Farm Machinery
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Lecture – 52
Performance Evaluation and Testing of Thresher

Welcome students to my lecture number 52, which is Performance Evaluation and Testing of Thresher. Well, it is very important that every machine must be evaluated and tested. And there are standard codes through which we should be testing all the machines for certification, and so that they can be sold in the market. And it will be better from its performance as well as the components, which are used in the machine.

Now, we will like to see; what are the parameters, which affect the performance of the thresher, and what sort of test we perform on them, and how do we report, what are the different ways by which we can report, and how we can certify a particular thresher. This is what we are going to discuss with this particular lecture.

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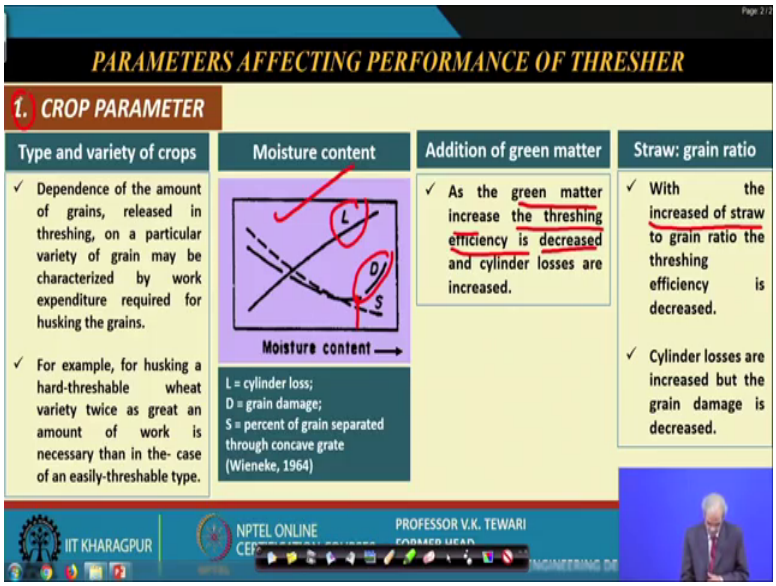

The various parameters affective performance of thresher: well, definitely you know that the crop parameters are we have crop parameters, then we will have machine parameters, and the interaction between these two. So, when you talk of the crop parameters, definitely moisture content of the soil as moisture content of the crop which is important

at what moisture the crop has been harvested, because depending on that moisture only the threshing will efficiency and threshers performance will depend.

Addition of green matter how much of green matter is added in the harvesting, when it has done. And what is the straw to grain ratio. Well, we have a small graph here, which indicates what happens to the losses cylinder loss, what happens to the grain damage, and what happens to the percent of grain separated. Now, you can see in this particular graph that the as the moisture content of the crop increases, there is increase in the grain cylinder loss, and it is quite obvious.

Similarly, if the moisture content increases, what happens, the grain damage also been increases. Now, this is something which needs to be looked into at properly, because you see that the variation here is that initially it decreases, and then at some point, then it starts increasing here. That means, the losses we restart decreasing, but then they will start increasing at this point. Similarly, the percent of grain separated through the concave. This is another important thing depending on the moisture content of the crop, which has taken. So, this is if the moisture content decreases, you will find that sorry increases; then the cylinder percent grain separated through the concave also decrease.

Now, these are some of the important things as related to the moisture content. Similarly, addition of green matter, if the green matter is there, you will find that green matter increase, the threshing efficiency is decreased definitely, because threshing efficiency will decrease more of green matter is there. So, the cylinder losses are naturally going to be increased.

The straw grain ratio: now, with the increased of the straw grain ratio, the threshing efficiency also is affected. Sure, it will get affected, because straw grain ration if it is very high straw to grain ratio that means, straw is more and grain ratio, then also you will find that the cylinder losses are taking place, and they are increased. So, as such when you talk of the crop parameters, which are affecting the performance of a thresher, the moisture content, then the green matter which is there, and straw to grain ratio of that. These play an important role, so far as the crop parameters are affected or considered.

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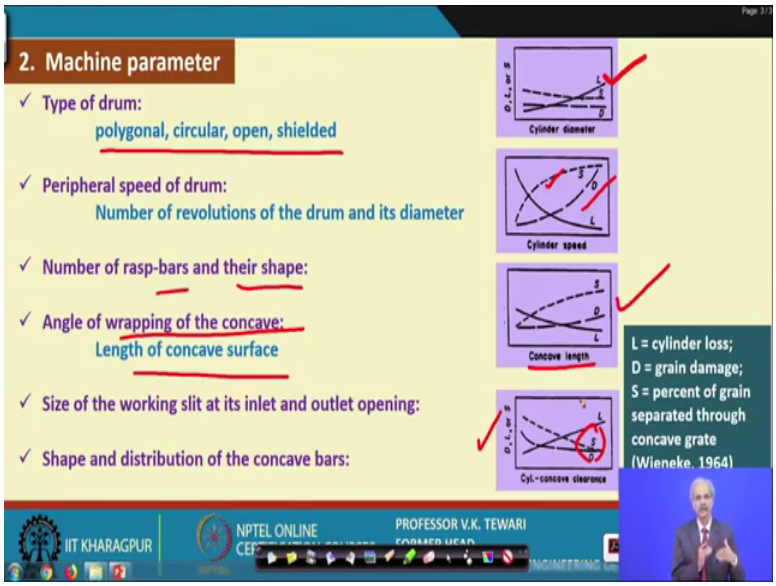

Machine parameters right: once you have the crop, what are the machine parameters, well we know that the machine consist of a drum, then consist of a concave. And there is there are certain the dimensions of this, certain speed at which the drum operates. So, we have to consider all these parameters with respect to the machine. For example, when we are talking of when we are talking of the drum, the type of the drum. Now, here the type of drum has a some sort of a effect on the depending upon if it is circular, if it is polygonal type. Then what will happen is the number of beating switch will be there, while the material is passing through this through the concave will be higher.

Now, peripheral speed; what happens to the peripheral speed, now let us have a look at all these parameters of the D, L and S, which we have seen the cylinder loss, the grain damage, and the percent of grain, which is separated, and the cylinder diameter. As the cylinder diameter increases, generally there is no difference in the D and S that is talking of the grain damage, and this percent grain which is there. But, the losses if the cylinder diameter increases, the losses are on the higher side as it is shown in this particular drop.

Similarly, when you talk of cylinder speed, what happened to the cylinder speed? Now, you see if cylinder speed increases, then the losses are going to decrease, well the cylinder loss as it is shown here. Similarly, if cylinder speed increases, then the damage grain damage is going to increase now. You see what happens, because then if there is likelihood of damage of these. Similarly, the S that is the separation, which is taking

place the separation of the grain from the straw, which is there within the concave and the cylinder; they are in this particular fashion, so they are going to virtually increase.

Now, depending upon the number of rasp bars and their shape, angle of wrap of the concave, length of concave; now, various aspects have considered, for example the concave length. Now, the length of the concave generally we keep as same as the length of the drum. So, the length of concave has also an effect on the performance of the cylinder loss, the grain damage, as well as percent of this as it is shown in this graph. Similarly, cylinder concave clearance, this is very important. With the clearance, you can see that has the clearance increases, you will find that the losses are going to be higher, because then the actual threshing may not take place properly. And accordingly, the others will also get D and S will also get affected.

So, when we talk of the crop, it is moisture content, the straw grain ration, and the green matter. I mean talk of machine; it will talk of the cylinder, the diameter of cylinder, the design of the cylinder, the peripheral speed of the cylinder, and then the concave. What is the size of the concave, how much is the width of the concave, it will also depend on how much is the input. In fact, the input you can see that the where we are inputting the material, what is the diameter, or what is the spacing there, or what is the size of the input and size of the exit. So, on these basis also, there will be effect of the on the basis of on D, L or S.

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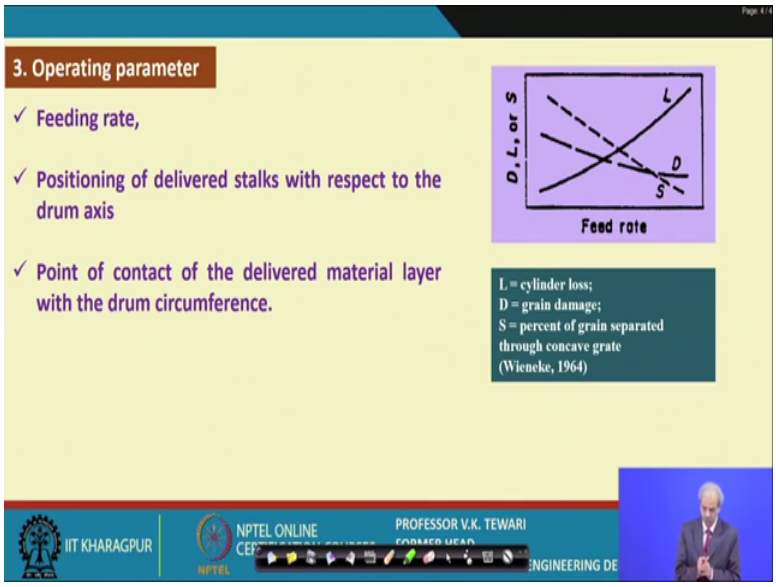

Operating parameters: well, feed rate that is what I was trying to tell feed rate, positioning of the delivered stalk and with respect to the drum (Refer Time: 08:18) and point of contact. Now, these are also going to affect definitely, because operating parameters talking, when we are going to feed, how it is coming out as I said, it will have an effect on both these all the three, in fact the cylinder loss the D and S grain damage etcetera. So, it has been seen that for all these there has to be a engineers point of view, and a trade off between all these values, and the dimensions which we choose, while we are talking of the evaluating the performance of the thresher.

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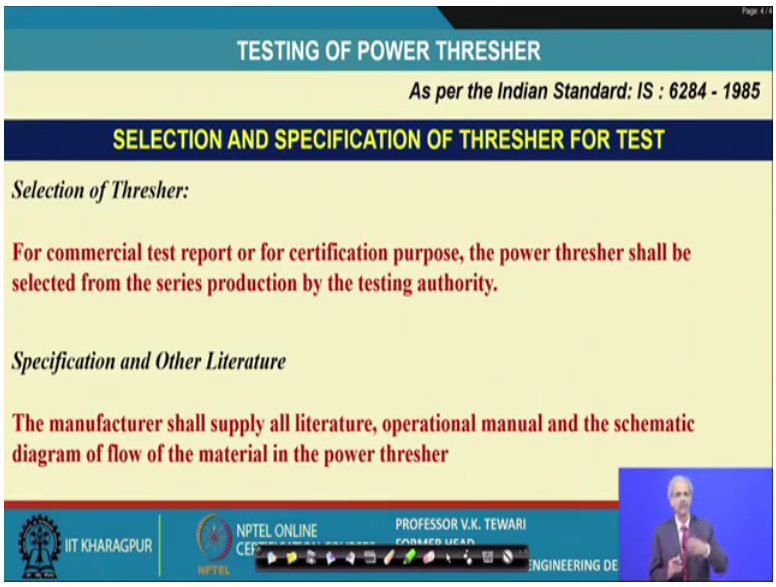

Well, selection and specification well testing of power thresher. Now, when we are talking of thresh, we have talked of the parameters. Now, when we talk of testing, because we need to certify that as an engineer, you will be require to do this. And BIS has put standards, which must be followed. We have just taken those standards over here, and put it slightly in a different fashion, everything remaining same, we have not anything modified anywhere about the parameters, and the procedures, and the data to be collected and to be reported; we are not done anything on that we have just reported that. But, since it is very essential as an engineer agricultural engineering, you would be required to test these and then certify. So, you must know the procedure behind doing.

So, first of all you must select, how do you get suppose a manufacturer comes to you and say that I have designed a thresher, please test and certify whether this is worth market

marketing or not. He may also get he may also apply for some sort of subsidy, which the government gives a particularly as concerned in case of this country India. So, he would like to do this. So, how do you select. In fact, he would like to give you one machine, but then that is not the procedure. What the procedure is that you should go, and see the lot of all his threshes, which he have made, which he has made. And then out of that you should just randomly pick up one. And then mark all these, things keep all the details, maybe that you can put some stamp etcetera, and then take those things along with some literature etcetera, and come back.

And that machine only he should be in a position to he should be in a position to send to you for testing that has a particular idea behind that, because it may happen that the one, which he is bringing may have the right kind of material, right kind of dimensions and everything that he has taken care of. But, in the subsequent or other models, he may not do, in fact that he may do later also. But, then when you have randomly picked up, at least this certificate will early for a period of time about 3 years or so. Now I think it has been increased to 5 years recently. So, up to 5 years this is so, but there should be a check on his material of construction of the various components, which he is blowing.

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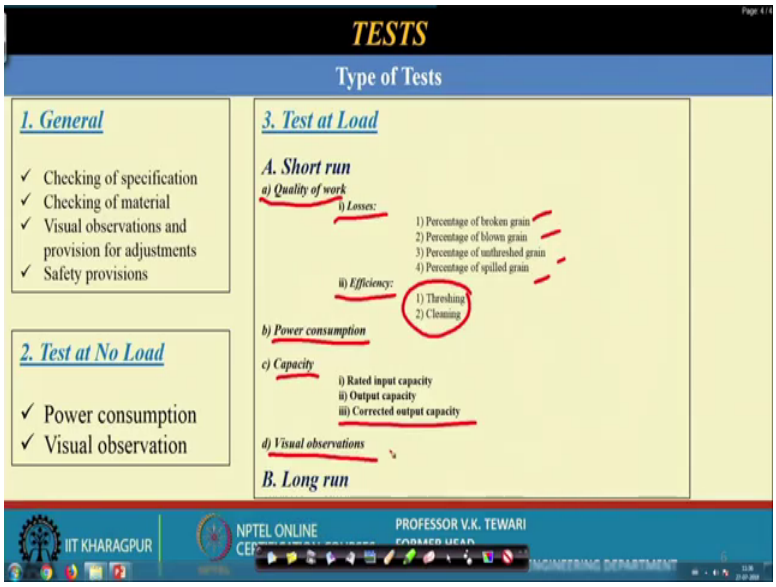

Now what are the things that we should report, when we are trying to test and give a report what do we do. See the general specifications, for example it is given here. What general specification, general specifications are there, that what is the type of thresher,

name of thresher, make of the thresher, size etcetera. Then visual observations and provision for adjustment, safety provisions, we need to look into that. Then test at no load.

Well it is essential, when we are not threshing something at that time we may like to test this. So, what all that power consumption, how much is the power consumption of that particular thresher, we have talked of the procedure for determination power consumption in our previous lectures. So, you need to find out what is power consumption of this, may be that this is ok, but it consumes lot of power. So, you have to find a check over there that is why test at no load is essential.

Then visual observations: visual observations are very important, because then they give you a look, they and some idea about the quality of the material made or quality of the whole product itself, which is very important. Because, if you were aware that it has a appeal, then only it will go to the market that is number 1, because ergonomics is one, which also talks of the requirement and liking of the people, while it is giving a good quality work done. It must have some appeal to the consumer, who is coming to buy. Therefore, as a designer, you should insist on him that you should have a proper colouring etcetera and proper marking, so that it will appeal to the person, as well as it will have sufficient safety observations and safety aspects, which are written or clearly defined over there on to the machine. So, these are the things, which we require.

Then test at load. When you want to give a load, what sort of test you should give. Now, there are as such if you a recall, we had discussed about testing of other equipment as well. There also we have talked of short run test and long run test, because short run test also give you some idea, but that cannot become a reporting matter, and we need not go for large, because it may happen that in short run test, where few hours testing everything may appear fine. But, once it is subject to a long run, then the problem comes, and that is why it has been said that.

The testing must be on the load, it must be for a short run, and then must be for a long run. And their specifications or details a specifications are given. Say for example, losses; see efficiency. Now, quality of work, we need to in a short run, we need to find out this part, where losses and efficiency could be found out, what is the efficiency of threshing, what is the efficiency of cleaning. Similarity, what are the different losses at

that time. You can see that all these four losses; we must see what are the value for this. Then the power consumption, what is the power consumption.

Then the capacity of this: rated input capacity, output capacity, and corrected output capacity and other visual observations. If you have tested for 3 4 hours maybe, and then you find what sort of things are happening in that you will if you are alert, you should be able to see everything in the how the movement of the grain is coming, and how to this straw is moving, or how the material, when it is fed, how smoothly it goes and all that. These are some of the things, which you like and the safety thing safety aspects, which are given in the design are they effective or not. Some observations visual observations are important, which we do in short run, and have some idea about the whole machine. After that, then we should go for rigorous test, what we call long run test, so that is very important.

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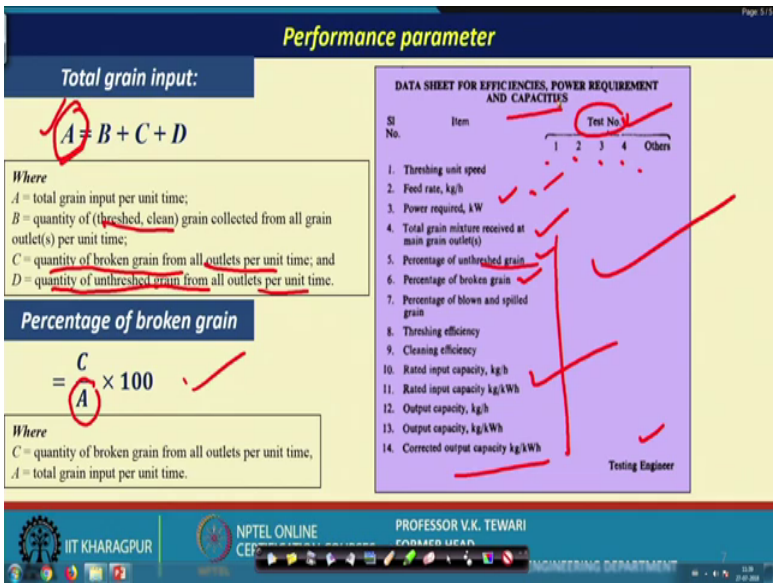

Well, performance parameters. Then definitely we are talking of see what we do, once we have the grain or once we have the crop, we would like to get the maximum grain out of the straw at the whole crop. And the straw must be cleaned at the same time grain must be also cleaned, so that is the aim. Now, so when we want to find out the performance parameter, we will definitely look for the total grain input per unit time. What is the total grain input per unit time, now we see here that A the total grain input per unit time is what is available between B plus C and D. See quantity of threshed clean

grain; then the quantity of broken grain from all outlets and then the quantity of unthreshed grain from all outlets. So, if you put them together, this is what you get the total grain input.

Now, percentage of broken grains; so if you want to check what is the percentage of broken grain, so if you know the quantity of broken grains from all the outlets. Then that by the total A is going to give you the percentage of broken grain, where C is the quantity of broken grain from all outlet. This is in fact, region here and total grain input per unit time.

Now, the data sheet how this information has to be put in data sheet for efficiencies, power requirement and capacities. Now, this is the data sheet, which is given over here. Now, as an engineer, you are supposed to do this, and then put them properly. Now, you see the test number are given here, how many such tests you are going to conduct. It virtually talks of the replications of this, because then you must carry over a period of time, you just cannot do for some time, and then say that these are the values, you have to carry.

Let us (Refer Time: 17:31) it for example, it is threshing unit speed say maybe 1, 2, 3, 4, 5 several speeds you have to take, those speeds will talk of. Then the feed rate, then power required the total grain mixture received at main grain outlet percentage of unthresher grain, percentage of broken grain. All these parameters then you have to while doing this test, you will have to measure, and you will have to record them over here, and with your taking a signature at this point. So, this is the data sheet for efficiency power requirement and the capacities different capacities. So far as the reporting is concerned.

So, you must look into these parameters, and report them properly, judiciously, meticulously, so that when the it will goes to any authority, he will be able to appreciate your sincerity of purpose so far as testing is concerned.

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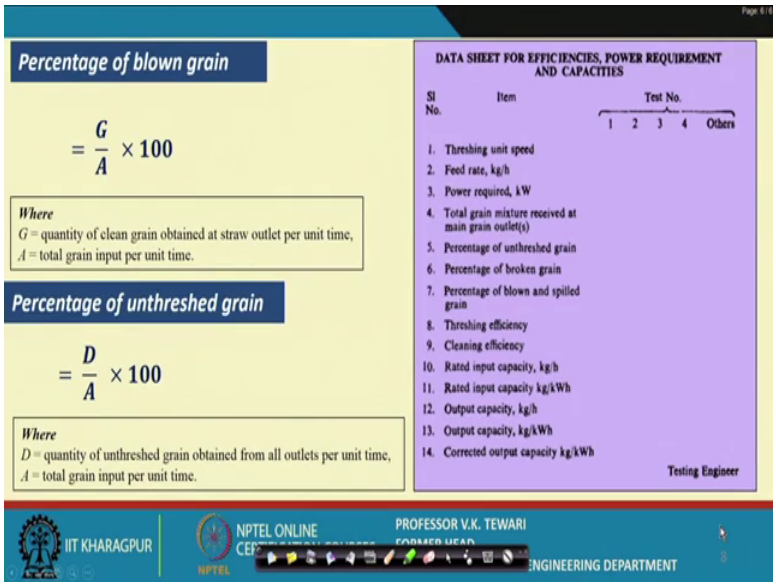

Percentage of blown grain: definitely, once you know the amount of grain, which is outlet gone clean grain obtained at outlet by this, so you can get the total. Similarly, for unthreshed grain, if you know the unthreshed grain per unit of the total grain, which have will give you the percentage of unthreshed grain. Now, this has to be put again in the similar fashion, you have to report. As we have reported in the earlier case, you have to report here also.

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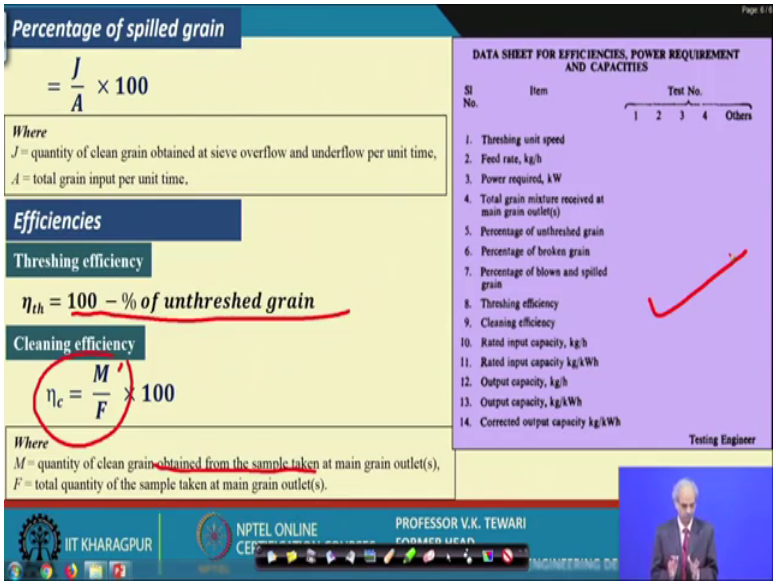

Percentage of the spilled grain: quantity of clean grain obtained at sieve overflow and underflow per unit time. As if you know the total grain input and how much is this spilled grain you were talking of that means, how much is the clean grain obtained, so the ratio of that will give you percentage of spilled grain. Similarly now, when we talk of threshing efficiency, now threshing efficiency here 100 minus percent of unthreshed grain.

So, this is what is going to see. We would like that 100 percent threshing must take place, but percentage of unthreshed grain we know, because there will be such thing happening. This has many aspects and as we consider those it is not possible to have 100 percent threshing. And therefore, there will be some unthreshed grains and hence if you subtract that from 100 you get the threshing efficiency of the thresher.

Similarly, the cleaning efficiency, see we would like that it should be clean as clean as possible. So, the total quantity of sample taken at main grain outlet and the quantity of clean grain obtained from the sample taken from this. So, it will give you few samples you need to take several samples in order to see that you get a correct idea about the cleaning efficiency of this. So, when you take samples and get this M by F you should be in a position to find out the cleaning efficiency of this. And then, accordingly report on this particular data sheet which is provided by the BIS organization.

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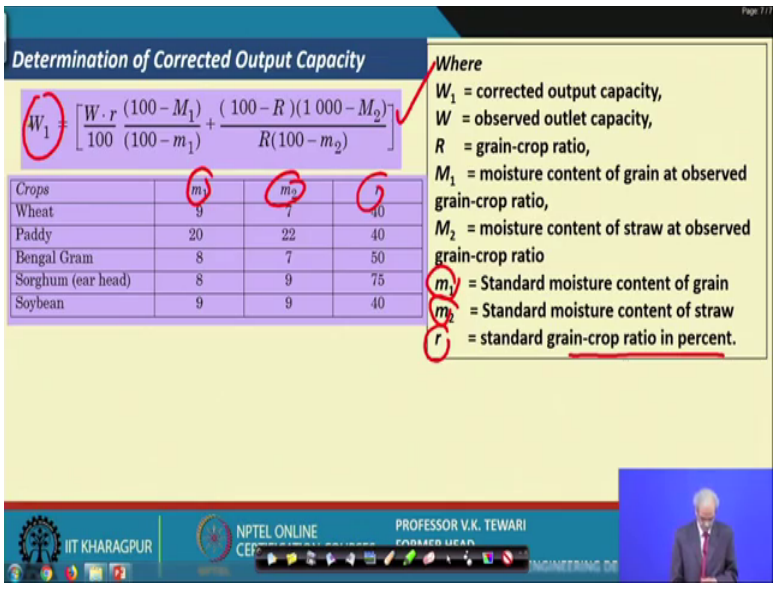

Determination of corrected output capacity: well this is another important parameter which must be done. This correction particularly with respect to the moisture content, and the grain crop ratio; this is particularly with respect to that you can see here that m 1, m 2 talks talk of the moisture content of grain at observed grain crop ratio, moisture content of the straw at observed grain crop ration of grain and straw

So, similarly we need to know about the standard moisture content of the grain, and the standard moisture content of the straw. So, this particular empirical equation has been found out; has been used actually for finding out the determined corrected output capacity when we want to correct tell about the thresher. So, for some of the crops, we have given you here which you can always have a look at particularly with respect to m 1, m 2 r, and where m 1 is the standard moisture content of grain, m 2 is standard moisture content of the straw, and r is the standard grain crop ratio in percent. So, these for some of the crops are given for information and it will help you in using it over here, so that you can get the corrected output capacity of wheat, paddy, bengal gram, sorghum or soybean.

So, these crops you can get.

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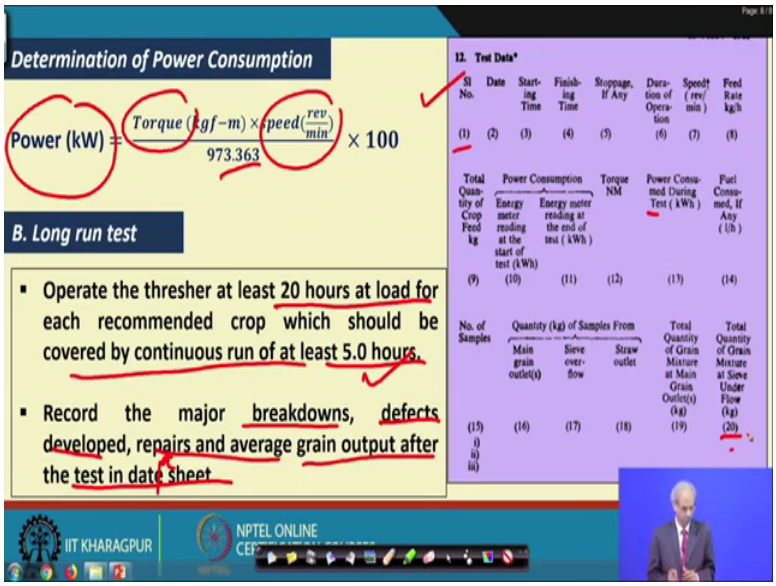

Determination of the power consumption: well, it is very important we had if you recall we had given you how to calculate the power consumption of a thresher. We had talked of the (Refer Time: 22:28) theory. Now, but generally how we do particularly when we

would talk of what is the what is the torque at the excel of the thresher which is in fact rotary and then find out the speed and that is how we get.

But then if you going to all details of the drum which has a air velocity wrapping, the wraping this drum while it rotates. So that way we had considered every aspect of the air and the material which was there and that way we had got some value. Now, here at the; what BIS wants you is that you should be in a position to find out the find out the torque, and the speed. Just we find out the toque which is in fact the torque of the thresher and the speed at which it is moving revolutions per minute. So, this being the because of the it is because of the units that you get this and into 100 will give you percent so kilowatt in fact into 100 know, this will in fact talk to you about the total power in kilowatt it will talk to you in kilowatt.

A long run test now long run test when we are doing see, operate the operation the operation of thresher must be at least 20 hours at load for each recommended crop which should be covered by continuous run of at least 5 hours. Now, you this is very important when we are talking of long run test. See, long run test are essential and have to be done anyway, but then it is important that at for continuous run of at least 5 hours which should be at continuous run of 5 hours, it is not that total time we have taken 1 hour, 1 hour and then say 20 hours, no continuous run of at least 5 hours is very important as it is said

And then recording of the major breakdowns, the defects developed repairs and repairs and average grain output after the test and data sheet. So, the data the here is your test data sheet. Now, these are the details of that where you get everything about total quantity of the crop fed, then power consumption, then torque, then power consumption in the test, then fuel consumption etcetera every detail. All these things are given number of samples and quantity of main grain outlet, sieve over flow, straw outlet, total quantity of grain mixture, the total quantity of grain mixture at sieve under flow kg. Now, these are the 20 items from 1 to 20; these are the 20 items which are there. So, these items must be looked into while reporting the values.

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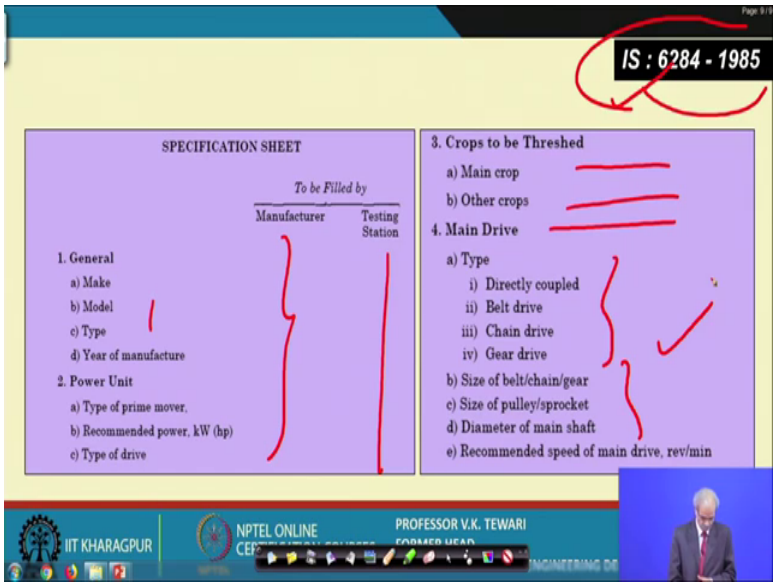

Similarly, for the specification sheet: yes, it is important to talk about this here this is the BIS standard which we follow. And the specification sheet to be filled by the manufacturer and testing station. Now, here all the details must be filled by the testing station and the manufacturer will give it here. So, there will be a comparison between this what whether whatever he has written, and when we see with the observations whether they match or not this is very important to recommend. Similarly, crop threshed the main crop, the other crops, main drive what is that directly coupled, what is the type of power requirement, how it is connected, all these details are to be provided in the specification sheet which is given by BIS which you have to follow.

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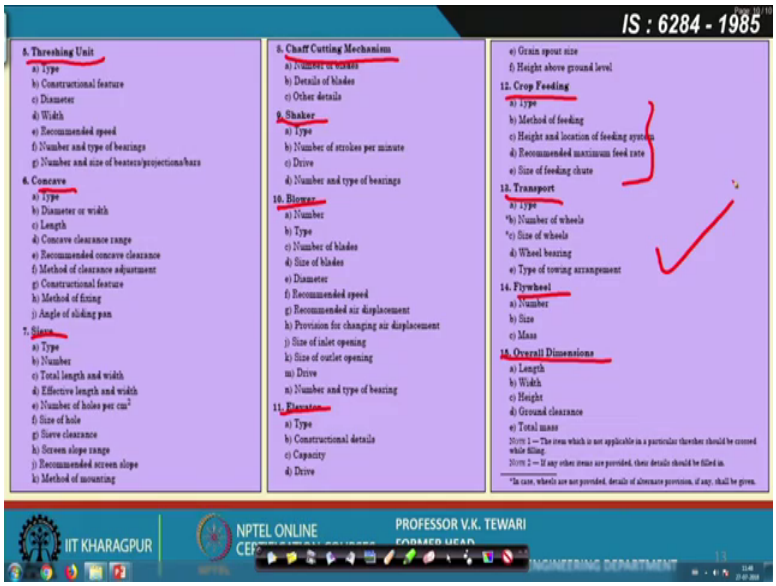

This is the in fact a long list for that matter I must have a look at this say for a threshing unit. So, the details of the threshing unit type construction features diameter width similarly the concave the type diameter or width. Similarly the sieve what is the sieve which is used, because then materials are sieved out then you have the chaff cutting mechanism cutting mechanism which is there; the shaker which is there, which is cleaning, and separating the chaff from the grain. Then the blower which is blowing out and giving the brown sow on one side and the green saw on the other side. The elevator, elevator after it is threshed it, and it is cleaned it has to go to the elevator for bagging etcetera. So, these are important.

Then crop feeding, what is the method of feeding, what is the height and location etcetera. When the person is feeding, you might have seen in this that a platform is there these people get up and then try to put the material. So, we need to look into that because there is aspect of safety consider, so that is why we have to have an clear observation while the testing is going on. Similarly, transport, how you what are the transport wheels whether the wheels are can be stalled at one place or not can be we can make it stand at one place when threshing is going on, what sort of provision given all details and overall dimensions flywheel details everything has to be looked into and provided in the sheet which is given here.

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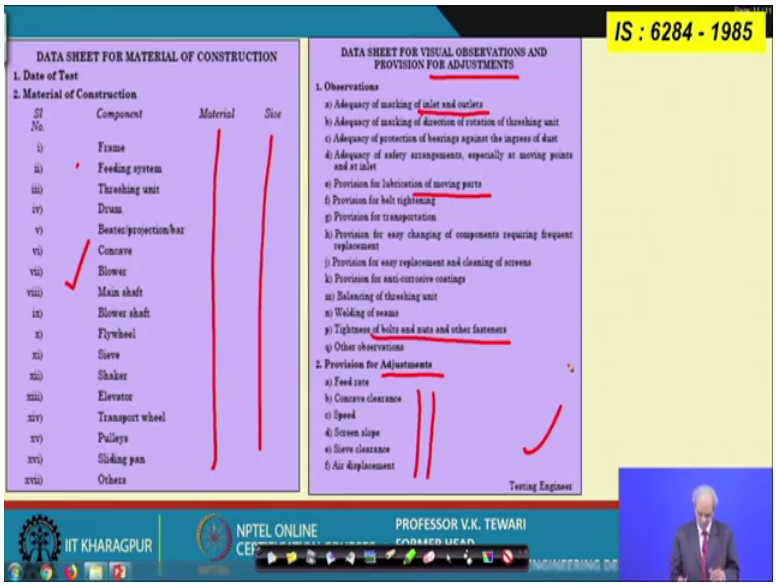

Further information about the date of test material of construction: yes it is very important. We also discussed you with you in one of my classes that what should be the material of construction of a particular component of a particular equipment. And this is very important over here that what the material the person has used, the manufacturer has used here what materials he has used. And what is the size of that. So, for each and every item over here material of construction what he has given and maybe that we would like to also test maybe random or even we should test each material after the use and before they used to check, how is the longevity of the material whether he is using a right kind of material or not.

Otherwise, the breakdown will be more and then it would be a loss to the farmer who has taken this. Similarly, data should have visual observation very important visual observations and provisions for adjustments many a times. Say adequate marking and inlet and outlet you just see, these are important. Similarly, we provisions for lubricating moving parts there should be provisions for moving parts or not. Similarly, I am just picking up some of these parameters and in that go through that you will if you go through the details you will definitely have a look.

But then, I am just going through this (Refer Time: 29:33) tightness of belts and nuts and other fasteners, how tight they are and all that is it loose and all that. So, you have to look at these parameters when you are having a observation, visual observation of these

the thresher before you testify that. So, adjustments what sort of adjustments for the feed rate for the concave clearance and other details are given sieve clearance etcetera, you must watch for that, and then the test engineer signature over here. So, these are the important things which we need to look into.

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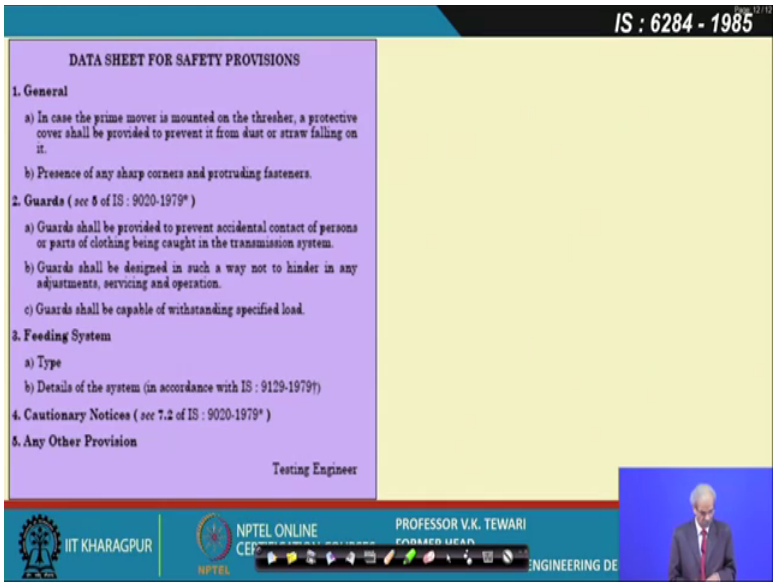

Data sheet, for the data sheet for test in safety provisions definitely we must have safety, because maximum of the accident which have taken place in this. So, the safety provisions must be looked into a how the feeding is taking place. So, it is very important, and this clause must be taken care of the test engineer must get satisfied, and then only give a signature of this over here.

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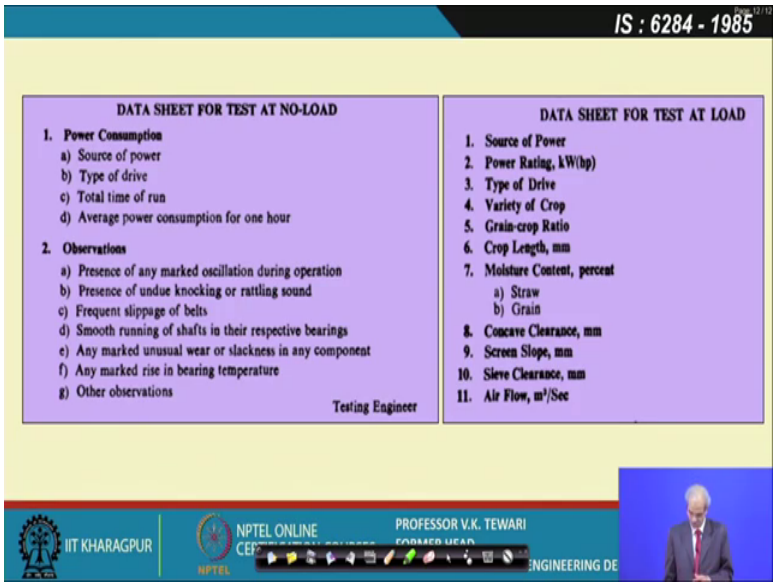

So, data sheet for test at no load and then data sheet for test at load. Now, the concise with respect to power consumption, observations, sources other details, which are given. These are the concise information which are wanted.

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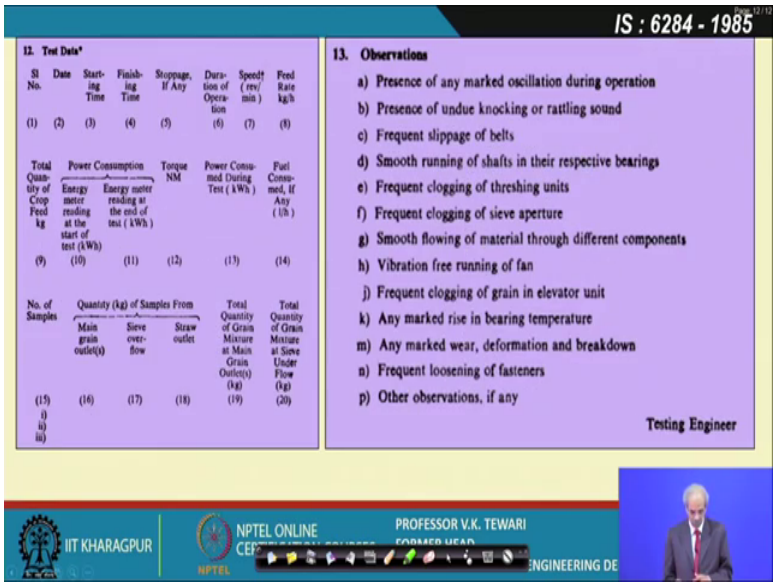

With same thing which has now given over here test data, which we had already shown to you earlier; and the other observations which are given over here.

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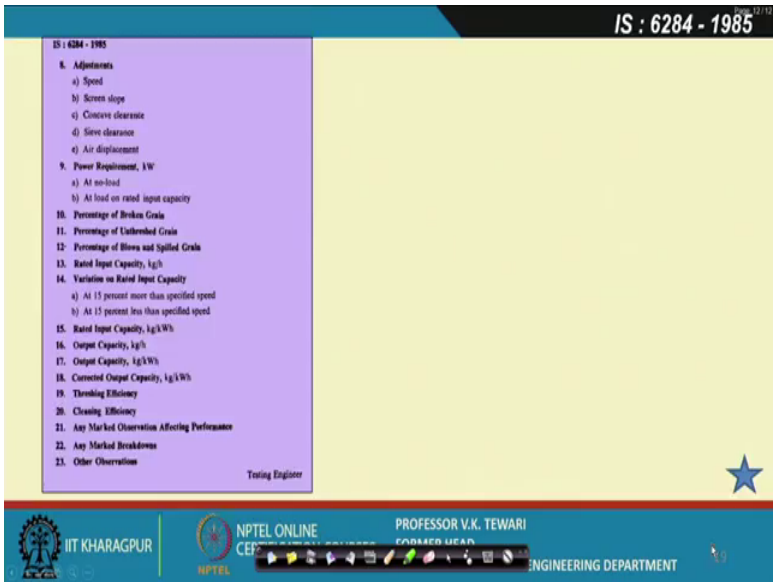

Well, I think with this we would like to conclude testing, because all details of testing the crop parameter, machine parameters, safety aspects everything must be considered; and you should be very careful while you are going through all the details where you are sampling you are you are giving a short run a long run test. And then all procedures proper recording must be done with all truthfulness, then only you can be said to be a good tester and certification certifying agency.

And, I hope we have tried to give you this information. If you have any further questions we would like to answer you as and when you required this. And we closed here.

Thank you.