Enclosure Design of Electronics Equipment
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Lecture – 43
Detailing of Built in Heat sink boxes

You some of you have a better what do you call alternate things you can tell me.

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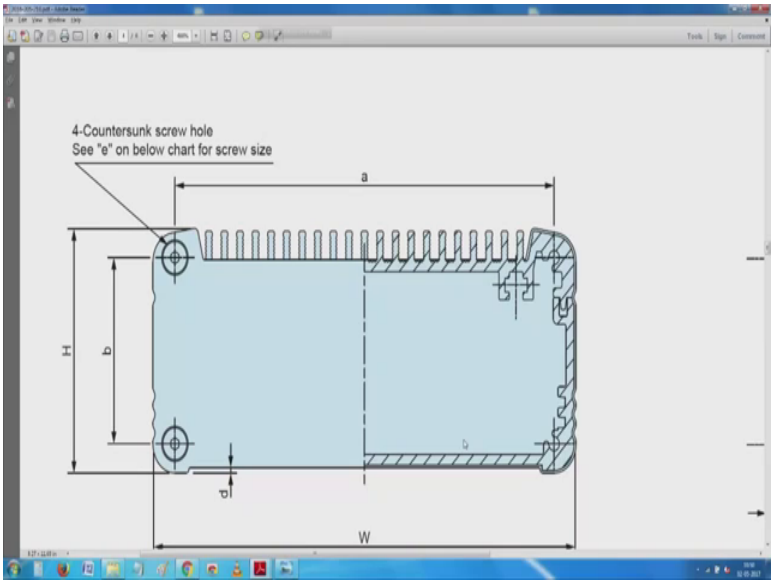

Once again coming back to like yesterday, I think you should familiarize were yourself with all the dimensions that are possible. A and b in this case refer to the mounting dimension so that in case you want to make your own hardware associated with it. You can use it you see here c talks about the clear length of the width of them I am sorry in this case let me call it.

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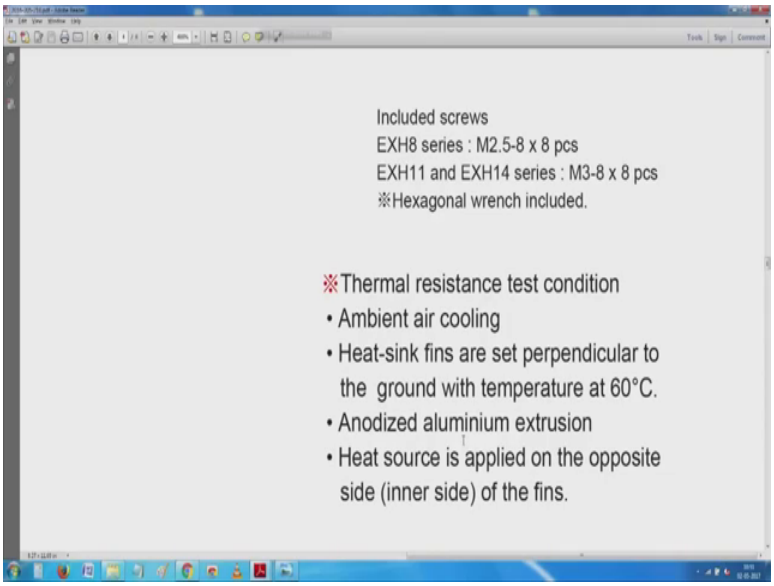

You have seen this very, but I would not call it what do you call clever this thing. It is not a new model improved shampoo.

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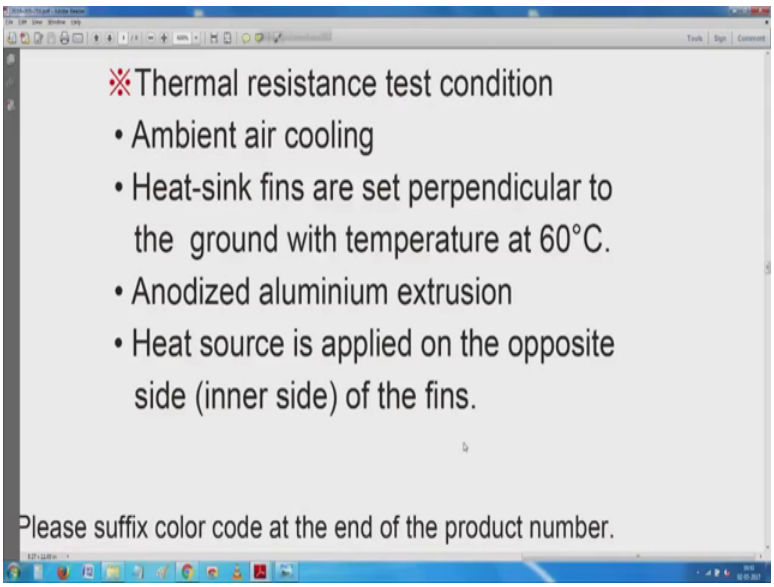

Which will make sure your hair will grow as you want and turned and so on and all that, but heat source is applied on the opposite side of the fins. But that is what the condition which were shown, you have seen that no? This is a condition in which you know the thermal resistance is included. Let me get back and see.

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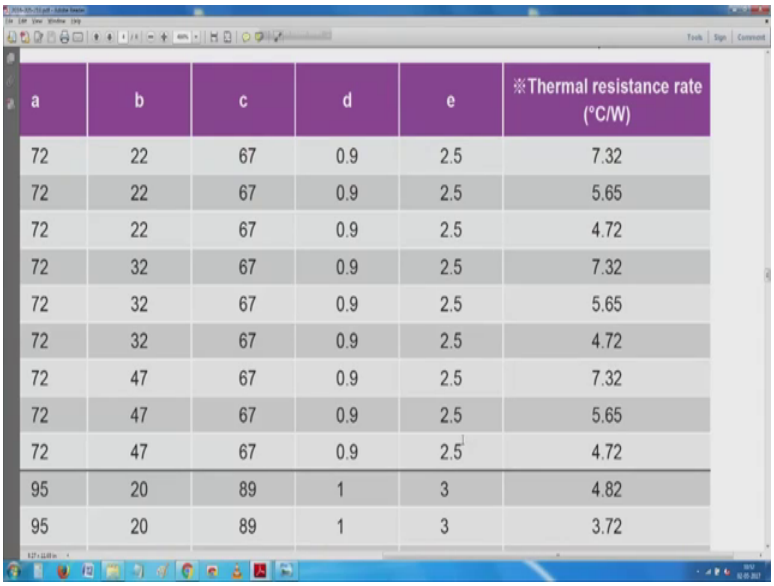

a	b	c	d	e	※Thermal resistance rate (°C/W)
72	22	67	0.9	2.5	7.32
72	22	67	0.9	2.5	5.65
72	22	67	0.9	2.5	4.72
72	32	67	0.9	2.5	7.32
72	32	67	0.9	2.5	5.65
72	32	67	0.9	2.5	4.72
72	47	67	0.9	2.5	7.32
72	47	67	0.9	2.5	5.65
72	47	67	0.9	2.5	4.72
95	20	89	1	3	4.82
95	20	89	1	3	3.72

Depending on the length as a length and width and all increases. They have given a beautiful thermal resistance rate of degree centigrade for what. This is the thing which I was pointing out in the initial stage. If you see that nice beautiful star thermal resistance test conditions in which they have done this. Say if there is a way of you are transferring all this and keeping it I am sorry, transferring all the heat to one of the reference surfaces and keeping it at that Necessary what do you call various temperatures.

Ambient air cooling heat sinks are set perpendicular to the ground and temperature of 60 degree centigrade meaning, that whole surface about 60 and ambient in this case he has not specified. Generally they take around 25 degrees. So, with this these conditions thermal resistance is degree centigrade per watt. So, if we have to have let us an amplifier which is giving 100 watts oh that 2 multiply it by 100, end up with 700 degrees not necessary. I am sure you think that you would do not know that I know very well you know, that only they can thing is generally the efficiency of the circuit and all that you know it comes into picture.

So, typically if you take the worst condition maybe around loss of 10 percent maybe there. All the power input and into the power output minus that difference is the total power dissipated in somewhere earlier that. So, multiplying by 10 you may get about a 70 degree rise across the what do you call temperature difference and so on. Based on

this now you have need to work it out, then has becomes bigger it becomes smaller and smaller.

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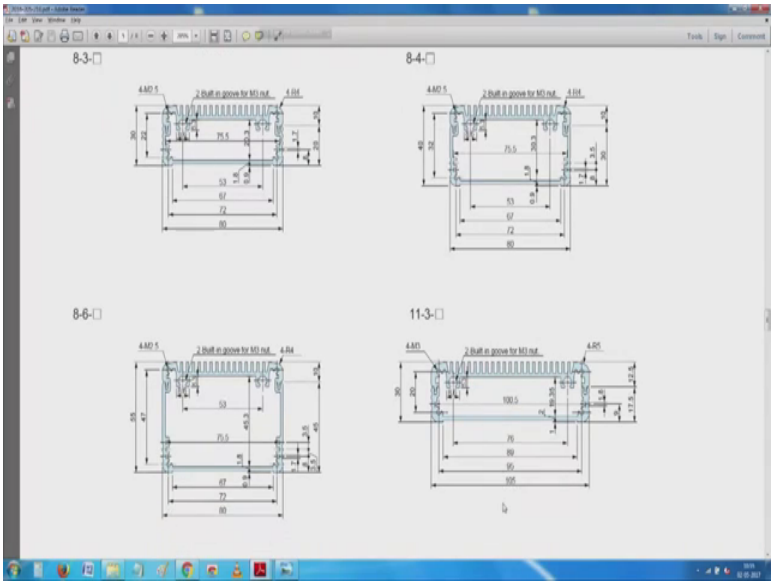

So, I will take you in fully all the way in, and then you see here we have different colours. And then there is dimensions. At the bottom of it this is the heat sink conditions and all they have put here. Cross section view is given quite a bit in detail at this point. I will try to get a little closer and show you what are all the details, yeah I think this may be a better choice.

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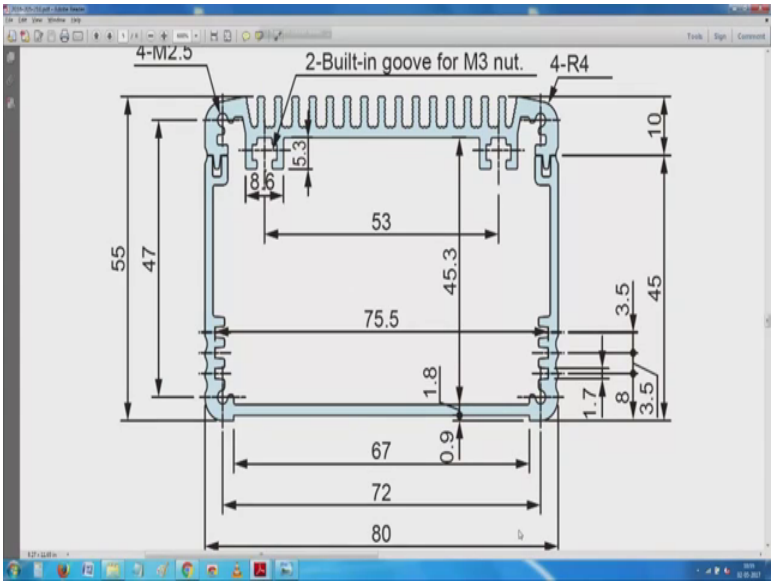

Ah now see something. So, we have a lot of details about how to assemble that nut, end at the bottom issues about the groove. And where the several other think and sit here one them is the printed circuit boards can sit here or you can have a HRC plate like thing which can sit here. So, lot of details about the groove and all and then yesterday if you remember I spoke to you.

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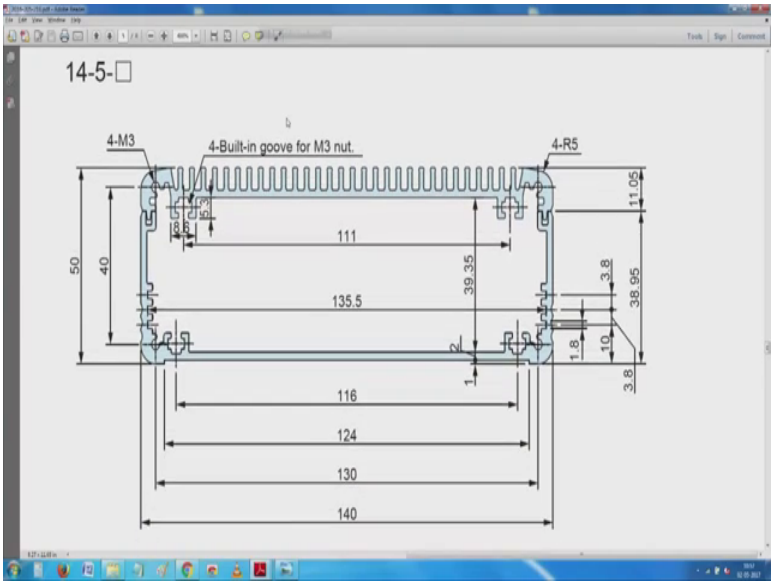

Why the groove are typically around that 1.72, 1.8 mm. They are all related to the average that printed circuit board which is after applying I think it is called someone nouns copper. That if around 35 microns are I think point I am sorry, I am not very clear about it with this thing, overall it comes a little around 1.6 mm and depending on the length of contact and how well we can assembled groove width may be a little more or less. And then they have given a small paper also while the dimensions are not fully specified here if you take one piece and measure it based on the tolerances chances are you will never go a wrong. Tolerances are extremely close for this 6063 extrusion. So, these are not these are all the matter of detail, about how it goes little deeper and so on and so on.

So, I will try to go down inside a little to seek and find more appropriate things as why go down. See here many, many, many more things are there.

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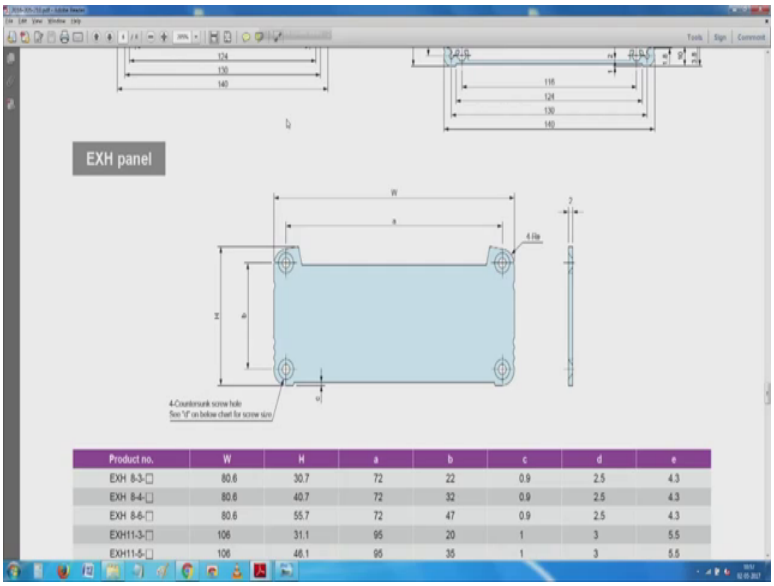

You see here one small very interesting and characteristic thing is the bottom of this panel fully covers extrusion there. And then top this panel there is a small groove here which clearces top surface. And why this is a distances and all are all given very clearly is that, when you assemble this big screws and all that, all the detail has been very, very carefully worked out. And seen that here you see this 4 into M 3. It probably comes pre tapped. So, you have an advantage here it is no way interfere with this, the M 3 nut groove where the nut goes inside. And depending on the manufacturing process I told you yesterday, sometimes the nut is kept there sometimes, they use a fixture to align the nut upfront. So, you align all the 4 nuts and then after that he oh peacefully can assemble the PCB you see here this is very, very critical. This is where now I said professional engineering helps in making sliding nut.

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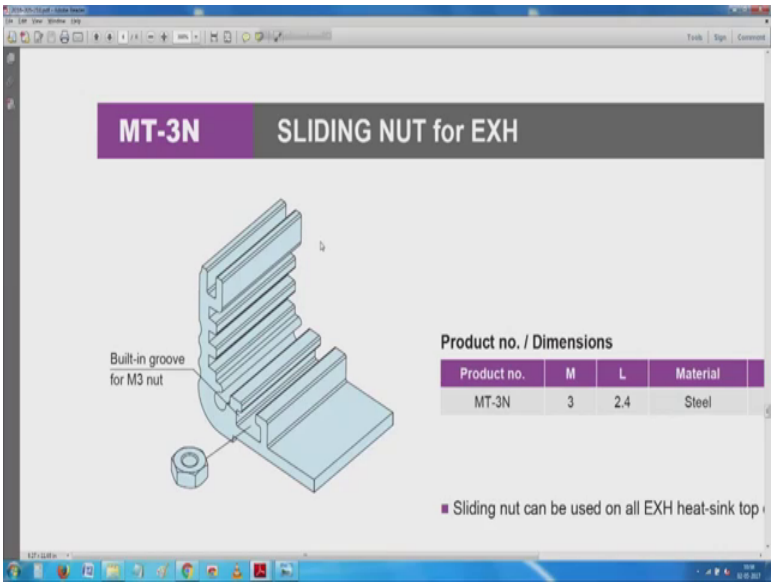

Saying as a built in groove these are all the standard accessories. And then this as you said this just shows their capability, but it is a little like the drawing which have seen earlier, except that here it uses heat sinks on the sides. I will go down further this is very, very similar to the one that you have seen. Most likely it is the same thing that has been there. So, at this point I will leave you back to where we have started because that will be unnecessarily repeating what I have done everything else is about the same except that, different panel has a clearance here, and you have all the professional things. So, if I can have the camera.

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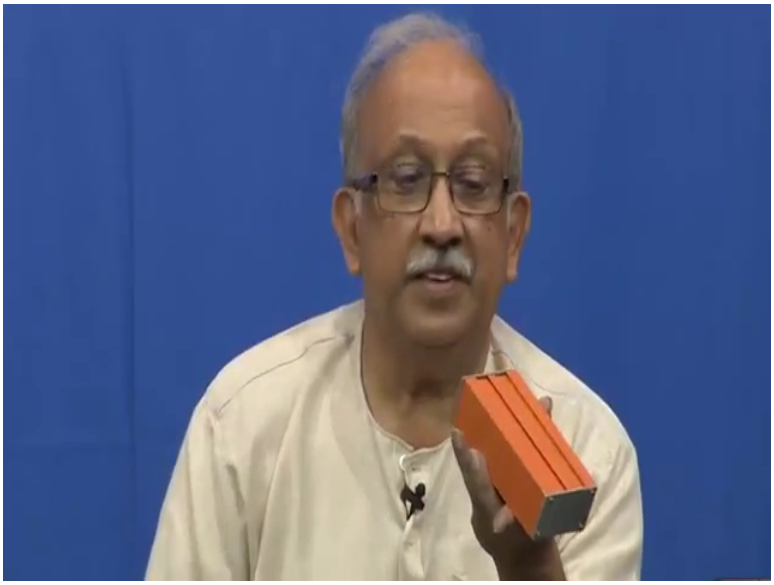

Set this is something which we have attempted using extrusions which are used for our construction, not the best I fully agree it is. In fact, it is not at all good it is not the way to do it, but I am very happy that I attempted. It we have taken one of these extrusions here normal extrusions added to end plates. And made a small provision here to assemble the screws, that is a small what do you call aluminum spacer of the full length has been carefully slit pushed inside and that spacer also has provision for us to mount printed circuit boards and all. So, smoothly we push it from one side then afterwards including the printed circuit board and then assemble it is held tight. And on the other side we have his other openings we have made provision here in the case we want we can always have any of the heat dissipating components and all have a heat bridge like thing which is tapped inside.

So, after pushing it in with a little gap maybe around point 5 mm sliding. Special fashioner which goes inside there is a small tapper and as we tightened it pulls the heat bridge and make set flash across. So, we have a heat treat which now transfers all the heat to the box. And then this box being continuous we have found out that it is quite effective. We have vanished dissipate around 10 or 15 words with our ambient here in Bangalore being around 30 degrees. And we have noticed by using a small thermistor mounted inside that the temperature of the heat bridge has not exceeded around 90 degrees. Which I feel is a very good and this thing I just wanted to show you that, you can probably do this in case you are furious. And you enjoy a little bit of this tinkering take standard aluminum extrusions which can be heat sinks heat sink.

One heat sink 2 and then some more join together make a box like thing make end plates and directly you are in this thing. But then as I said it will still be in spite of the best analysis it may still be a borderline, how do I say, trial and error hit and miss approach. Because specific conditions about the heat transfer coefficient across, this is not known very well at least there you have a guiding figure. So, this is one of the things you know I will see whether I have more pictures which I wanted to show, sorry.

Somebody is watching, yes I think finally, I could locate.

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Now if you see a little carefully, the fact that there are few fasteners here, and something here the whole thing maybe a special heat sink that has been made specially for them. Alternatively it is very much possible for you if you can get a long heat sink like this, cut it somewhere and make one of these ends like this into a surface on which you can mount all your beautiful things here. I do not know I am able not able to check from here

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Whether I am able to get a heat sink and not this is the one which I wanted to tell you. See here the reality of any of these devices is heat loss. In the only way of at least in our

case of our this making anyhow this enclosures and all that is somehow you have to deal with 2 things one is how to transfer heat across another is how to keep them sealed.

So, imagine a condition where somehow sealing is critical the very best way is if you can I can get back to my thing very best ways try to somehow make them touch the surface from inside in my case I told you how to do it alternatively if you have a certain grooves and extrusions and all inside it can try to mount all your heat dissipating things inside. Alternatively you can have a heat sink like rather heat extrusion which has grooves on both directions you understood. Inside there are grooves like this outside it there are grooves like this across I am not able to do this I expect it is there you understood imagine a plate with groves on both the sides. And now use that as one of these faces now inside if you just re circulate the air properly that is enough for you to have convective heat transfer inside to the surface and from there to the ambient.

Some of these manufacturers also give this in the case that you do not have access to that you can always make your own reasonable sorry, I mean it crashed a little while back I will see if it loads. So, if you go and have a look at this catalogue one of the thing you will notice is there are So many of these which are available.

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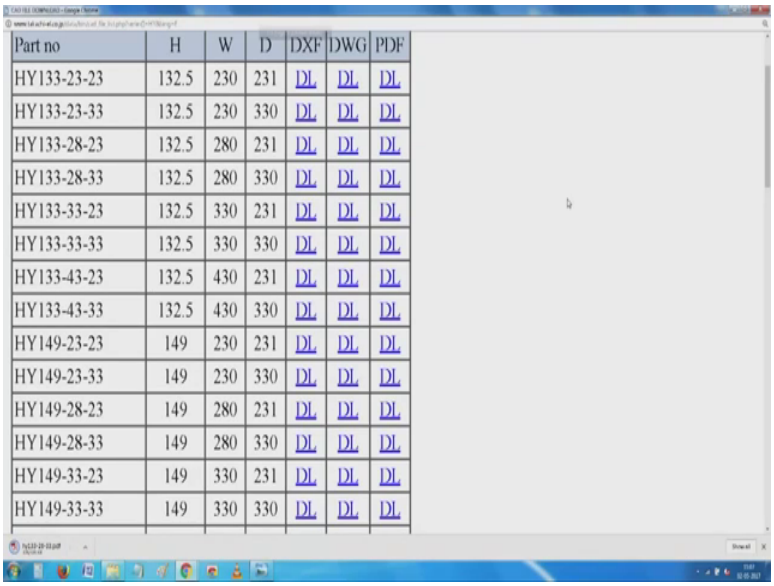

Part no	H	W	D	DXF	DWG	PDF
HY133-23-23	132.5	230	231	DL	DL	DL
HY133-23-33	132.5	230	330	DL	DL	DL
HY133-28-23	132.5	280	231	DL	DL	DL
HY133-28-33	132.5	280	330	DL	DL	DL
HY133-33-23	132.5	330	231	DL	DL	DL
HY133-33-33	132.5	330	330	DL	DL	DL
HY133-43-23	132.5	430	231	DL	DL	DL
HY133-43-33	132.5	430	330	DL	DL	DL
HY149-23-23	149	230	231	DL	DL	DL
HY149-23-33	149	230	330	DL	DL	DL
HY149-28-23	149	280	231	DL	DL	DL
HY149-28-33	149	280	330	DL	DL	DL
HY149-33-23	149	330	231	DL	DL	DL
HY149-33-33	149	330	330	DL	DL	DL

Heat sink enclosure let say and then the most critical thing about it is in case you have a full drawings are available. At this point I hope it is downloading yes, yes something has downloaded I would like to point out something I am sure you will oh.

Coming back again to this drawings which are available good, good we are lucky.

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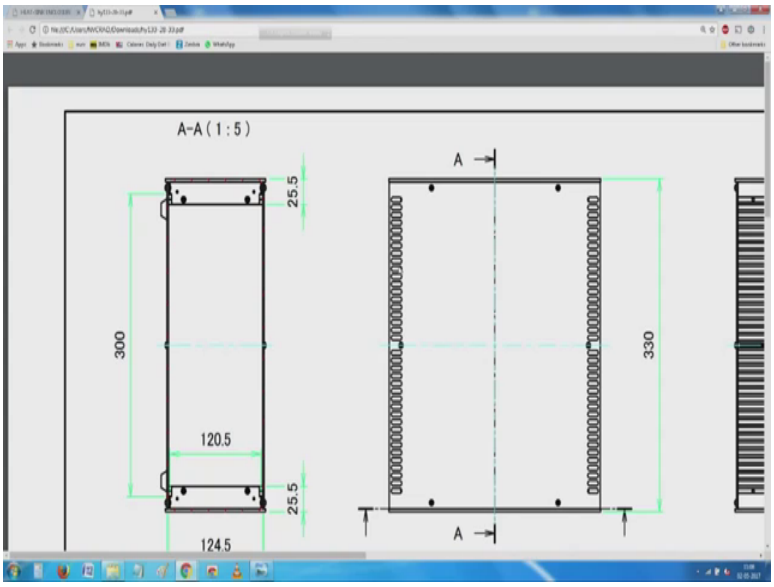

You seen here this is what I was trying to tell you. There are you probably need a little bit of when I would not call it a full Engineering skill I am sure all of you are at acquitted in the normal course what I wanted to point out that you have a you have seen this top and bottom covers are there. Notice something very interesting about it their openings on the top cover which correspond to heat sinks here.

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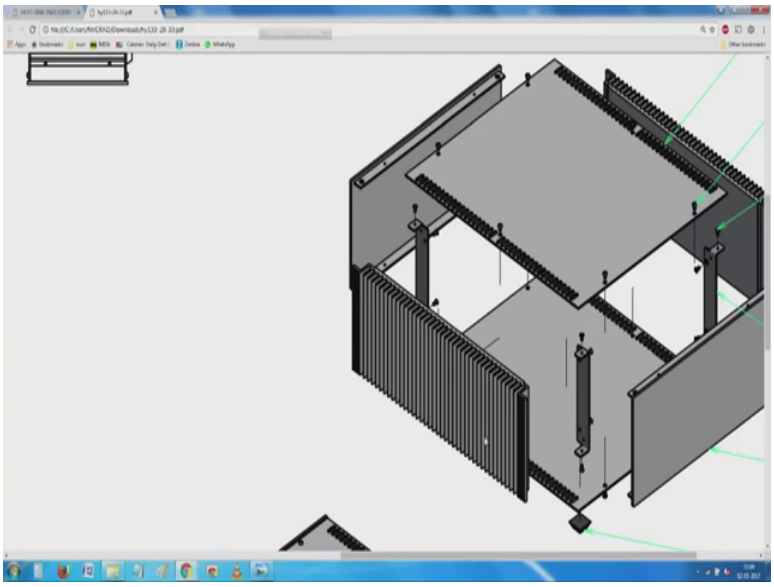

Seen this? Further if you go down this may be little more self explanatory. So, we have any heat spreader here then there is a top and bottom cover therefore, what do you call pillars. I am not saying you copy this design, but because I am 100 percent sure that that numbers what they have given is extensively because of the quality of the material. So, copying this dimensions would not take you anywhere, one thing it will guarantees that you know your equipment will fail and well I pay is another issue chances of failure are very high.

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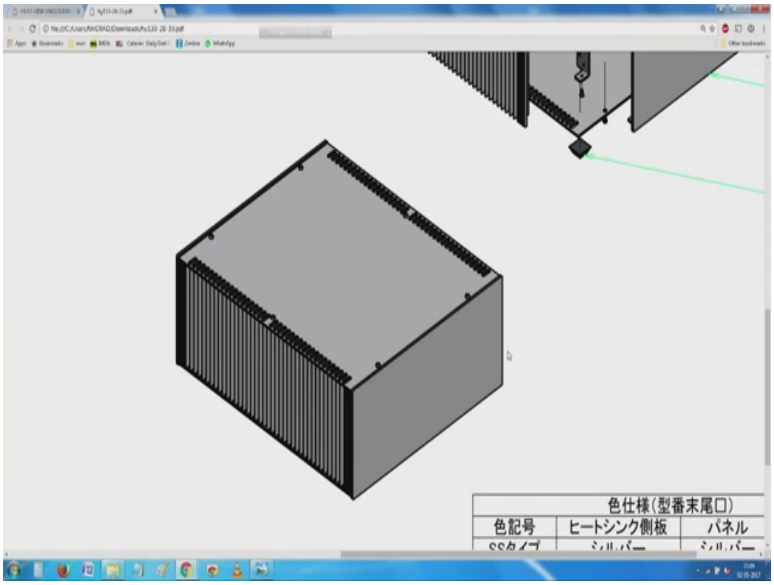

So, for the first 2 or 3 units which would like to have which my this thing is the first whatever breadboard which I will still call it a not a full fledge prototype a technology proving thing you should start with these enclosure.

So, once it is proven and you are sure their negotiate in get more of them do not try to make it on yourself. That will be a real problem. I will just close it at this point. Same time you will notice that 2 more things have been given here. This I thought if I get a practical chance I have asked my one of my colleagues who works on EDA tools. This dimension set has given here if you work with a package which can understand original auto desks DWG format it is good 100 percent. Release is a little issue, but all of them right from I think r 12 to whatever current issue this things open and most EDA packages allow import of outlines from here. If that is not allowed you still have DXF, I will try DWG because I expect that it works without much problem. I hope it is opening oh, what

happened to my? There, wait sir, do not show, let it come after it loads it come, because it takes a little time to load.

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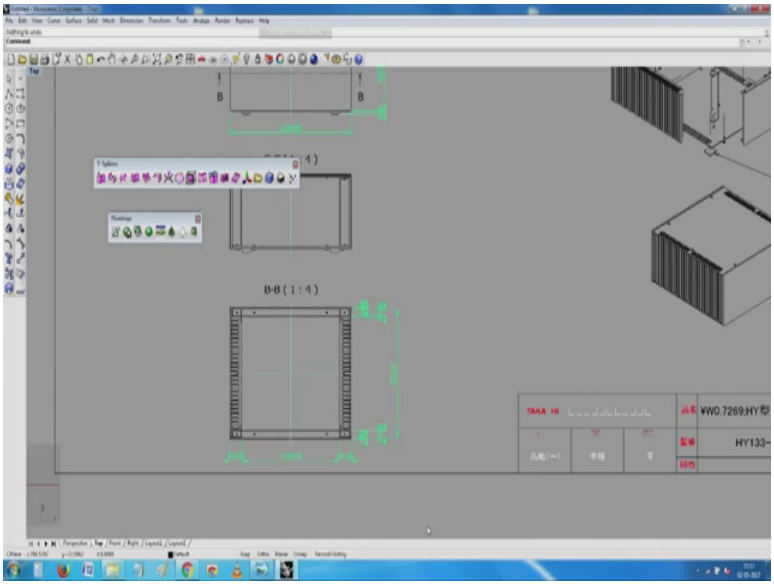

So, you see here, that same drawing which you have which was in the pdf format is now available for us to open with (Refer Time: 22:02) readers. So, the you have to be little careful, but you have seen this even this a cross sections and all you know.

They have given a beautiful things, one is to 4 it will little careful about this thing, but the important thing is you can directly pick outlines dimensions everything from the drawings that are supplied in the catalogues. So, instead of trying to start with in EDA automation, with you start with the screen and then you know pick corner here corner here corner here, and then have a schematic capture. And then after that slight to place components and make a rats nest, it will be too late you cannot do much further incident you can go back to this DWG or one more DXFSR, that is drawing interchange format. So, this format things if your pick directly from there and make a provisional layout of your equipment especially where he dissipating components can sit where heavy components need to be placed, and most important the ubiquitous and the most unreliable Connectors.

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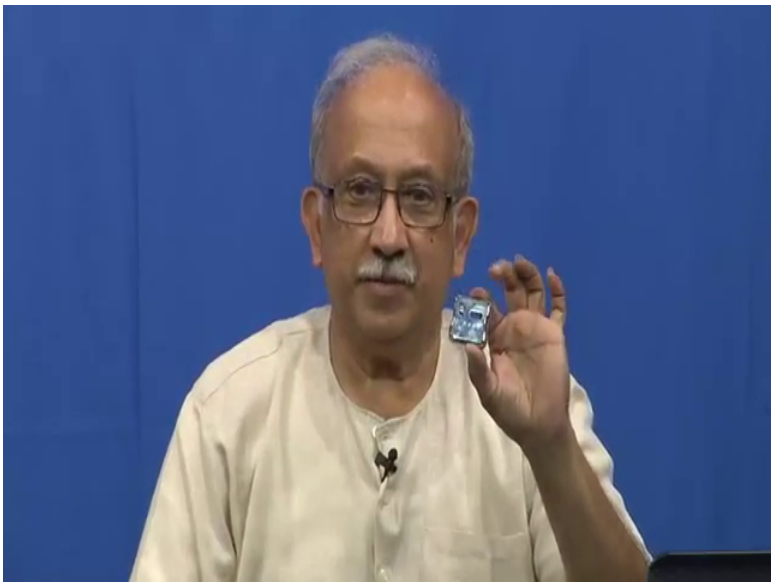

I am not saying these connectors are unreliable, by misuse you see here this is a beauty absolutely not misuse I am sorry, sorry for the you know English wrong this thing, it is a beauty of a this thing, but at best it follows only the layout that is practically possible insight.

So, eventually when I assemble it I can take my mobile and then try to charge it.

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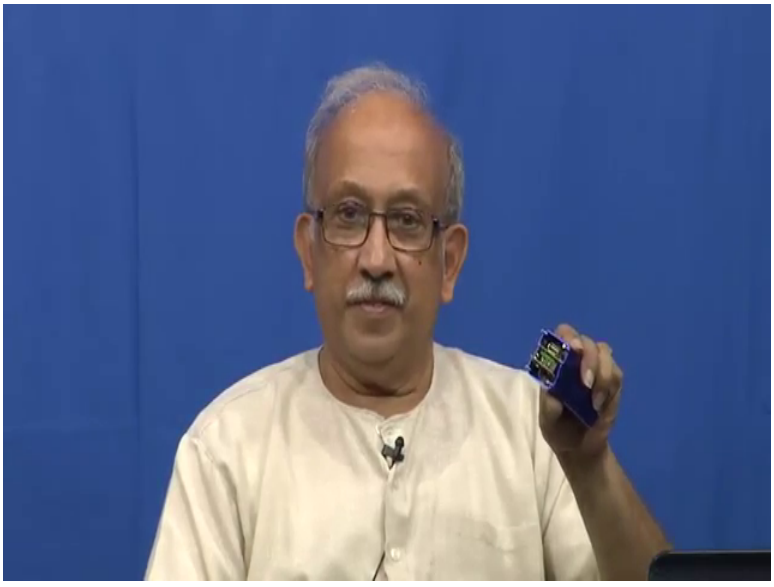

So, criticality of using any of these extrusions is, you need to be prepared with the details of the extrusion. Including how much space is there where all we are likely to have our

thing, but in the case of these what do you call construction hardware, generally the guarantee that this is 30 mm this looks like 60 mm. So, I have a 60 mm by 30 mm extrusion, but of course, here they use inches most likely it is one and half inch or yeah one and a quarter inch versus 3 inches extrusion little yeah, little less than 3, 2 and half external sizes are compatible. And it goes and sit is against a door opening or a door jamb details come with that small star, terms and conditions apply they may change anytime. It is not to full as a written what has to buy a improved what do you call shampoo. It is only to make sure to optimize the manufacturing and the use already like that often this hardware the corner brackets hinges and various other mounting hardware keeps changing. So, something which is 10 years old or in our case maybe 30 or forty years old is not automatically applicable.

So however, if you contract with the supplier most of these extrusions you can use them directly that not optimum still available, but I still prefer you go to a professional supplier and then try to deal directly with this. So, at this point I would like to say thank you for your patience, please look up the internet and Secondly, go to a fabricator locate some people, and they have to work parallely. With you that old so called over the wall works in most conditions, but if you are a innovative designer and you would like to start fresh does not work.

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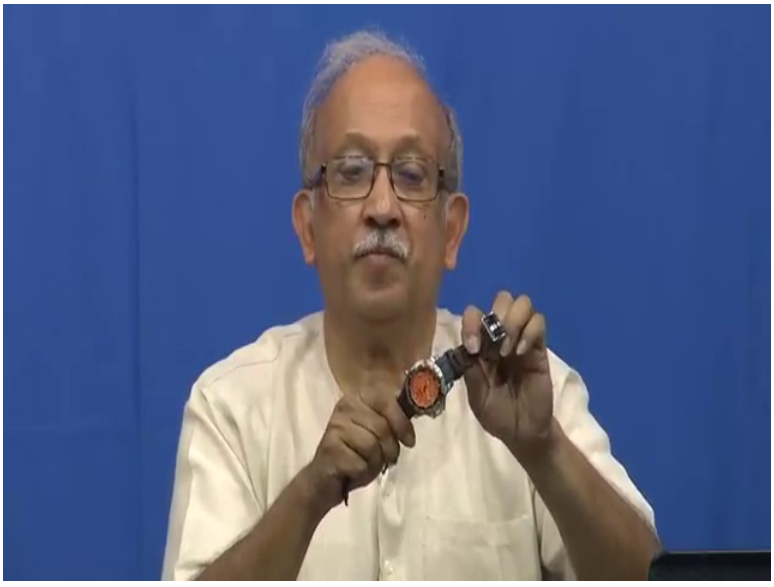

I just wanted to show you this is not a very old concept or anything you will see a watch here. For a long time all these watch cases for expressions. And some of them are even stainless steel extrusions, stainless steel extrusion shocked yes, at least aluminum is standard like that, but after this other what do you call acetal copolymers and So many other thing you know I think it is called some rynite and So many other things have come. This co polymer cases are equally good except that impact resistance is probably not as good as a this thing. And then a lot of times we do not select things only for the functionality is also the little cues you want visual cues.

So, if I show you this item is whole thing can be made probably out of cheapest possible styling.

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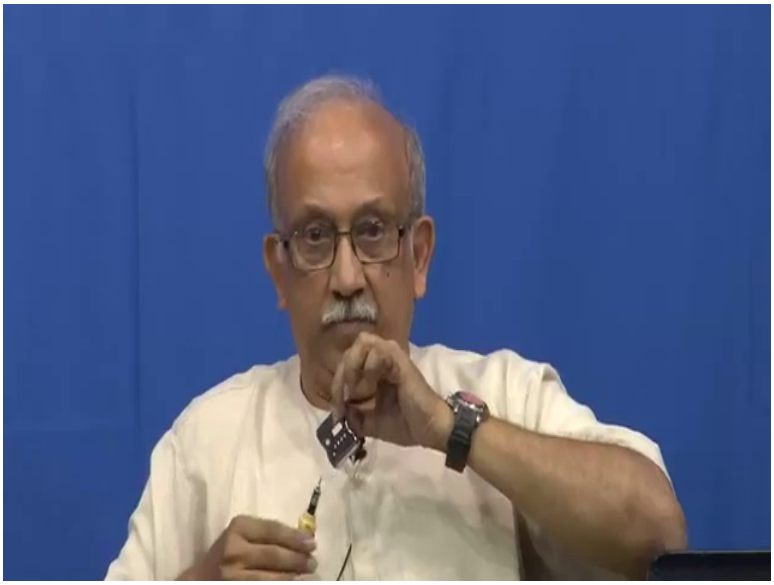

Which happens with several of your bottle caps and all that end coated with copper and nickel. But this particular one is a zinc die casting. So, if I strike it we can probably here the sound I will see, I am not able to hold it correctly. This is a zinc die casting why they have used zinc die casting is it is probably taken from an earlier design saying the unlikely case it drops it is quite heavy 4 into the cells I do not know the whole thing may be weighing around 300, 400 grams nobody will take too much about this if it breaks, but if it when if it ingest something and this is a problem. So, they try to make this nice rounded corners and all. Simple easier to weighs make a enclosure like this. And probably the whole thing is also made with necessary inserts. Probably the back end

there are in the front portions are all made with the same thing either this is been subsequently mild nobody will do that; however, it is made with some inserts by it is making see after making a 100 thousand pieces of this it can make a 100 thousand pieces of this. And extrusion comes continuously it cuts and then the corner they have used normal self tapping screws these are equal into M 2 self tapping screws.

Very routine thing, so I manage to get it for about how does a 10 dollars 10 or 15 dollars it costed me little more, 20 dollars it costed me around thousand rupees maybe around 15 dollars. For 15 dollars for me to buy obviously there mark of set at every stage the same thing would have been know about one fourth of the size.

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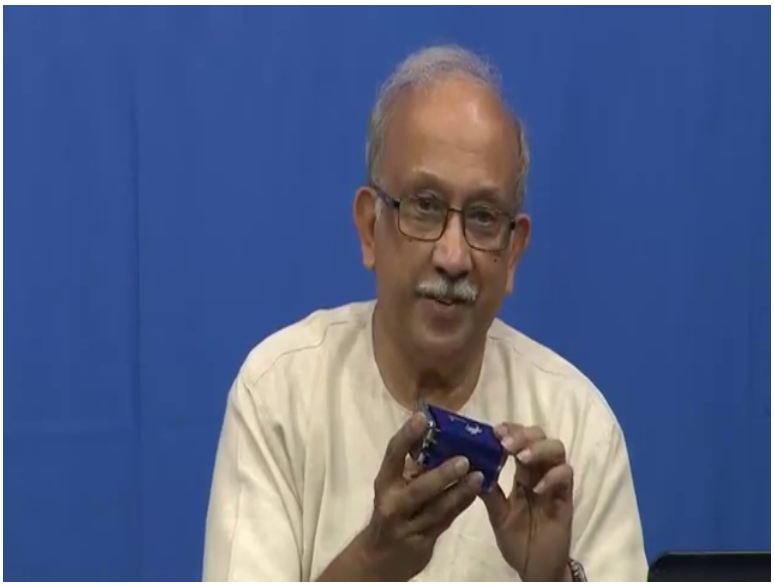

And I am proud to show you a sample you know where I wrote a normal thing, also is expected to have impact resistance, you remember last digit in the IP class is one more last digit IK class. There depending on how much it can injure you and how much things it can take very beautiful sample of a thing here. So, I will take a break at this point. Let us meet again with little more details on if at that time I can get the samples about the interconnection devices. So, so far I have covered the enclosures part, little about the heat and all that, so two things in then a little about the fabrication and details about it.

Two things which are still related to this is non electronic or electrical hardware which are the border line what do you call medical a million shades of grey it is not just 50 or the connectors especially. They have a fantastic function how to give a loose contact. So,

added to that we have a problem of if you have to take any of this hybrid answer on the go drives and all that, we carry them everywhere we want. So, they are still prone to various types of exposure not necessarily indorsed body fluids like sweat and in makers of hearing aid all the ear wax and even saliva and all that is not good it corrupts absolutely.

So, the movement in you have this going to that connecter area it leads to lot of problems. So, I am sure you know when something is sold at low price we call it cheap, it is the best way of describing cheap products, first thing cheap products fail is probably at the connection. Second thing they fail is inside which is again all the manufacturing technology. And we guys the box fellows now or otherwise enclosure designers tend to get blamed.

Now because the functionally electronics as worked on the bench and even it is passed a few test, but in due course enclosure may fail. So, prevent it all the action can be done. And then in this case we try to improve on it further we have seen these 2 grooves here. We have thought of saying why cannot we have a lib here, you understood? Means all around like cup like thing is there. And part of it goes into the groove to the extent of about 6 or 8 millimeters once we push it inside and then try to make this right we do not need there are no necessity of these screws at all understand. Now we try to fix that directly with what is called a riveted clinch nut inside. So, you do not have this ugly face. And then this can be used as a nice front panel. So, thank you, I will stop here.

Thank you.