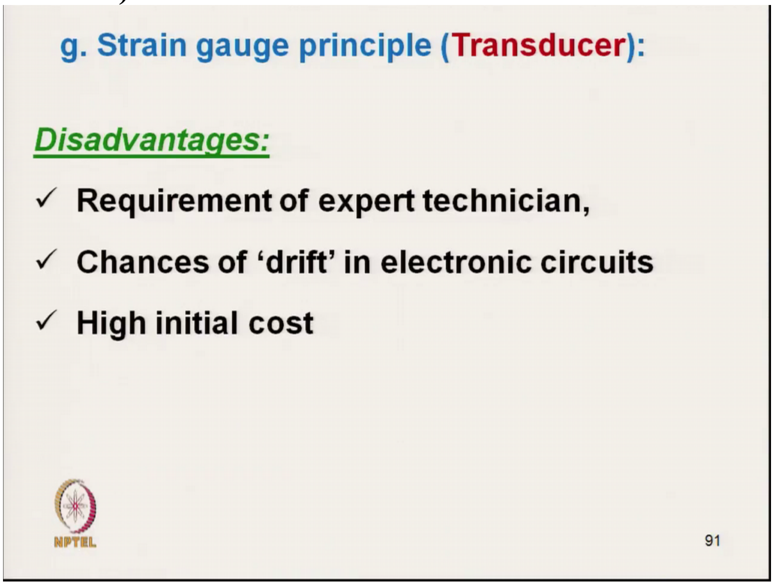
And this is actually that is true for other instrument but here the inertia effect is not there, so this the advantage of the instrument. The deflection of the end of the beam is very small and so that physical deflection is very small mechanically that is why we assume it is almost 0 so we can see that its condition is that CRE principle this is the one of the rare instrument which works in CRE principle.

Otherwise CRE mechanism is very difficult because it actually you cannot measure the force we can get the CRE but you cannot measure of force because force you have measure from the other side is like this is the fixed jaw and this is the movable jaw, movable jaw it will moves we can move it at constant speed but load has to measure in other direction. So earlier case we have see in pendulum case load we can get direct movement of this upper jaw. If we does not move the we will the load actuating, load measurement system will not work.

But here as it is moving load as to be measure here without any deflection and that is why strain gauge principle here if we assume that there is no change movement in upper jaw then only we can get. Then the confusion comes here the total actuation total load measurement is basically change in resistance it is basically after deflection if it does not deflect then resistance will not change but at the same time that this is CRE principle.

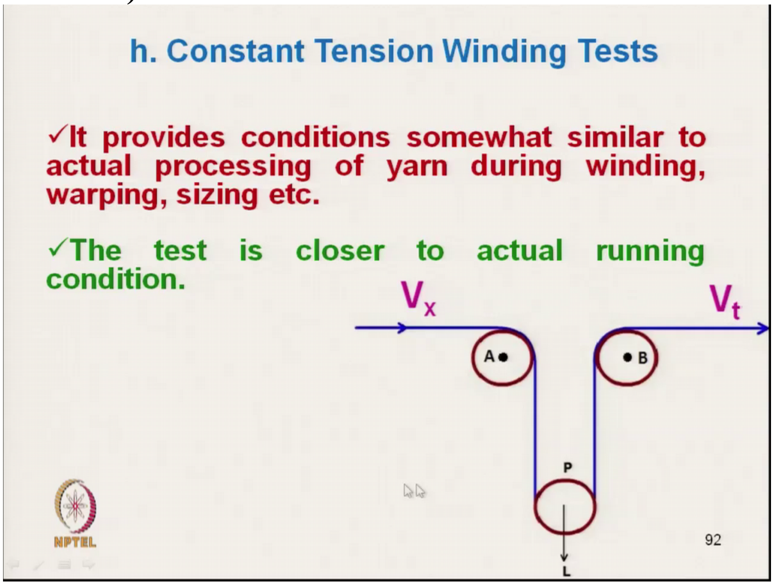
Because deflection is very, very is small that is very important you have understand this basic concept and versatile instrument we can use for yarn, fibre and many instrument we can use for different type of wide range of material we can use wide range of material we can use few milligram to say few tones so that range we have instrument.

(Refer Slide Time: 47:49)



The main disadvantage is that it is very sophisticated instrument for any repairing we need spot technicians and basically there is a chance of drift in the electronic circuits. So that the wheat stone bridge after repeated deflection it may the resistance may get changed in that case we have to recalibrate once again ok. High initial cost basically the cost is very high.

(Refer Slide Time: 48:21)



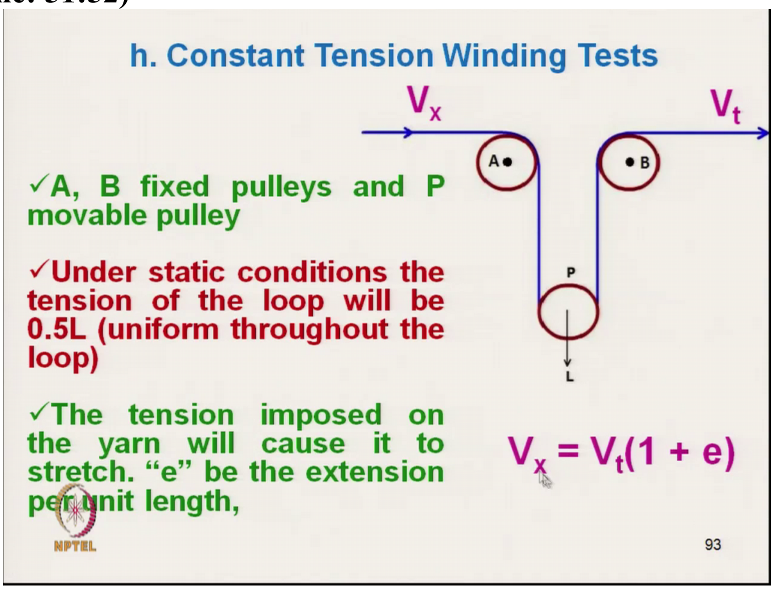
Next we will start another concept which is practical in nature and it is more towards the application if we test the tensile test in static condition that may not be actually applicable in normal application. In normal running of yarn the breakage occur in dynamic condition. So, static measurements only give us an idea about its strength. But dynamic measurement will give us the practical applicability of the material like its method is called constant tension winding test. It will replicate the winding method. And then gives us the idea about the tension required for particular breakage.

So, it provides conditions somewhat similar to actual processing of yarn during winding, warping and sizing. So, knowing only the yarn strength in static mode it would not help because that will give us the test value of very specific length but yarn which is giving very high strength that may fail because if that yarn contain many particular weak points and this constant winding test give idea about number of breakage occurs for a particular tension that idea it will give.

This test is closer actual running condition ok this is the; this instrument basically nothing but winding machine where this is the feed roller. This take up roller and this roller is just for putting load on that. So, for certain load we would like to test ok at certain tension and what we measure? We measure the number of breakage occur per 1000 yard. So, that is the tension level. So, that says t tension number of breakage occurred say 10 breakages occurred.

So, the standard is that the number of breakage occurred 20 at what the tension required to have 20 breaks per 1000 yards that is the tension. If we get; if we do not get less than that then we can increase the tension till we get 20 breaks per 1000 yards that way here we can change the load.

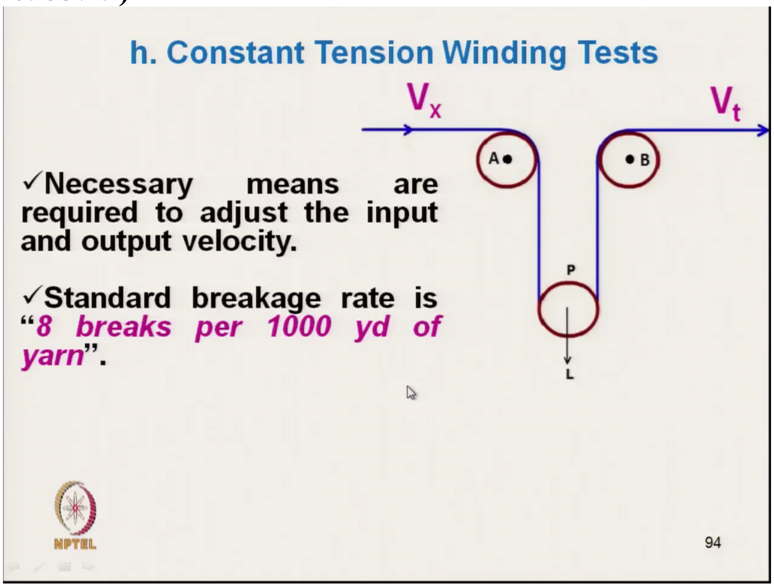
(Refer Slide Time: 51:52)



AB are fixed pulleys and P movable pulley because of dependability of the extensibility of the material it may change because we are putting load on that So, under static condition the tension of the loop will be 0.5L so 0.5L means basically that loop is there. So, L is the total load so that will get distributed so that under static condition it will be 0.5L equally be distributed.

But under dynamic condition it may change. The tension imposed on the yarn cause it to stretch. So, stretch there will be stretch is e, so e is the stretch of the yarn tension that means we can adjust the speed of the Vt and Vx accordingly. So Vt will be higher than the Vx that we know. If know the extensibility of the yarn that we can adjust with the Vt ok. So, this is I think it is reverse Vt will Vt = Vx * 1+e ok that is the thing.

(Refer Slide Time: 53:19)



Necessary means are required to adjust the input and output velocity. That we have to adjust if you know the extensibility if we have idea about extensibility then we have to change because extensibility is mainly due to the load ok that we have to adjust otherwise the yarn will be slack. And as I mentioned standard breakage rate is 8 breaks per 1000 yd of yarn. So, it is not 20 breaks we can also get but it is a standard as per BS standards 8 breaks per 1000 yd that means expressed in terms of load required for 8 breaks per 1000 yd in the yarn. So, we will continue this topic till then thank you.