Electronics Equipment Integration and Prototype Building

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Lecture – 10
Improvement on Marking and Skill

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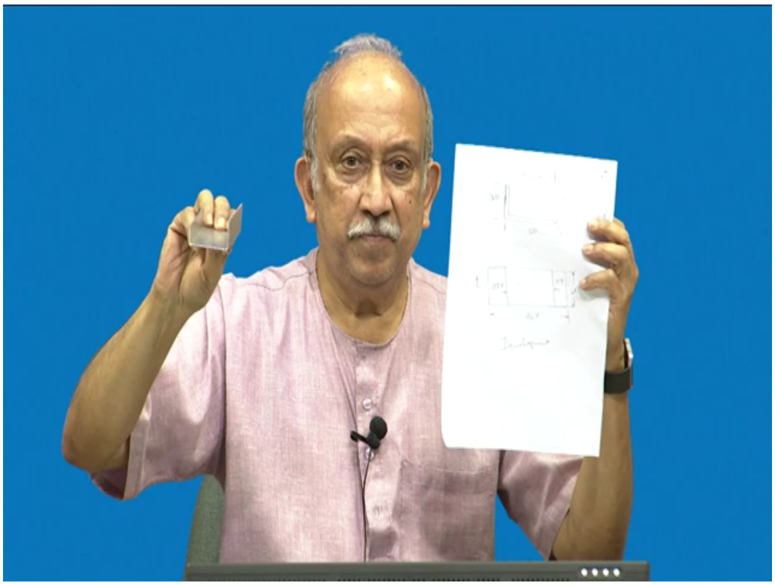

I am continuing with where I thought a head left off and also get back to few of these fundamentals, do not worry about it, I have taken a picture of it. This is the small sheet metal part which my colleague in the workshop has fabricated.

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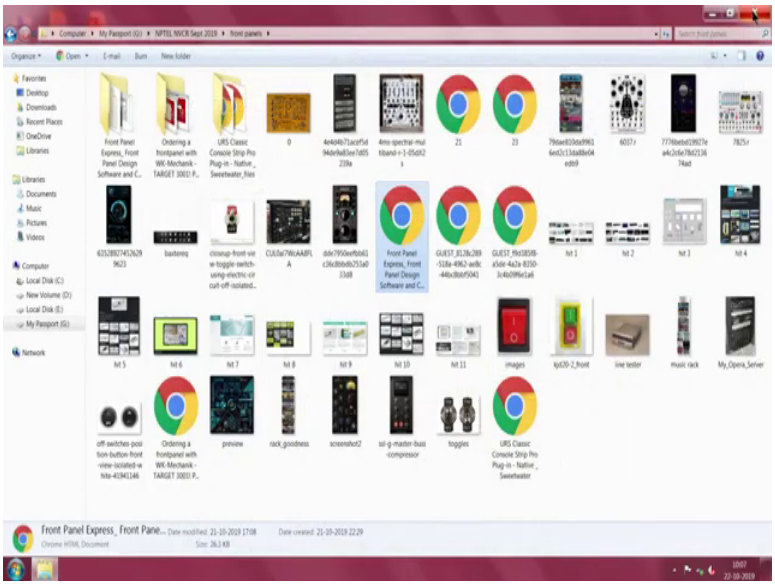

The issue being, it needs very very complicated and highly skilled operations.

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These highly skilled operations; if you remember I had I do not know whether I have shown you or not; all for just making this small timer, they have gone through just large number of this thing. I will quickly go through this; it is nothing, it is just that you know saying we can make the timer in the conventional way.

Now, we will take it to the workshop. I have just showing how it is the difference being in this case; instead of going through that elaborate calculations and so on, we have made a template stuck it on a bit of raw material and we are going to make all these things as they are. This what I had shown you, this particular you know there is a blank which a already; if you see there at this point, this is the blank which is already kept it on the machine. This machine was used for making the blank, it has kept here; then we have something here and because this you know what it is, the video is followed afterwards.

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Now, one thing you have to notice is that, 45 degree or angle thing is very easy to generate in CADD.

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Which by; if you want to use this, it is not easy to do the marking on these things, standard basic marking. They next what you call demo will show you that, there is no issue about the horizontal lines and vertical lines also is there no issue. However, if you want to make lines of some arbitrary or derived due to procedures in laying out if they have come, it is not easy to make those things.

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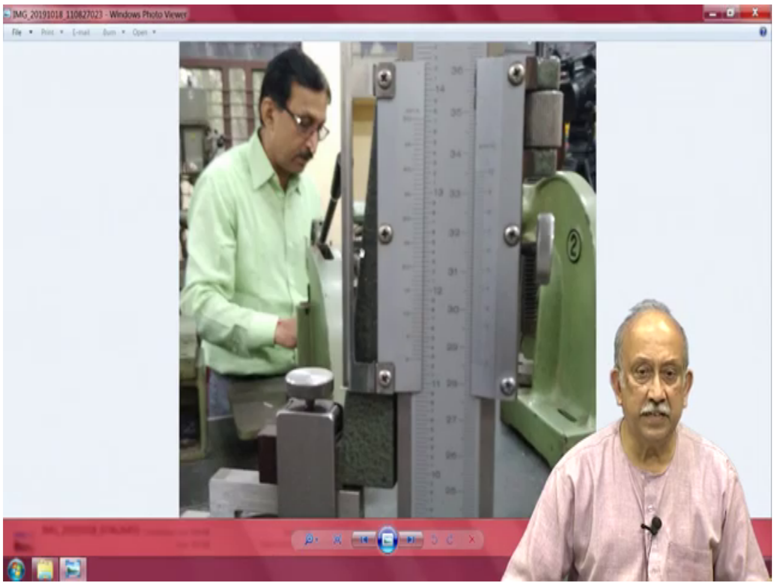

Because see it looks here; if you look here, it is not easy to even read these things. And this one in fact, has a provision for attaching a lens, lighting and one has to be you know really sharp and tremendous amount of collaboration is required to see that this marking edge, ok. This is a marking edge, this marking edge has to exactly coincide as for the skill that it shows here; not easy to read is not easy, to make everything is not easy.

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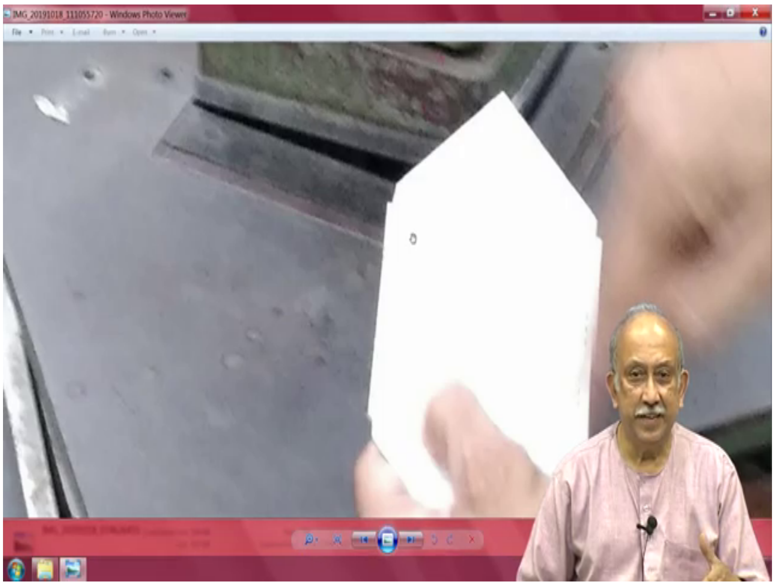

In contrast, if you have to just take a simple print out in your any printer.

The normal printers we have at home is ok, even in the office the accuracy is about the same; depending on the conditional the printer and all that, a minimum of point 1 to 0.2 millimeters you will get over the total length of 290 millimeters, actually it has 297.

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And afterwards, once these are marked here; you see here there is a bending line, then there is a slot that has marked here and very easy for us to follow these things. I will say if it you know, can you see there is something here very very tiny device, any small this thing can be done.

And see there is trying to set up the machine, after that necessary reliefs have been made; there is a small relief here, we can see it here, he has used at normal hexagon. And the critical thing we need to observe is, they wanted limb versus the other limb where things can change a bit. And same thing here; if you want to ensure that these limb dimensions and all come properly, it is very easy for us if you have a template, else you end up having to market; you see here, quite easily he has done it.

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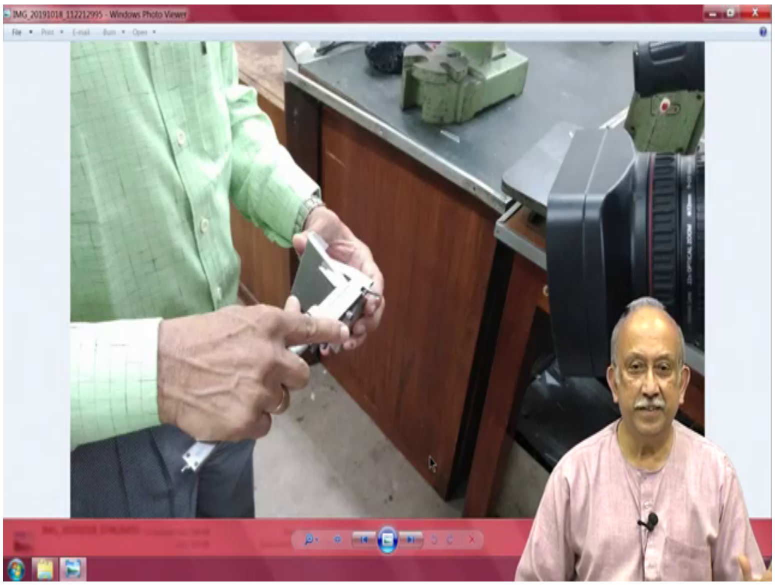

Next what you call set of slides will show you this and finally, he is measuring whether the dimensions are or not.

This being the first phase; let me be honest, they were not to my satisfaction.

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So, this is not encouraged, but still one part which comes last, the final cover; he has try to take a equivalent sheet and then he has try to bend it. You have seen it here, he has try to cover it and made something which is tolerable; but not to my not to the standards I expect. Seen here, did not come out well and even here if you see; there is a little bit of projection and the radiant match and probably you know quite a bit of stuff.

Just to show you the conventional way and difficulty in making it; I thought I will present this to you. While it is also useful in case you really have a access to a workshop or a professional shop, and you are one of those people who enjoys highly technical items. Saying if you are a serious hobbies or you are one of those I will say hackers, who enjoys taking things under control.

Point being here is somebody has to give that person an actual drawing of the part we want. So, I made a drawing of this part and it is a part drawing. I will show you back at where the drawing is; then probably you will appreciate it better and let me go through why, see here.

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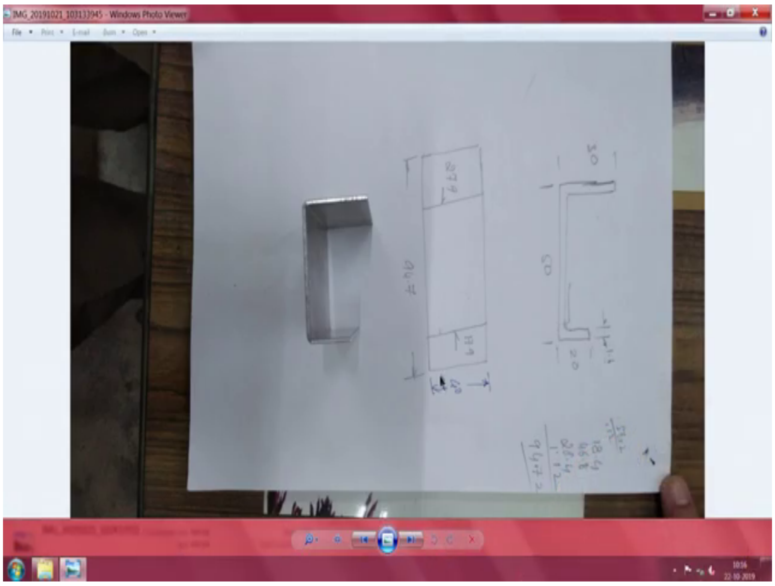

If you see this here, now I wanted this limb to be approximately something; something here and something here and unfortunately things like this you know I wanted this much, that much does not make much sense to a person who has to fabricated as per your instruction.

So, easiest way for us to make a sketch; see here this is a sketch, saying this limb I must have a 20 millimeters. And in the case of production we also add a what is called a tolerance and fit and a allowance on this same thing; this limb has to be 50 and this limb has to be 30. Now, comes the important aspect of what is called how to calculate bend length. So, you see here either way I go, I end up with a very peculiar 20 plus 30, 50 and 50, 100 millimeters; you know very well that it is probably not 100 millimeters, but then we also have a small thickness here, can you see here 1.6 millimeters.

So, now how do we carry out this calculation? So, traditionally what is being done is the internal dimensions are added up, this represent the 20 mm limb, this represents a 50 mm limb minus 2 thicknesses, and this represents 30 mm limb, these are added up and added to that factor called the added bending allowance is given to that. In our parallel lines we call it z, because I mean we are used to it. So, for that depends a lot on thickness of the material and how it is going to be clamped inside, the bending minimum bending radius that can be achieved safely.

And this is a empirical constant, it depends very much on the type of material they what you call various other factors very much related to how the material gets squeezed in between, what is the direction of grain, what is the hardness treatment that has been given to it. Soft materials behaved differently from brittle materials. And in the end we do have a beautiful piece here, can you see something about it; if you see carefully this piece does have an internal radius whether you like it or not, depending on how you have clamped it plus a thickness. And if you just take the internal dimension; internal dimension will be starting from this point, internal dimension is starting from that point.

Alternatively if you take an external dimension; so there is two ways of doing it, if you take the external dimension, there you have seen total will come to a 100 millimeters and then you have 94.7. So, 100 minus this 94.7 will give you a deductible allowance. So, that will there is a lot of difference; have you seen here, so it will come to 5.3. So, which will come to a approximately 2.65. So, we need to deduct 2.65 from both these items, some places they follow such things. But in our case because of the issue about clamping it which I have gone it to come back to it; you see here something, you see a designation here, the designation here shows that this part is clamped inside the machine.

And here it says in another way you know this part is clamped inside the machine, I will come back to it later. Using all this and we traditionally have been using this 0.56 is a related for a 1.1 1.5 millimeter material with an internal radius of 0.5 and done in our folding machine, where the length that is not to be altered will be inside the clamp, inside the fingers. So, instantly if you see, if you add this to this; you understand if you add 18.4 to this thing it will come to a approximately 18.96 which in some other context should make sense for us.

But you see here though it is has internal 18.4 something else is marked here, 17.9 is marked here. So, why is 17.9 marked here? This particular thing is related to the way or machines work. We have a finger which holds the removable part, then after that the internal radius is added to that. So, if you say internal dimension minus that 0.5 may need to mark a line here. So, that is how it has come. So, we have an internal dimension of 18.4 minus 0.5, 17.9 is marked here.

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Advantage of this is; now this line is used for clamping it. Now, I will get back to this you see here we have, a developed length which has been calculated and is trying to share it to the necessary developed clamp. This is the open thing and mind you there are fingers here also which clamp it and much more important is, there is a straight edge and a back sharf.

Right now the back sharf is been what you call it retracting; then after that if you go here, you see here this is the machine which is at the back. After carrying out all the necessary markings and calculating the length; it has been fit to the machine and this is the wanted phase which we want to which has come out of the machine.

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So, he is just picking it up and is doing a various things you know, including this particular thing is called debarring.

So, unless the machines are in nowadays call some new what you call laser, cutting machines are something; traditionally burness all waves formed.

So, here we have a scale or a straighted; in this case it is a damaged thing and this is red thing saying do not use it for measurements. And he is using it to make sure that there are no burse on that. Now, sorry for you know a sort of going through in a very funny very quick thing. The point to which I wanted to make right from the beginning is, after having done all these things the most important is trying to make a marking.

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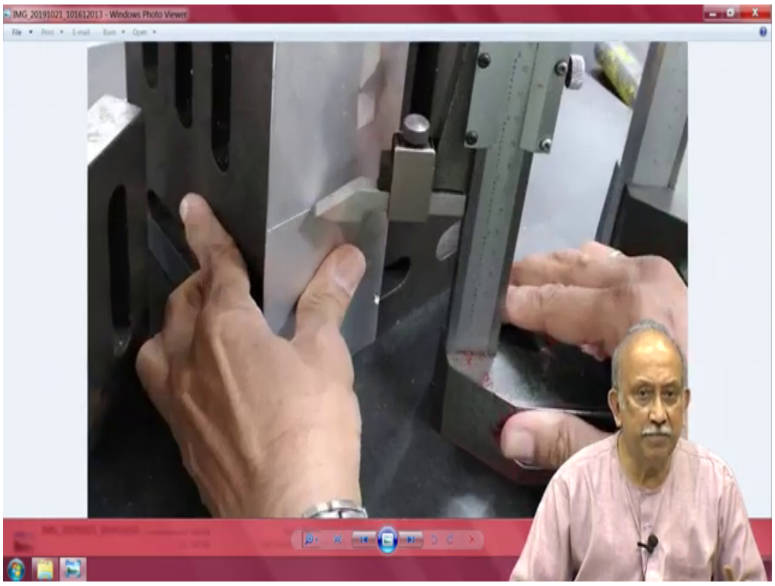

Say what we wanted to do is, mark it here using a vernier height gauge; vernier height gauge is are normally used only in very accurate work. But the problem is everything depends on how well the this bottom, it is a stone, it is a granite stone how well it is maintained, how well it is lubricated and kept. And something equally important is how well is this marking edge maintained. Now, you see already it has a thickness and it is already showing a thickness. So, it is no longer a zero thickness line and not a very comfortable way of trying to handle it, see here.

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The operator is forced tilt it, take it out from the stand and try to look at it.

Is this how it is not the best practice, but we hope things fall; and then some of you belong to India will say what it is, we believe in somebody to take care of it. So, here what is done is, normally the proper way is it should be at an high level and you should never take it off from the surface.

Now, with these restrictions it not easy to actually read and mark things; seen here he is trying to point to me saying, sir you see this is the one. And eventually marking is done here; can you see here this is what I was trying to show you not easy to make the marking, it does get done.

Somewhere all the pictures are there, larger thing, I will get back to that and show you again; sorry for this thing, because I am forced to go back and forward.

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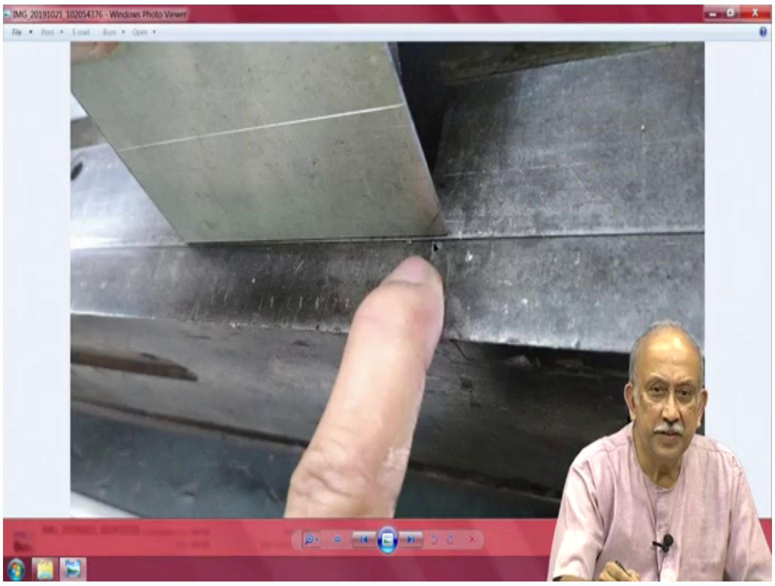

Now, having shared this machine, having done the marking; we now go onto the next operation saying, we have to get ready for bending. You see here, here if you see this is a folding machine and there is off course are long paper and then you can say this two lines are there and this is the clamping finger. What that clamping finger does is it holds the material underneath.

So, they my colleague the operator is trying to show me how to move the finger back; to move the finger back is supposed to give that 0.5 millimeter plus one thickness of the material. So, this is a thickness after that, he is visually he is you know he is very what you call a skilled at that 0.5 millimeters thing.

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So, he is now that is the finger which is clamping, you may not be able to see the line; this material is now under the finger that clamping finger. Now, you see here, may be you will be able to see a little. Now you see here is, what he has done here is; this is the thickness of the material, then that 0.5 millimeter, total approximately 2 millimeters are there and these lengths can be changed, it is a modular device.

So, see first of all a little gap here and then you see he is leveling this, and for leveling it you have some other arrangements. Right now what seems work best is, we have a draw and then he adjust this what you call operating liver and the draw it sets on that well.

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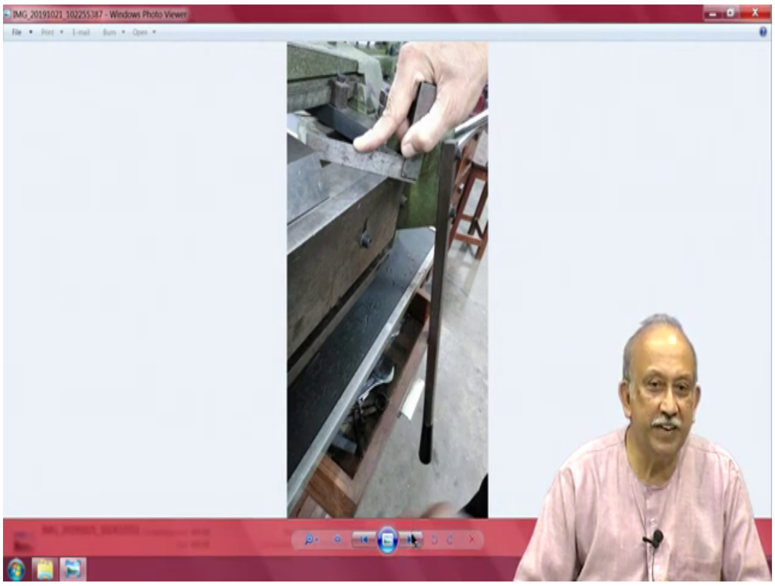

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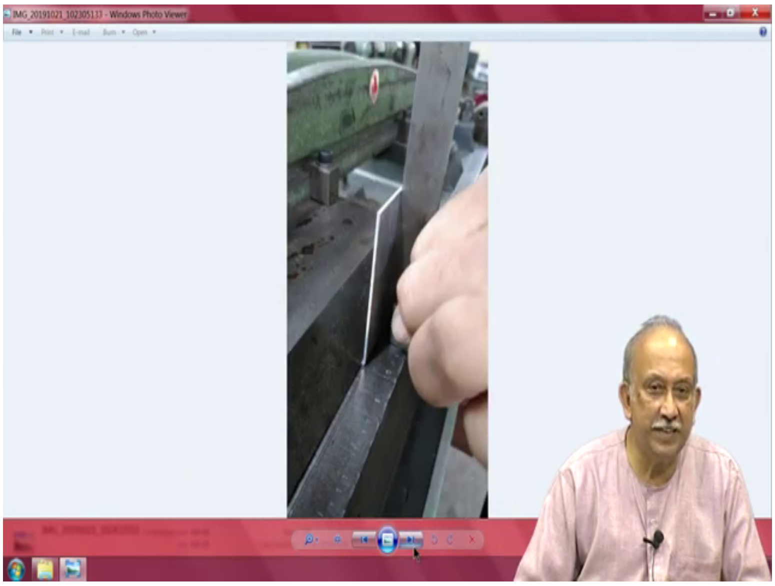

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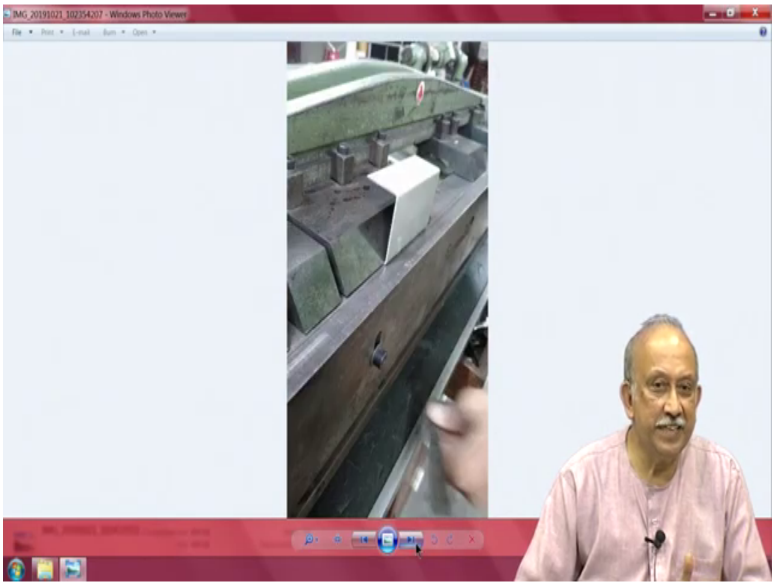

Can you see here, that make sure it is level; once it is level they after the bending limb is formed well, after it is formed is taking a try square and checking that we have a perfect 90 degrees. Can you see here, it has been bend twice; other direction also is checking this.

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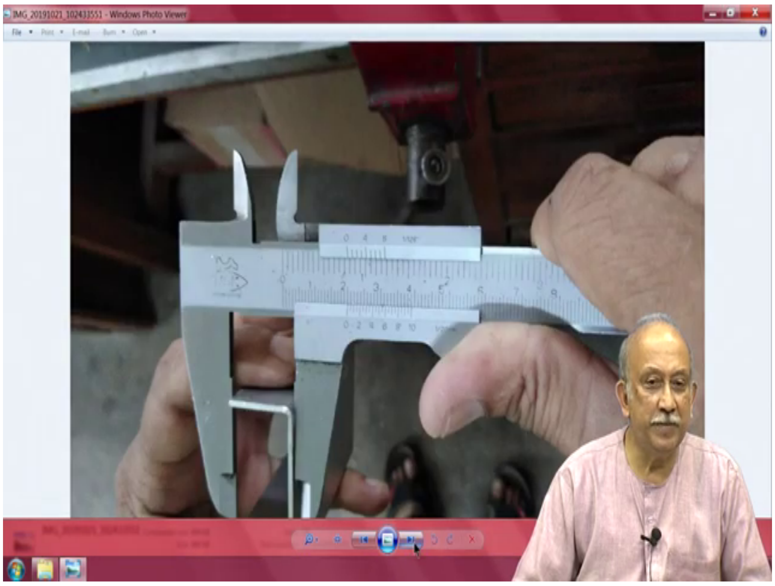

And now the basically the job is ready. Now, you see here; if you have done the calculations right, seen that know we have taken the inside dimensions, then we have added the extra bending allowance that 0.56, then the machine has been what we call set properly and a limb of 20 mm pressed away we have it, good.

This looks a little like, is it not a technicians trade you know, it is not a technicians trade not all a technicians thing; if you want something work, you need to be familiar with it. Same thing with the 30 millimeter limb, same thing with the 50 millimeter limb; it did not focus, see all the lengths have perfectly matched.

So, what I wanted I got and why this? This is the focus says is a very complicated way of doing it. One of the first thing is you have to determine the actual part what we want, dimensions of the part which is where I feel now or CADD, any CADD system will work; second part of it is how to make the parts fit properly.

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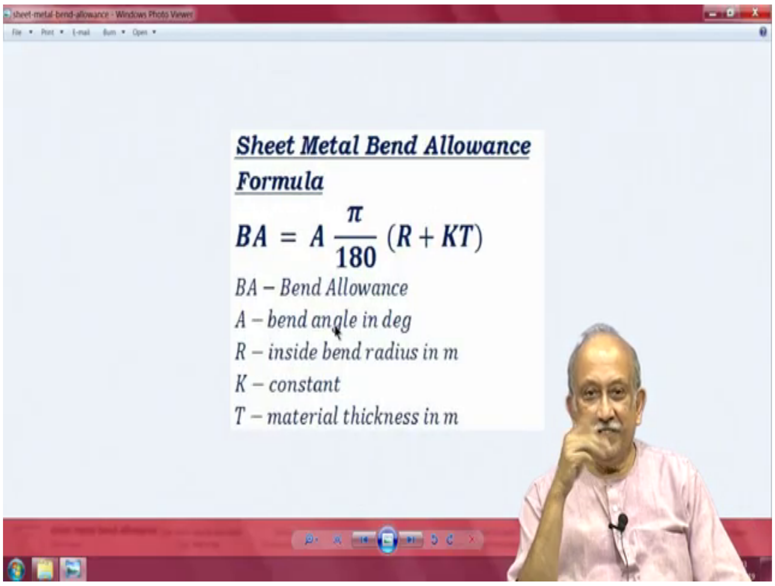

So, the next I will go up; to calculate this is that bending allowance we have any number of this formula which are mentioned in the web. You seen this, this particular case we have the inside bend radius and we have material thickness; I do not know here it has meters or it is millimeters. The important thing we end up with this is only K, where do we get the constant. Like all other engineering calculations, our part comes to how do I determine this K constant. So, if you go into the, this I could not unfortunately save these things.

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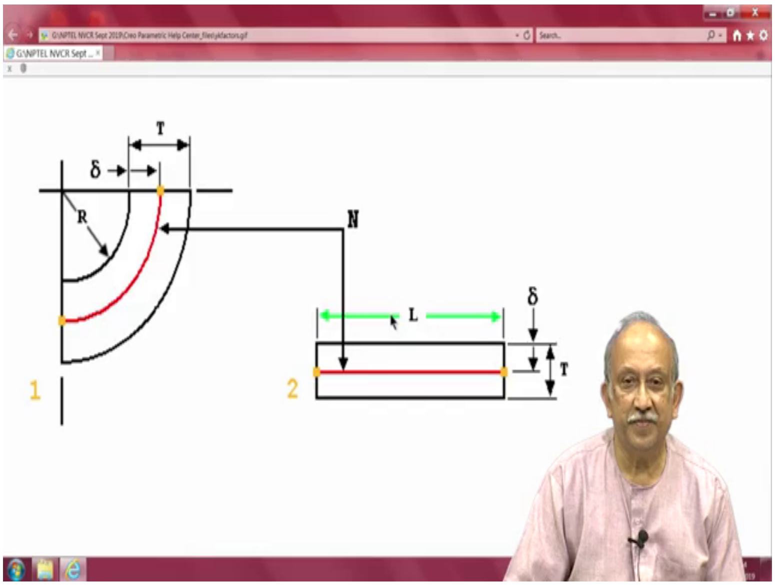

A lot seems to depend on where exactly does this, so called neutral access end up with.

So, we have a still a problem; in the thickness of T where is the offset of the neutral access which has not at all so easy to get remained. Hence it has treated empirically and depending on the type of fabrication and machinery and so on; generally the shop people are familiar with it, it just takes you know that way, we just use it in one of our this things and then try to do what best.

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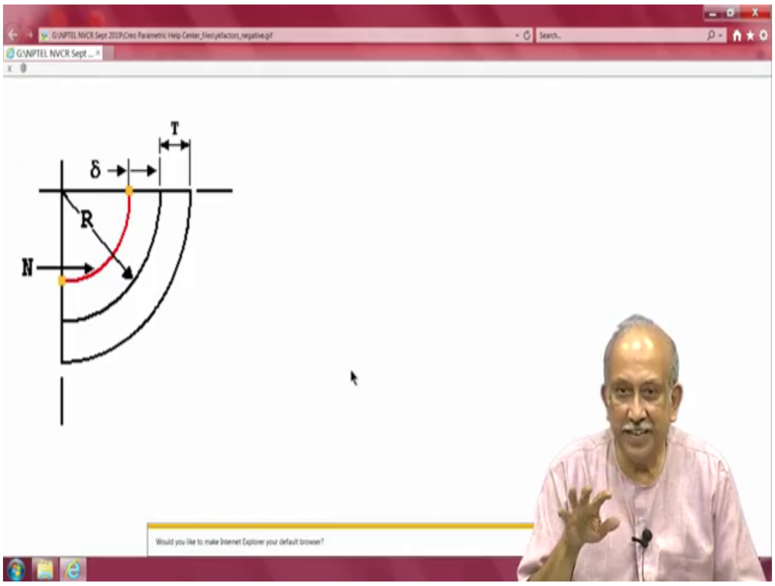

You see here, we have a little problem here; in this case the neutral also x is shifted to the inner line.

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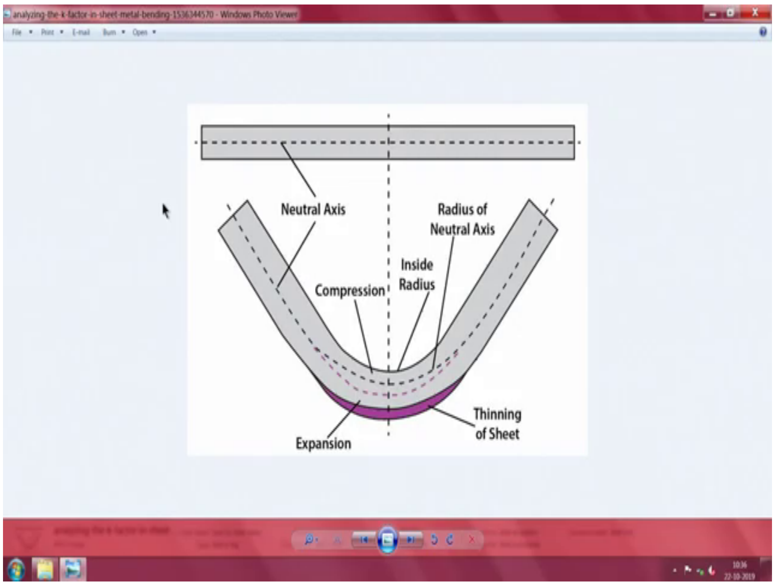

So, in this case the bend allowance changes dramatically. This is what I was looking for, finally got it here. While that was a folding machine which I had shown you here, this is a air bending using a punch and a dye. The tops end is were the punch comes and the bottom side is where the dye sets. In this case it is loose like air bending, because there is a small gap of air and then it is allowed to freely take any shape you like. So, depending on the details of this; this particular thing is called air bending, some places both sides touch the thing that such a thing is called coining.

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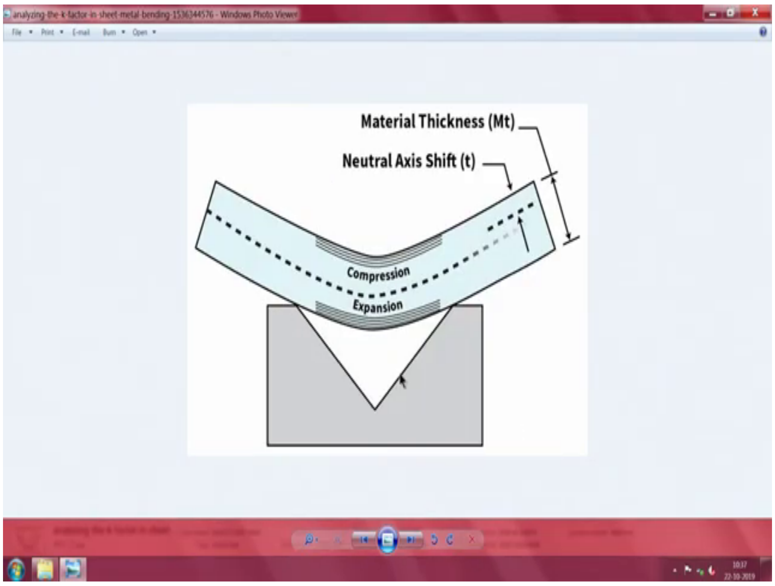

So, what happens in all these things are; one limb gets compressed another limb gets expanded and there is a neutral access shift. This neutral access shift has to be determined by practice. So, and there are a large number of tables here.

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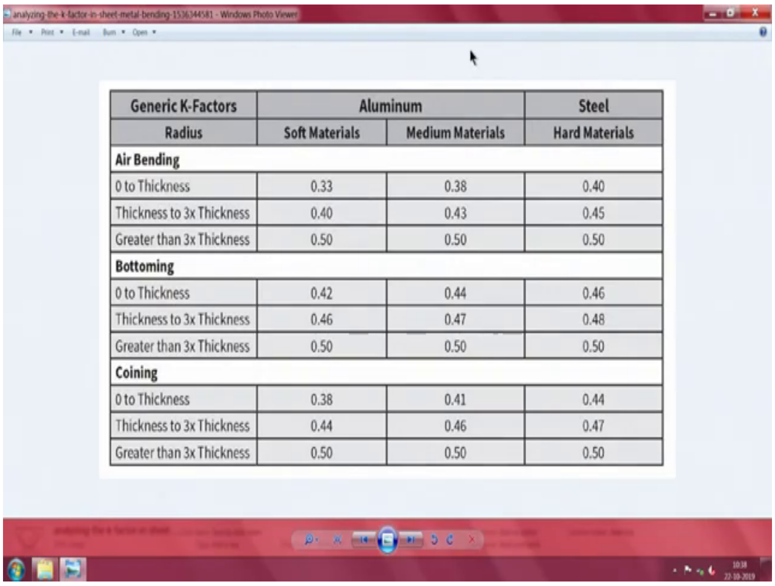

Generic K-Factors	Aluminum		Steel
Radius	Soft Materials	Medium Materials	Hard Materials
Air Bending			
0 to Thickness	0.33	0.38	0.40
Thickness to 3x Thickness	0.40	0.43	0.45
Greater than 3x Thickness	0.50	0.50	0.50
Bottoming			
0 to Thickness	0.42	0.44	0.46
Thickness to 3x Thickness	0.46	0.47	0.48
Greater than 3x Thickness	0.50	0.50	0.50
Coining			
0 to Thickness	0.38	0.41	0.44
Thickness to 3x Thickness	0.44	0.46	0.47
Greater than 3x Thickness	0.50	0.50	0.50

So, we have the generic K factors, remind you the word generic again, reminds us that we need to make specifically for our particular operation, ok. So, in this case it says from air bending which I have explained; bottoming meaning it just touches the bottom; coining saying both sides are squished fully.

So, up to a certain thickness where the radius is 0; 0 radius means it is a sharp angle to one thickness this is what used. So, generally we are in this area; mind you it is a K factor, it is not the bending allowance directly. So, in the case of steel, we know generally most steels coming in the work harden condition; work harden condition means as it is rolled or as it is done it comes into a thing, very rarely any limb or such operations are carried out. In some way very very strange specific cases, a little bit of aging is carried out, but never this end.

In the case of aluminum depending on the content of magnesium and silicon; the material property changes from soft to medium, and some of them can be hard and all the way of to this. So, this K factor keeps changing, and which I have told you earlier it is a lot dependent upon the specific working conditions.

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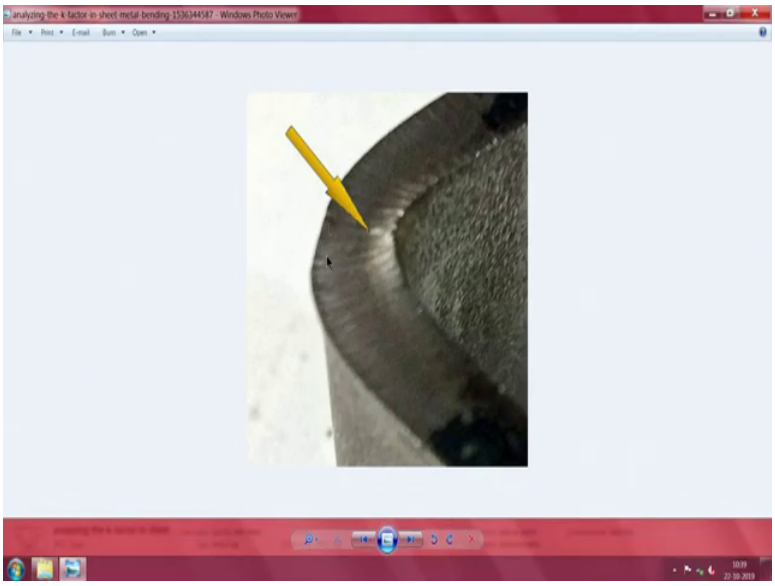

Here he has given pictures of say what happens here. The one outside you can clearly see as the stretched; the one inside there is compression. And whenever we are talking about any of these further operations, we need to be familiar with this. It is not clear, it is nothing it is just that various sources I have try to take it and at this point today I would like to stop, ok.

Thank you.