Electronics Equipment Integration and Prototype Building

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Lecture - 21
Basics of engineering Drawing

Hello, I interrupted the last times lecture saying a little about what are the geometric and other primitives that we have. So, I have also suggested that you look up the web to say what is it that people talk about as the, basic primitives.

And if you are a what you call just a somebody who has left school or you remember what you did in school. In basic geometric, they will tell you that the thing called a simple line, then there are various types of curves, and there are things which are very very familiar like a circle, and ellipse, then square, then various types of parallelograms, and traditional thing like a cone.

So, if you were to draw on them one feature about all of them is that they are all simple flat two-dimensional representations. So, I will go here and see I know I just started a blank sheet, so that it is easier for me to draw on the sheet.

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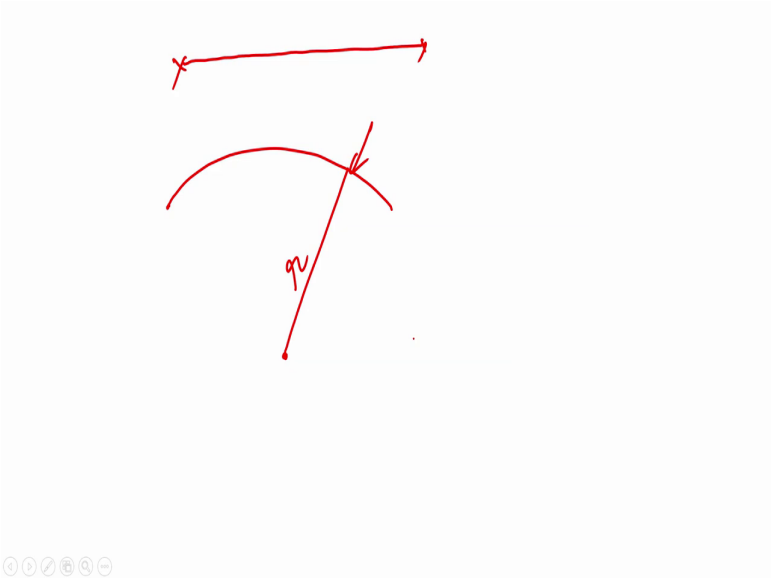

We know the basic thing saying this is a point ok. It is here little difficult to make, but it is there and then we have another point like this. And early on when you are learning various things, they will tell you that the shortest distance between two points is the line or the straight line. So, it did not come out well, let me take the edge as a reference, the shortest distance between any two lines are, I am sorry the shortest distance any two points are the line.

And next best this is instead of being a straight line, supposing you have something which is a curved line this is called a, if everything it has an arc; with a center this one is a arc, this is you would have learnt various things, so I mean not too much of time need to be what you call repeated here except what we require now.

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Often we come to various types of constructions. So, you see here we have a point, and this is where mathematical representation and simplicity have come saying. If you want to find out the shortest distance between this point and line, earlier you remember they were two points being joined together. Now, we come to the mathematical definition saying something which is perpendicular to this will invariably be the shortest line, I think this is very easy for you to make out.

Except that if you are interested you can go and look up again on the internet saying, in real life and on earth, real life and on earth, because our earth being curved and spherical, there is no simple way of talking about a shortest line unless you want to drill through the what you call part of the earth. So, there you end up with curves which appear flat when you look from

the top. And I think I do not know whether I have covered earlier I have showed you the thing about how to make a picture of an earth made out of flat features.

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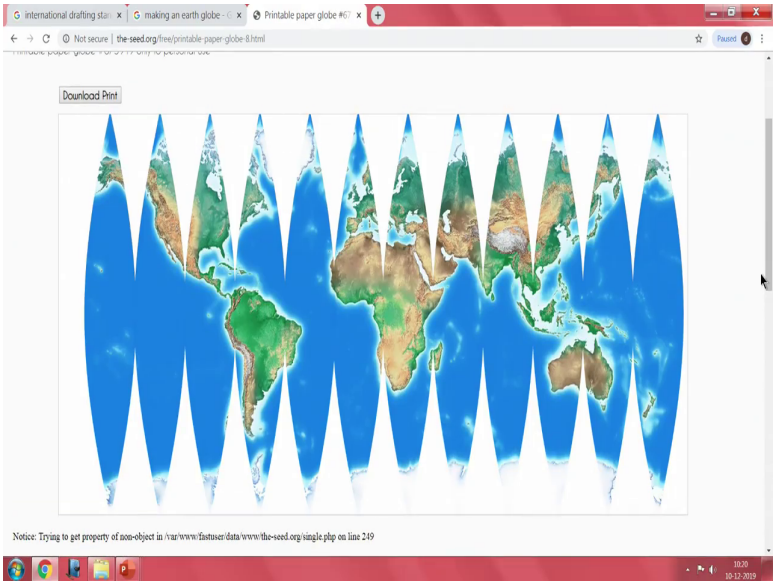

This is where invariably we will end up with things like, this is a beautiful earth which is actually it is a template; you can print the template, and then try to attach these things together. And you get what is a what started as a standard flat, what you call template, and you can attach all these thing together and make a perfect globe, maybe you had a chance to try this at when you are a child there is. So, many other ways are also there saying as I think I showed you about the saying how many pentagons and hexagons can you can make into making a nice round object.

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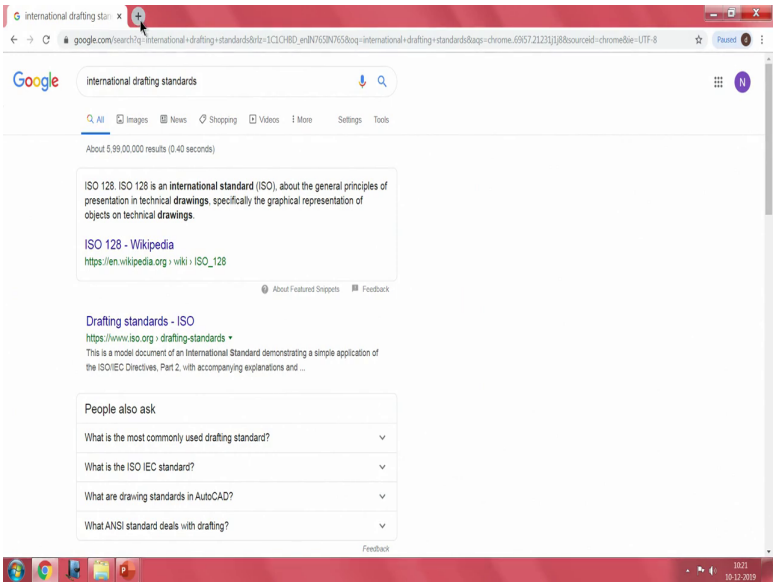

Now, at this point while it is ok, we now end up with saying why do you call something as a first angle and third angle projection.

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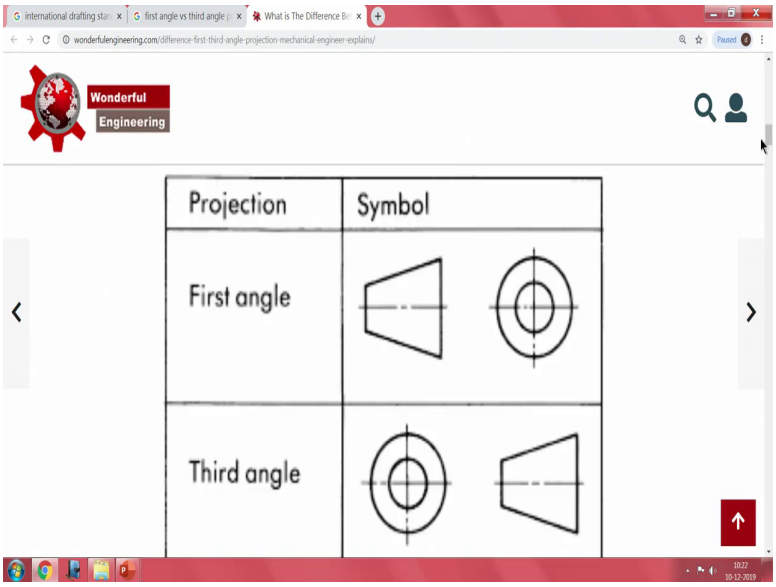

If you remember in the previous lecture, I tried to tell you saying depending on this is usually indicated in the title block. In the case of a first angle projection, in fact, the word projection is you have just seen that itself appears a little hint of saying what do we mean by projection or do you say a view. In the case of a first angle it is it appears that we shine a light here and then keep a piece of a screen which captures it, and when you do it here and then you do it here you get two things you see here, you get the larger circle, and then you get the smaller circle which is visible inside here.

So, there are some people I know some proponents who imagine a claim, there is a only drew projection which we can talk about. In contrast, third angle is slightly easier to understand, because what you see is, what you have draw. So, at this point if you look at this frustum of a cone, this one comes here and the other one comes here. And similarly if you look at this point and see here you can imagine now, what will happen what can what do you call if you

look at the object and draw here you will get it imagine if you look at the object from here and draw, you will just have a large circle and a smaller circle with inside dotted line.

In the case of this first angle projection which say for some reason, I do not know how it has come about, most of Europe and parts of early what you call mechanical engineering people continue to use this that is you keep a orthogonal thing and projected from here, similarly if you are to now project this on the other side just look it up ok, you will get it.

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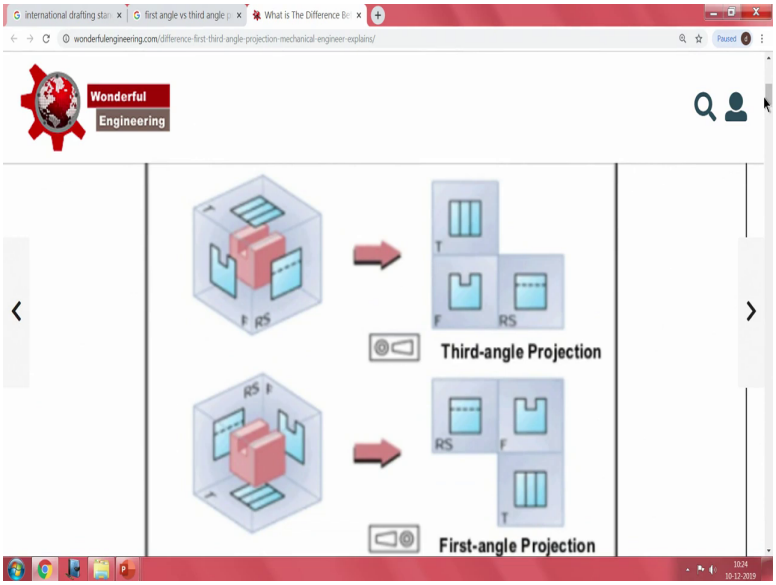

Now, let me give you an example here. In the case of first angle, you will see that if you what do you call shine a light, and this is what we will come here, but actually even there also we have this little problem about saying how can we call it a projection because in general actually if you are to shine a light here, you will just get a big block, you understand, you can

get a just a rectangular square because although whole light is blocked here. So, in principle it is not exactly what you call like shining a light or anything.

But if you now tie up these two things, you have seen this here you will notice that if you were to do something here and projected you will get. What you are actually looking here and that is presented here which happens here. And there is no absolutely no view no problem about something which we because it is in it looks like it is same from both the sides. If you shine something here, it will automatically it will appear here like this. And this view is where now if I shine things from this side if I shine a light and say projection I get a block plus I represent a dotted line ok.

In contrast the third angle projection appears a little more logical meaning. This is a top view you see what you see on the top and draw here. You see whatever whichever way you see you look at it and draw here and when you look at it, you know you will see a what you call fully blocked thing and then put dotted lines and then represent whatever you want.

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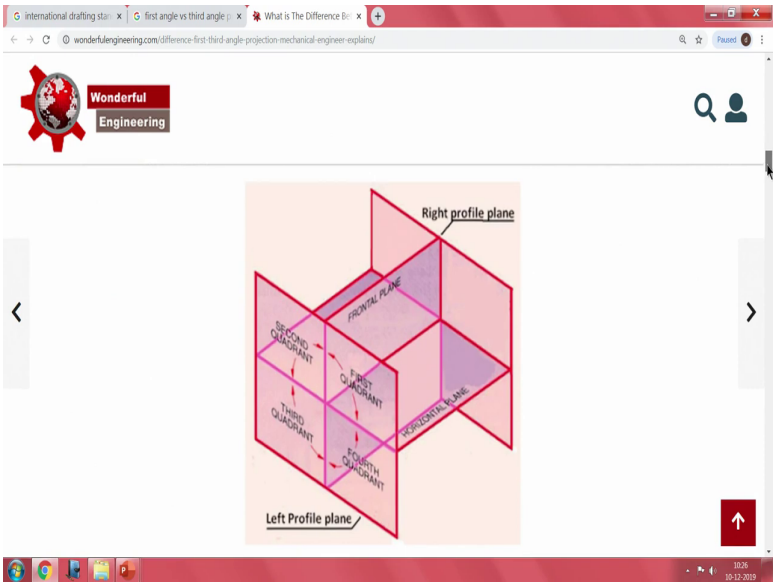

So, this in case now that is the symbol which shows all this, this is a little bit of what you call pure engineering students will probably need it. So, do not worry too much about it. All you need to do is, anytime just remember this one is what you remember in the first angle in case of first angle, you actually look at something here and draw it here. And in the case of third angle, you look at it from here and actually draw it here, that is all that matters. Anytime you have a doubt you can just come back to this, these are all a sort of people who need when need to taught, I do not know whether really it helps.

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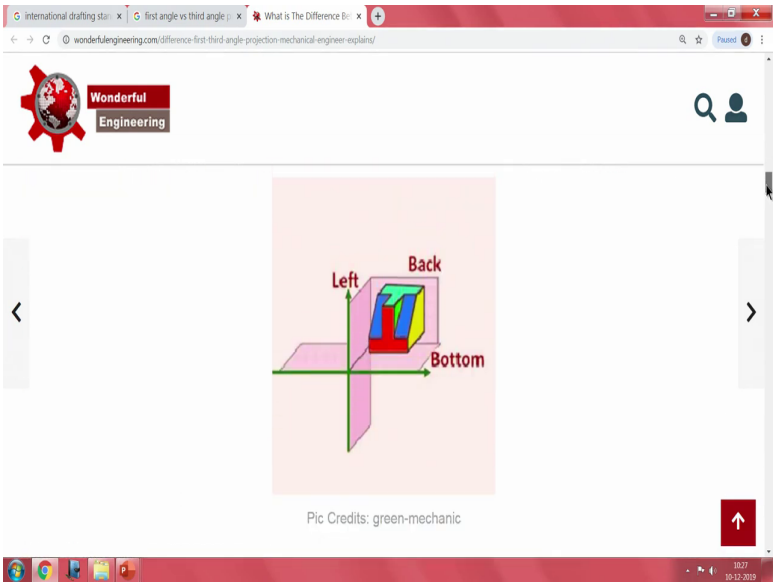

So, things like you know a bottom and left and right, if you remember earlier on in the lecture I tried to show you this inclined plane. And how these things actually how are this represented, and even how something the word first and second and I mean [Laughter] sorry first and third angle and all shown like this.

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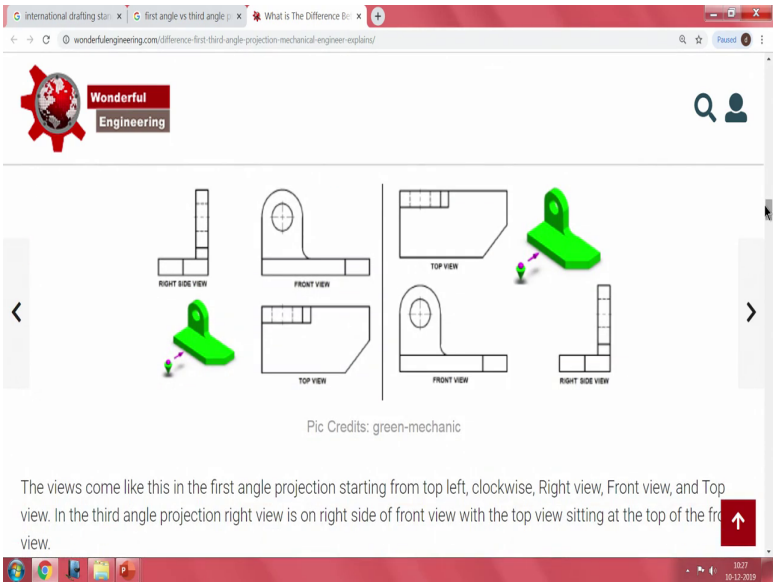

You have seen this. Just have a look at it later on go to wonderfulengineering.com, and then try to read it for yourself. The it is very convenient in fact if we probably clearly write what it means and then similarly here right what it means, and happily represent it here. So, if you oriented here, this is called a front view. If you see it from a top, it is called the top view.

And when you look at it from here this is called the right side view, because this is the right side. And you see when small top like thing with a small spherical thing being shown there, and you see here this are all that new cad representation has given us this beautiful way of representing things.

Why I need to stress on this is finally, when you are using any of these drafting or any of these compote rated modeling packages, at some point or the other you will be asked to make this because dimensions and all are not easily represented there in these things.

Now, coming back to the old earlier representation what I was talking about. So, right now I will not get into the details of you know what comes, where, anything, just have a look at it, just have a look at it, because it is slightly different. And coming back again I need to tell you about how to dimension these things. You see from here to here, if you show a common dimension, we know that this total width of this object, the width of this object is same here.

Similarly, if you see the height of it here, general things are common. And only one more thing is if we were to show this, this, this dimension here this is probably represented here. Depending on the orientation, depending on the way we present these things, any number of what all I have spoken a little earlier is all presented here.

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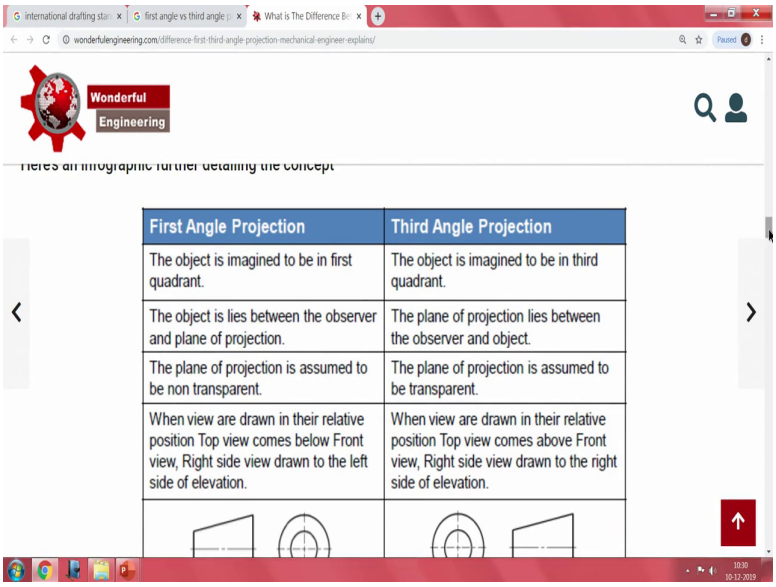

You just have a look at it saying how these things are and anything anyway that other thing is I mean I do not know. The it is part of the advertisement strategy.

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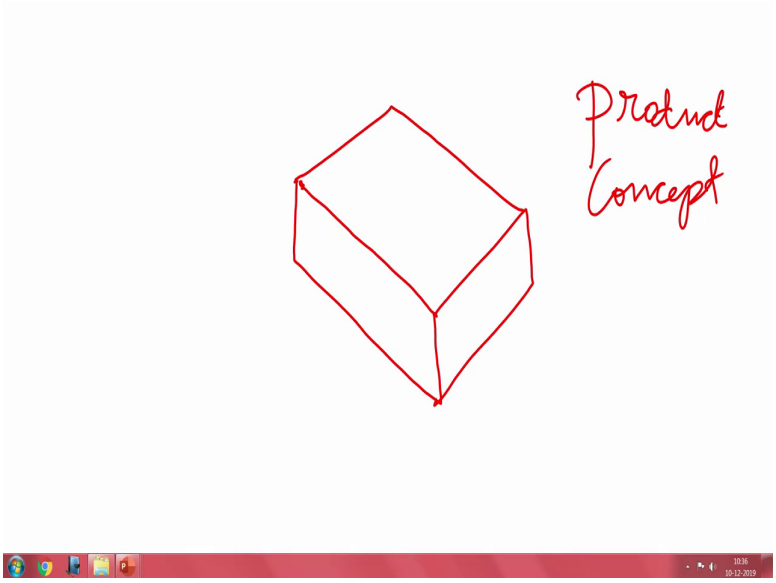

Now, if you go to a real life project, we need to if you remember I had shown you about how to make a dummy what you call first cut prototype model, especially this is not for production. You understand the first cut proto type model is not meant for production; it is only meant for you to show it to your other team members saying this is what I am trying to work towards. Then you will end up with saying there are some people who have a simple product concept.

I will avoid any what you called debate on these nomenclature at the mind, at the point, just remember that what I am trying to convey that what you also have in the mind is that whatever you have somewhere global and saying in the end I will probably make this.

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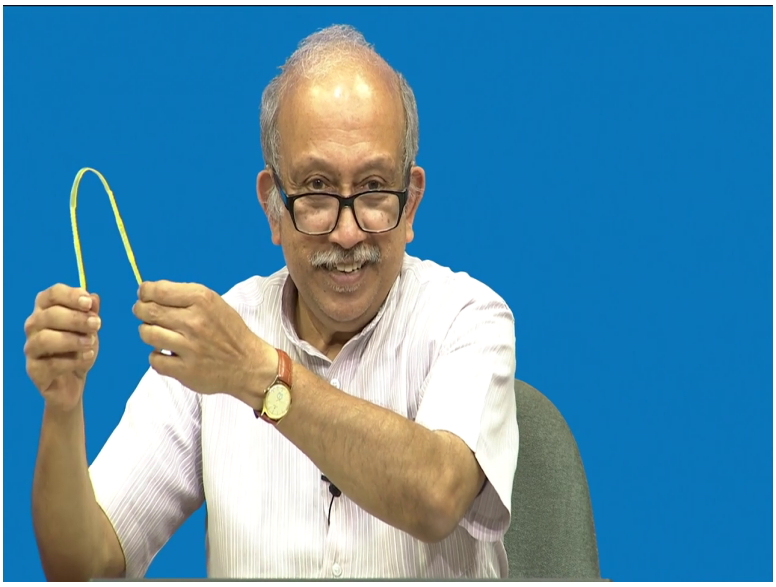

And just to be on the safe side I mean more than just to be on the safe side I am sure some of you may remember this especially those of you live in our earth side of the continent, it look gross if I tell you how to how to describe it, you understand. Now, this one is a small personal tongue scraper which it is used in the parts of the world which I come from.

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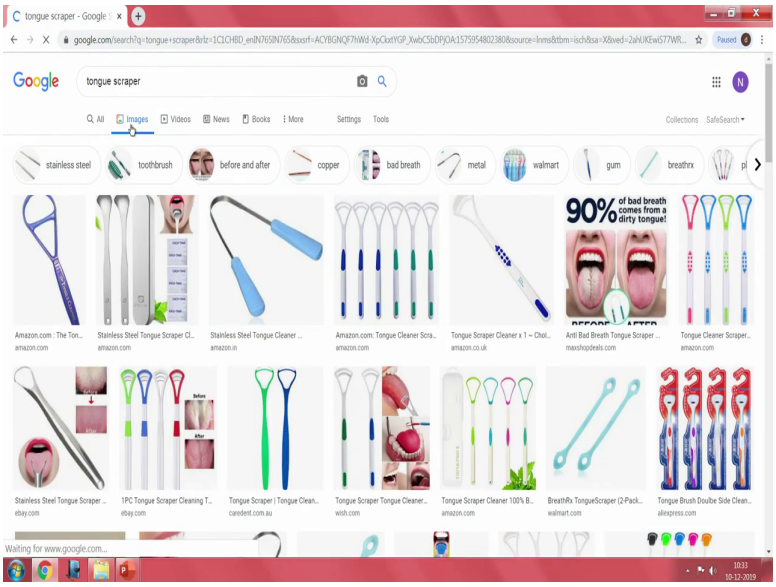

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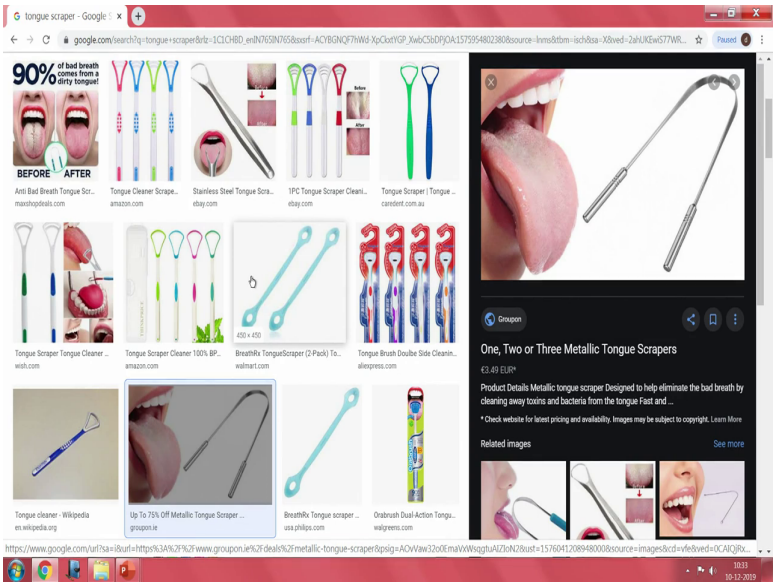

Now, you have seen here suddenly that many variants are available. What I have shown you is a variant like this. You have seen this, this variant like this which it is able to be used. But now this starts to be a metallic object, so often aircraft what you call travel authority will not permit this in our air planes, while it is somewhat ok, it is not that what you call that object which is frequently used. So, then next bresh is if you go to the especially the this is a very common.

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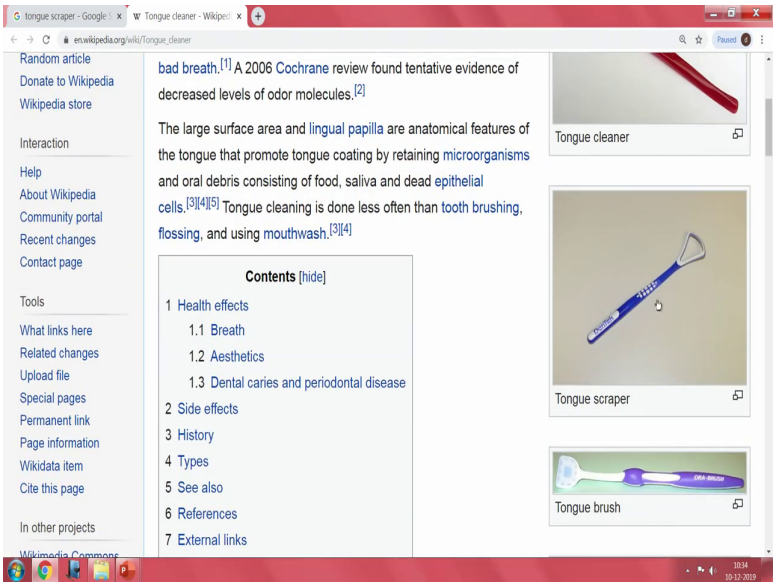

These things called the tongue scrapers are very, very common. Now, why I have showing to is it is a very common thing, some of you are familiar with it, some of you may not be familiar with it, some of you use them, some of you do not use them. And some the little higher expensive toothbrushes already have something which is built on the other side of the tooth head. The brush head is there on the other side small variant of it is been made available.

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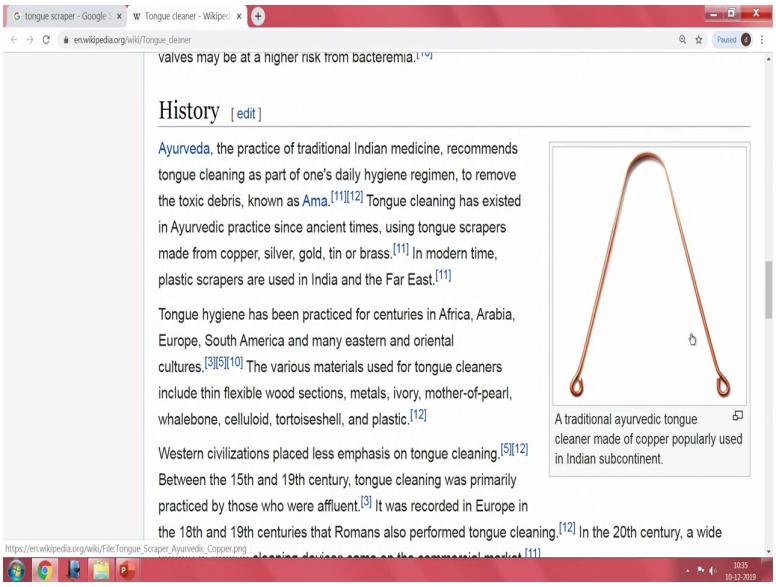

So, it is not it has been there forever as long as I can remember traditional, so we call it now ayurvedic tongue - made of copper popularly used in the Indian subcontinent. What I try to show you is that while I am not very sure how good these things are anything. The issue being actually after every food, I mean after every consumption of every dinner or lunch or any food dentist in fact recommend that you clean your brush your teeth. And the people go to the next extreme saying no also use the tongue cleaner and then try to make things easier for you. I call this as a product concept.

You need to know explain to somebody this is what I am looking for. So, obviously, you talk about what are the functions it does and this being a little about making prototypes for a product that in the initial stage, we try to present it or friends, and eventually it will be manufactured. And when you want to do the manufacturing you will end up having to make engineering drawings. You understand, when you want to do the manufacturing you have to

make engineering drawings like what I have just now try to show you about the two types of things one is called projections, and I have spoken to you about it earlier saying projection is only a representation of how these objects will look like, how do you represent them.

And finally, most how to say manufacturing continues to have things where a cutter moves, it moves horizontally in maybe two directions and then vertically. So, we have the xyz coordinate system. And related to the x y z coordinate system is the all that this thing I try to show you about saying.

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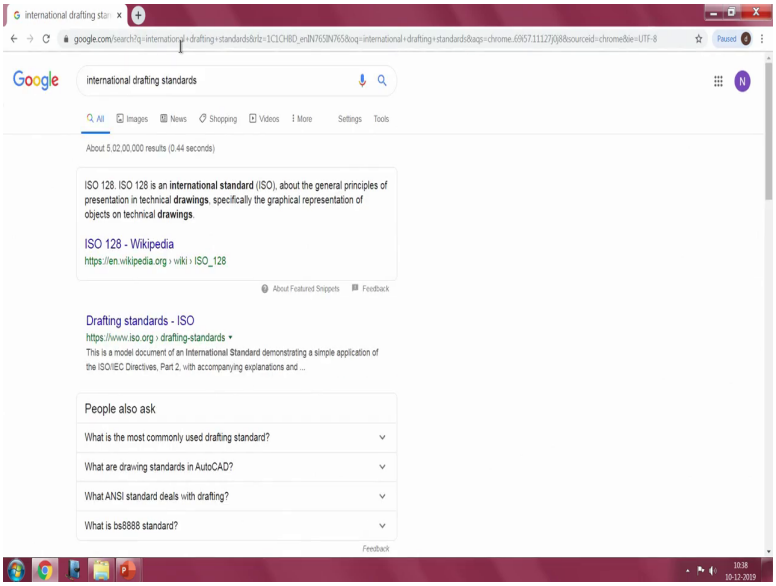

When we now go ahead and see if I little looked ok, we end up with this large number of standards about general principles of how to make technical drawings.

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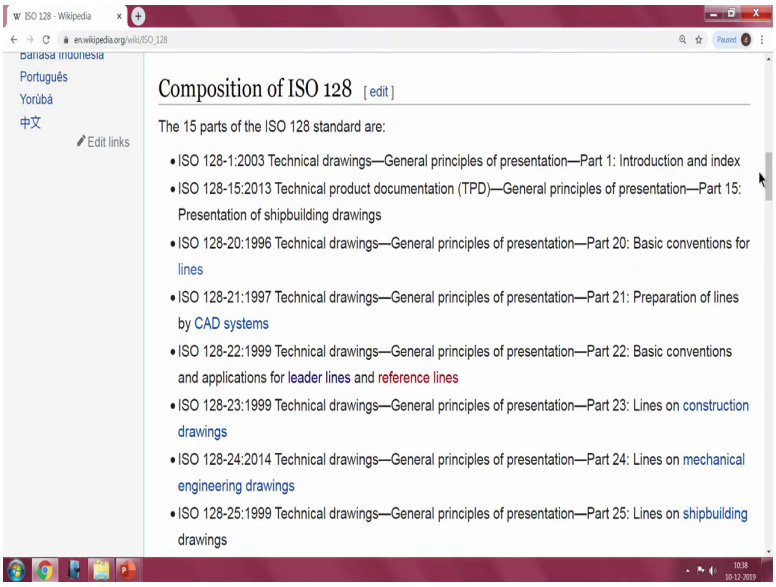

So, this ISO 128 incorporated what was done by din DIN - Deutsches Institut für Normung, and VSM that is the what you call French and Swiss norms. Then we have the probably NSI the American things, and then also the British standards regarding drafting practices, again the word drafting should be slightly different because it is also the word drafting is also used in connection with legal documentation, where some norms are there.

In this case, it is all strictly related to only technical drawings. In this technical drawings, you see we have basic conventions for lines, basic conventions application for leader lines and reference lines. General lines of construction, lines of mechanical engineering drawings, all these a very large number of norms have been presented.

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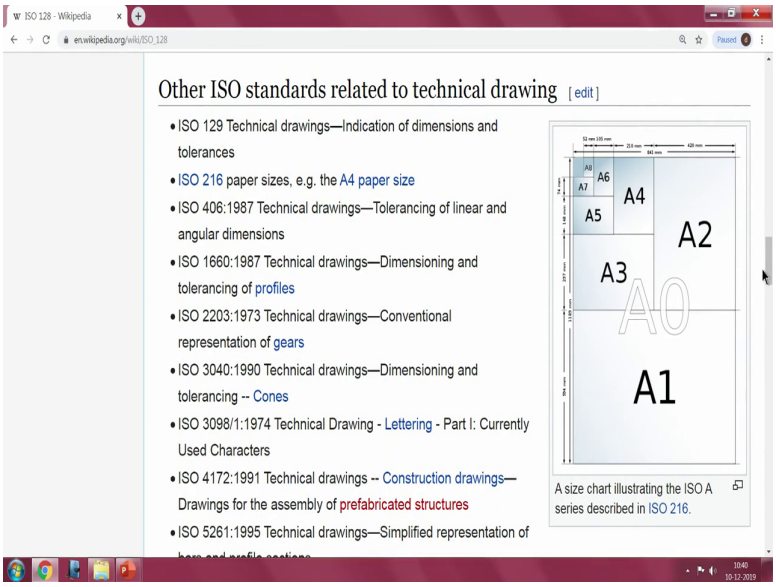

Why do I tell you this? Because the design does not stop with we are just making a prototype or making something which works. You understand know it does not stop with very simple thing like making some prototype and making a what you call functionally showing if it is a working. What you need to do is make present a file of technical drawings for production. And once the technical drawings issue come, we also need to make sure parts which are manufactured separately fit together.

For earlier it was very easy all we have to do is in the what you call previous workshop also I have shown you, how we have made a part and then after making the necessary concept and drawing, how the top cover was just fitted into that. But in reality things do not fit easily, so we end up with very very important things like tolerancing things what is the tolerance and how much allowance do we give.

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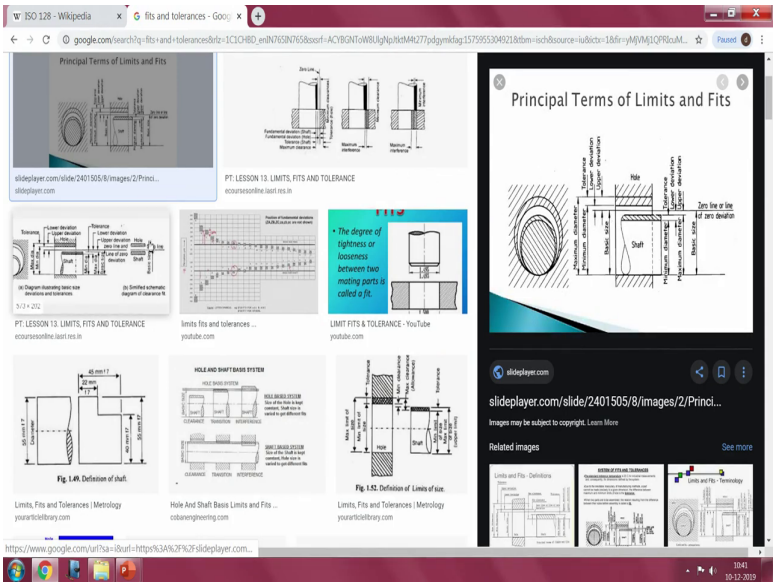

So, the thing which we are all familiar with is how a door, we have a huge this thing about how these things fit with each other.

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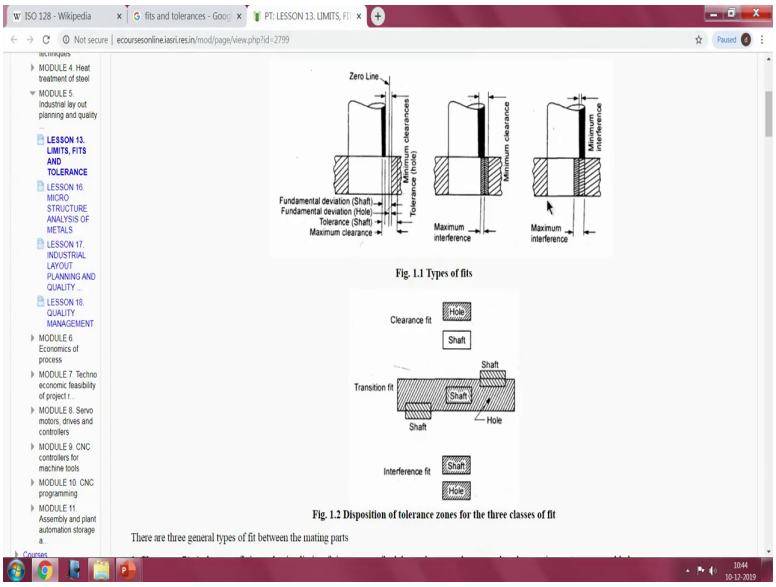

This though it looks a little complicated reality is this. I just a little while back I said the word door if you see how a door fits into the doorway.

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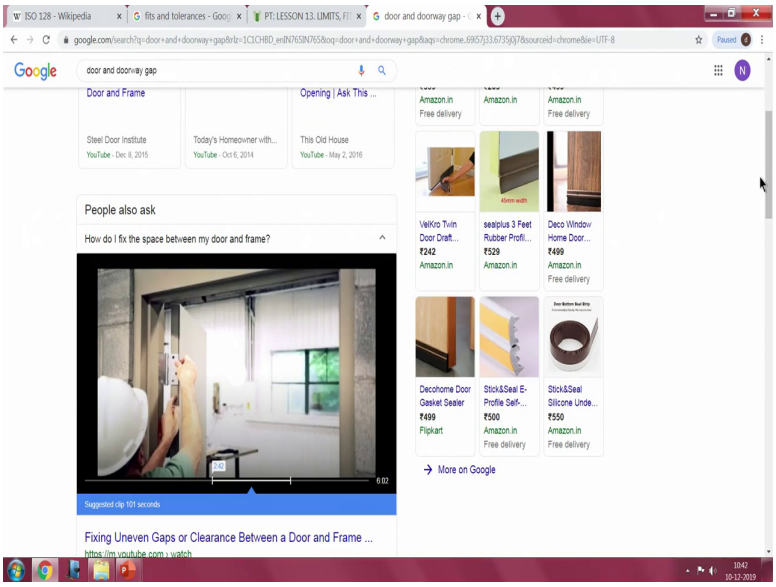

You will notice that it is a slightly it is not that easy to make sure that the door fits the doorframe which is intended for you end up with what is called a a jamber.

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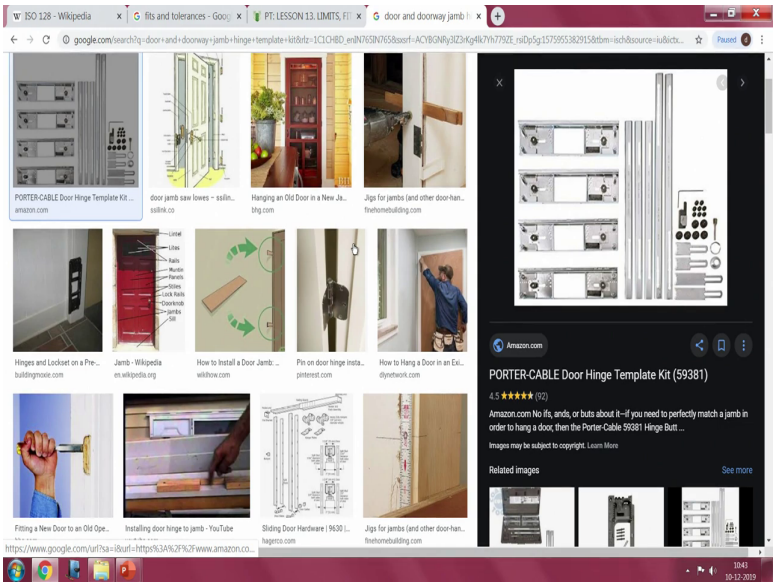

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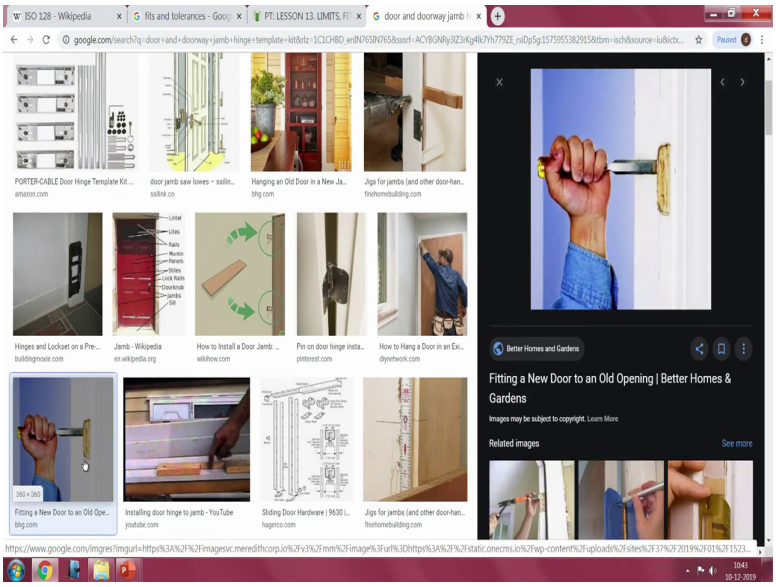

So, how these doors touch each other, and how do we try to avoid reworking when the weather changes.

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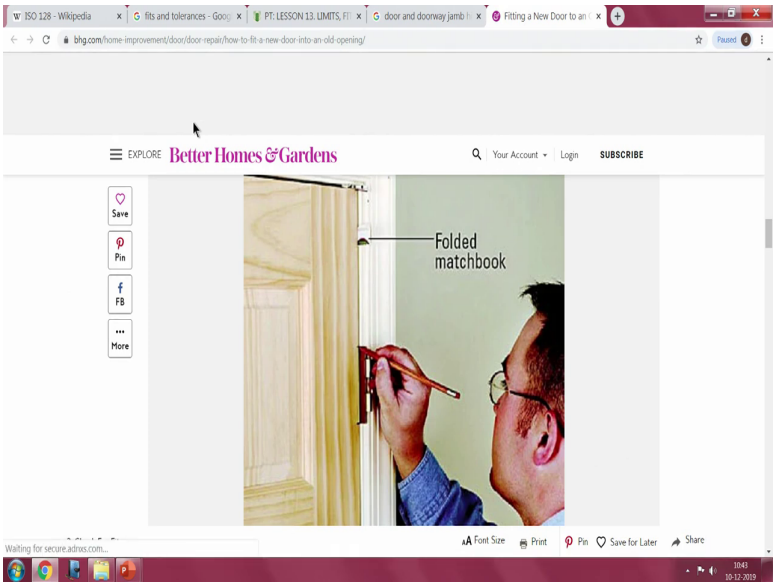

In the case of wooden doors, what will happen is that probably the frame is fixed already or in our case you know it is if we call it a hole base system. So, the frame typically represents a hole and then the part that goes inside the shaft that goes inside.

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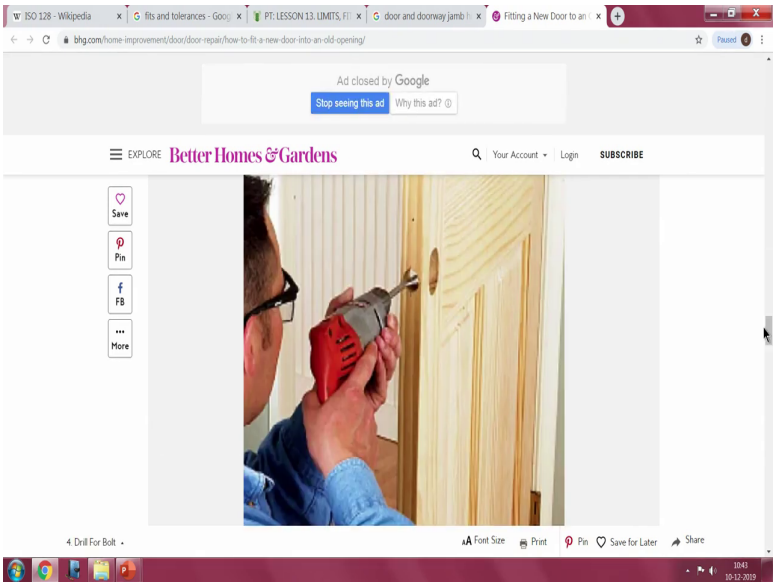

So, over the years several of these things have been represented such that they are universal. So, every time you need not go about the way the other previous they what you call the crafts on carpenter is doing it. So, a lot of times where does the fit type of fit that fits you know makes two things assemble.

So, if you have let us say you have a bearing and a shaft has to go into the bearing. You have to make sure that the shaft fits snuggle inside or we make sure that it does not slip because if the bearing is a roller bearing or a ball bearing. The friction is to be handled by the bearing and not by the (Refer Time: 25:49) shaft. And this similarly let us say we have the housing and which the bearing has to sit, we need to have a perfect I will right. Now I will not call it a perfect interference fit which make sure that on all conditions the bearing will not slip from there.

In the case of wood, we have the issue of where the while wood itself may or may not expand the way we think about in the case of a metal it swells when the moisture changes, and with the temperature lot of buckling and all takes place uneven thing depending on this. So, when a door fits a door jam, imagine this the door jam, and this is the door end, we always provide a small step and we give a gap. And the thing is the door should not go through, but then the jam should not you know reduce the width that we have for the opening of the door. I have given you normal real life everyday example.

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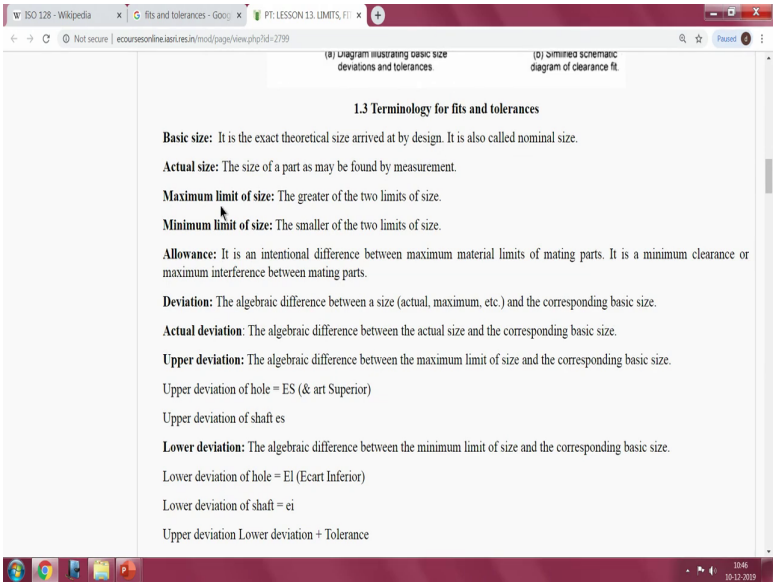

And in the case of our technical drawings especially involving what are called fits, this has been standardized such that things like all these things which are given at the back saying what is the allowance intentional difference should not maximum material limits of melting

points, and what is it nominal basic size, and deviation and so on and so on know. A lot of these things are to be considered.

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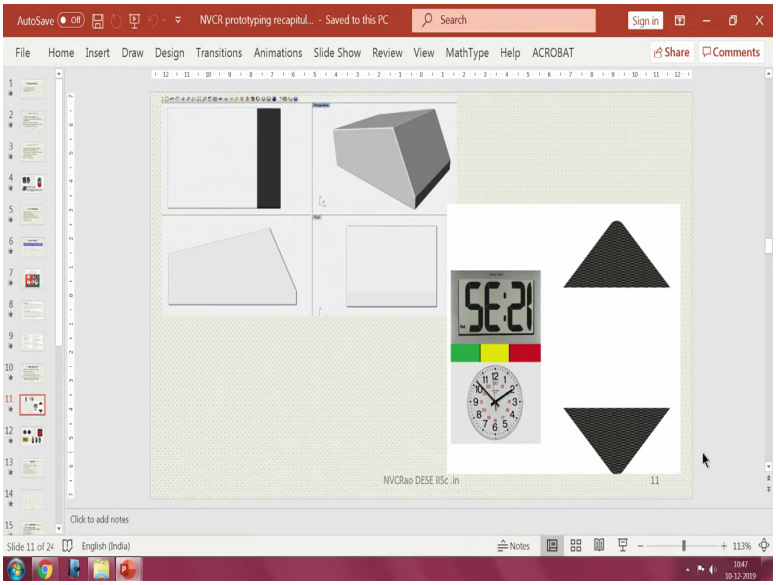

So, it is not you know if we just say we will just make it you know what you call things just miraculously fit nothing fits in fact so if you remember I hope you recollect these things.

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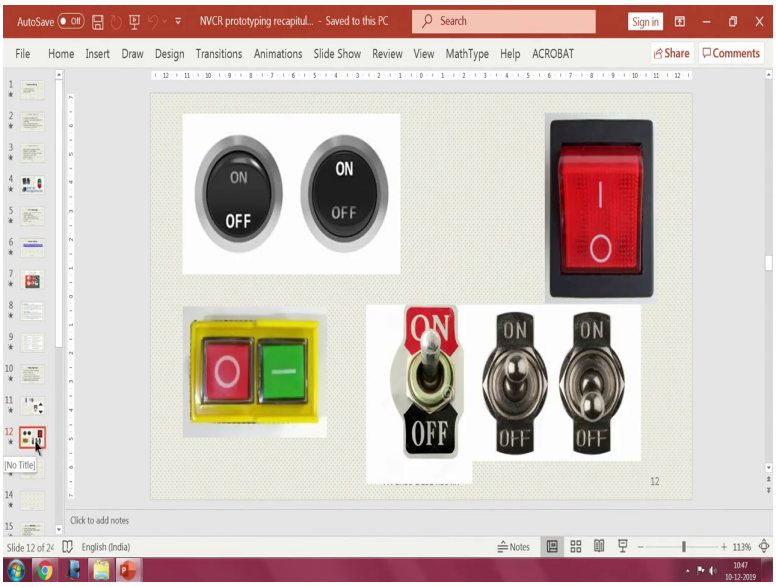

What looks very simple here, we have a switch here, then we have various types of elements. And if you refer to the drawing of these basic components there, lot of technical data is presented saying what should be the opening size and all that.

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While when we first made this it looked quite fine. This is easy I just took a print out and then I stuck it on a piece of cardboard, and then it looks fine. But when make it into a real life prediction, you will see that each part is made separately. And any cover has supposed to fit with any of the (Refer Time: 28:27) elements similarly any front panel is supposed to fit this, and then I also have a red screen glass on top of it, I mean not glass what I call filter inside red filter. So, this red filter should perfectly align with any opening switch we have made at the back, and this whole front panel should go and fit with this item, and the stop cover should go and fit with this item which we do not do it at the prototype stage.

Earlier what was being done is you make a concept, and you make a model of some sorter anything, present it to the workshop. Workshop will now think about all these things, and they make a creative file in which various things are mentioned there. And usually you will have to work with the that fabrication people to see which is the most important thing where

you need to concentrate because things do not naturally fit as we expect things know nothing fits morphemes it work all the time, and you does in it with.

Even if you take a very ordinary nut and if you take a screw, and if you take it from a box of spares which you have at home, you will notice that none of them seem to assemble itself properly there is usually some problem with the whether it does not go in or it is very loose. If you take a nut and if you take a screw and then put them together especially taking from a bin you will see we have a problem that is how full standards about how fasteners are made have come about. So, we have thread standards which make sure that everything any nut from a badge will fit any thread alternatively.

If we have a some part which needs to hold a threaded piece, we make what is called a tap set, when you tap it we expect that any screw which follows that standard saying I say British standard width work or I say what you call some ISO m 6 ok, or I say quarter inch the any of the what you call American standards if you have the corresponding the tap you tap it and then this screw goes inside.

While so fasteners are you can play with it when you come to things like gas threads or when you come to things like what you call hydraulics items, they tolerances and all are extremely, extremely close and not everything is what you call taken care of. At that point things like pressure variation of viscosity of the materials and the temperature variations all this come into picture. Fortunately for us in the case of our simple electronic enclosures, where you need not worry too much about it, and usually after you make your whatever first level drawings and then pass it on there other experts who work with it.

This is where I feel which I thought I will stress. First time when you make the drawing if you consider all these items. If you make a proper solid model and that to if you make a solid model with any of the little more advanced packages, you can directly specify tolerances, and you can directly specify fits. And usually there is a way of checking back in the in the whole system by which it will tell the package will give you a prompt saying yes this is feasible or saying no somewhere you are exceeding something.

So, I will stop here. I will continue next time. In this lecture, what I try to cover you is the there are certain standards regarding how to mention the features that we want the simplest features are the lines and the shapes. And even in a flat sheet when you are representing something for somebody else to understand we have a common language was a highly technical language.

So, in fact, nobody right see or know something needs to be plus 0.5 mm or plus you know 2 mm, and all instead they will specify if it saying this is a JS fit or this is called a H14 you know what you call n 6 K 6 fit and so on like that.

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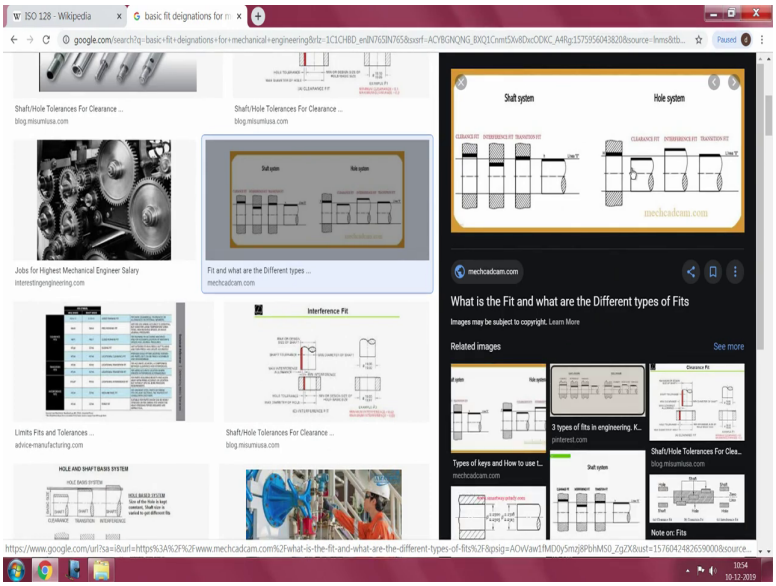

So, N6 refers to a particular range of the whole K 6 refers to a particular range of the shaft and when you push them together, so there is in fact in ISO, which I will come back some

other time there are a list of types of fit that are possible have all been standardized saying if you call that as some JS system or if you call it some HA something and so on.

So, all these have been standardized, and they usually mechanical engineers reference books will give you what you need to do. And why all this is required is it is, not that you know you keep on assembling the parts, you cannot take one bottom and try to put the assemble, remove something and assemble it and so on like that for everything you have go no go gauges. So, these gauges have all been standardized with respect to the tolerances and fits that we specify. And this where little you know what you call (Refer Time: 34:20) that you need to add all these things to your drawing at the drafting stage itself.

I will continue with this later with a little you know coming back so.

Thank you.