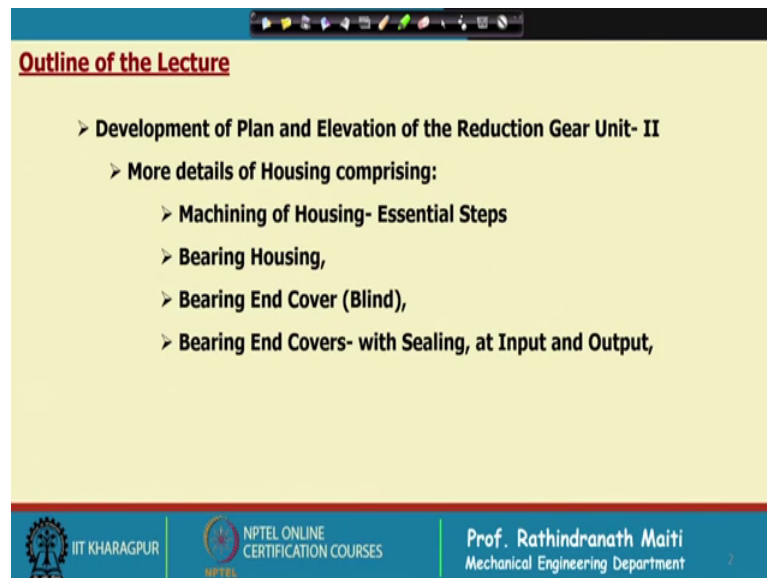


**Gear and Gear Unit Design: Theory and Practice**  
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**Lecture - 29**  
**Development of Plan and Elevation of Gear Reduction Unit – II**

Welcome this is module 6 means week 6 lecture and we are continuing with the drawing plan and elevation or little drawing of the gearbox. This is design of general purpose industrial helical gear reduction unit this is part 4 the last part and today's lecture is development of plan and elevation of gear reduction unit this is part 2.

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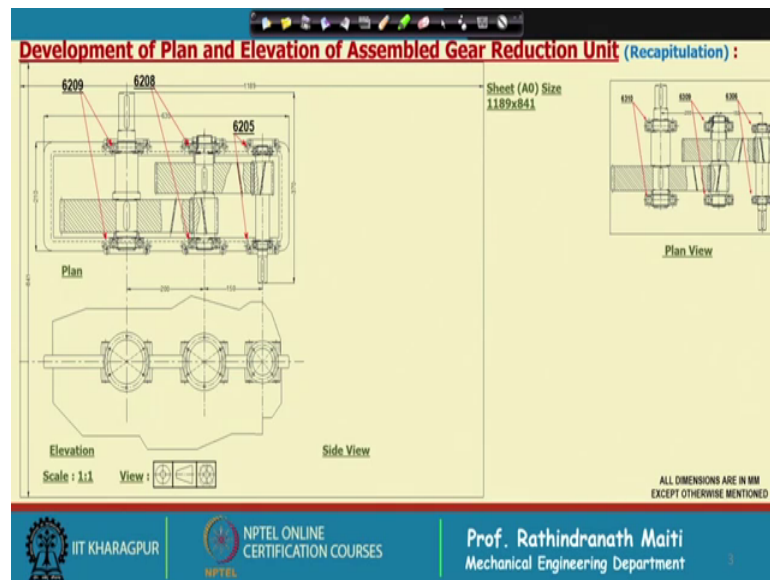
**Outline of the Lecture**

- **Development of Plan and Elevation of the Reduction Gear Unit- II**
  - **More details of Housing comprising:**
    - **Machining of Housing- Essential Steps**
    - **Bearing Housing,**
    - **Bearing End Cover (Blind),**
    - **Bearing End Covers- with Sealing, at Input and Output,**

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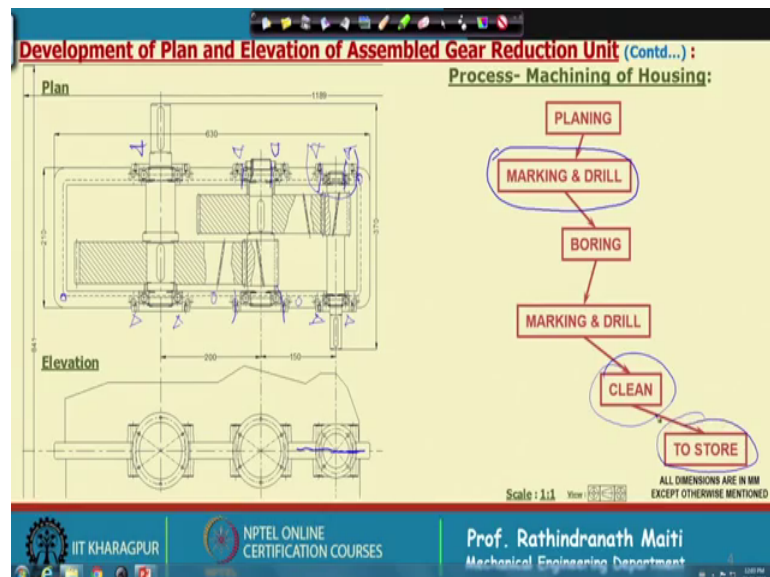
And in this lecture I shall cover development of plan and elevation of reduction gear unit 2 then more details of housing, comprising, bearing housing, bearing in cover machining of housing of course, that is the essential steps I have to discuss and bearing n covers with sealing and at input and output.

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Now, so far I have shown that we have already made the developed the sub assemblies of the input, intermediate and output shafts and also we have started developing the plan and elevation and we have taken easy resides heat and scale 1 is to 1. And all the details are in third angle projection as shown below of these slides. .

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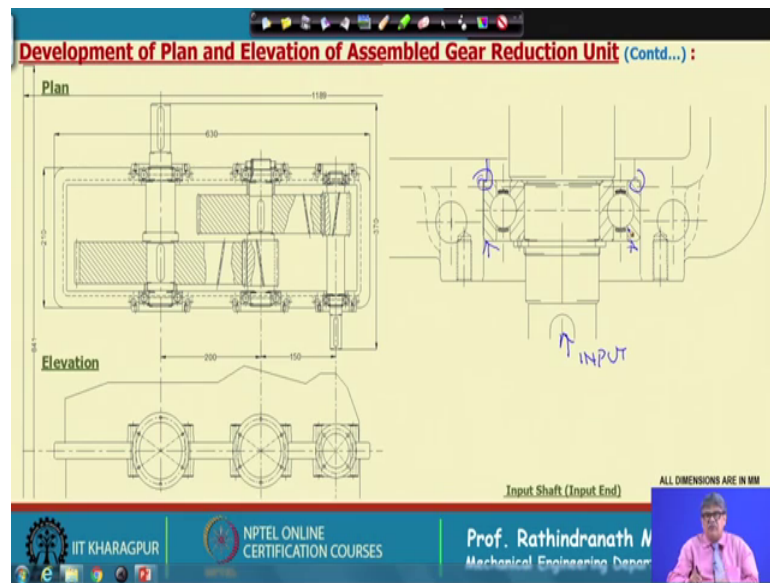
Now, first of all going into the details of the elevations further details of the elevation and plan, let me tell about the, what are the process of housing machining. So, first of all the housing; that means upper cover and lower cover they are cast or fabricated.

If the number of order is less then we make the housing by fabricating this is a ms plates of men for main housing usually 5 millimeters are taken and they are cut into size and then they are welded to give the shape of lower and upper cover or bottom and top cover of the housing. Now, after making the housing bottom and top then first the surface where they are joining, say this means if we look into this elevation it will come over here say, this surface these 2 surfaces are machine in a planning machine and then after that there are marking and drilling; that means, we have to join together for further processing.

So, the fixing bolts will come into the details, those are for those are marking and then drill are made then they are held together by the bolts and nuts ok, but here one important issue is that once that bolt and nuts are opened and then again if you try to replace then we will they be in the same location, probably not. That is why what is done 2 holes for dowel pins that is locating pins that are also made during this process that that the first step that marking and drilling and that first step these are made, then the dowel pins they are put there and they with the help of bold they are tightened.

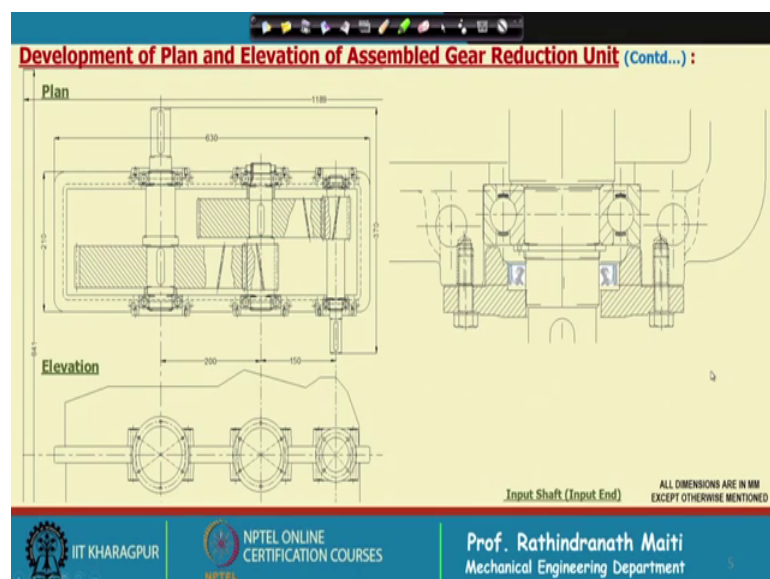
Then it is sent to the boring machines for the process of boring got all the holes bearing holes that is this bearing holes these are made, these are mates and we make the holes here for tightening and dowel maybe these 2 corners. I will show the details with the next slides they are tightened together and then these boring holes 3 boring holes and also this surface machining these are done ok, this side also these are done ok. Then again necessary marking and drilling that is in this say for example, the for these holes for this bolt holes this marking undone and drill the tapping everything is done at that stage and then these are cleaned and it is stored it is kept aside for the assembly ok.

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So, these are the main processes we need to go for the housing, now if we in this next slides, what I will show that how this further progress is done on the developing the plan and elevations all the other components how they are developed fast, then they are made the detailed range. So, first of all we will think of the this is the input shaft, this is the input end say this is input end say this is input and what we have put that this bearing that is the housing is made such that the bearings are resting at these 2 corners and so, therefore, we have to put a cover so that it touches here and these are firmly fixed bearing are firmly fixed axial movement are restricted ok.

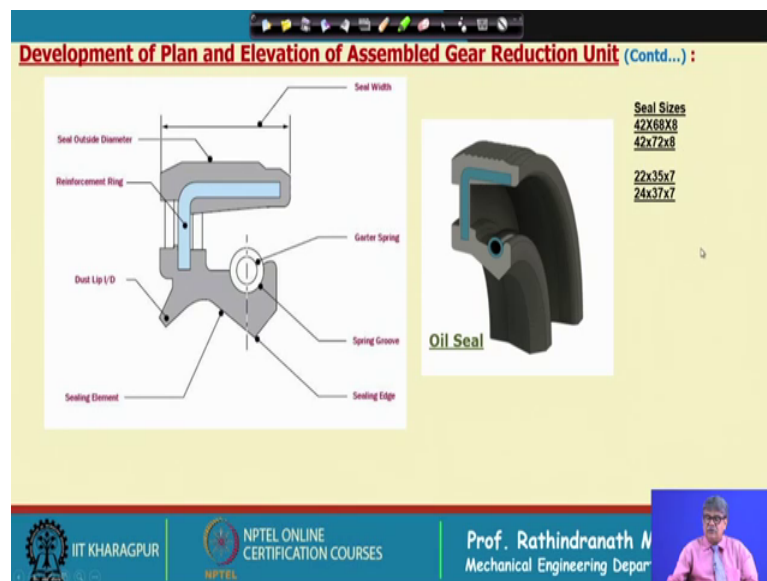
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So, for that what is done a cover is put so this is the cover, we have not drawn fully because that we will put it there and these are the bolts which will tighten that and this cover end will touch the bearing outer race; however, as this cover is being put there we need to put also sealing of oil. So, oil should not come from outside sorry, from inside and that should not go inside. So, some sealing arrangement is there, now I will show that what are thus these sealings. So, this is sealing elements I shall discuss in the next slides, how the sealing as you see here. So, this tip or this tip, if we consider this tip of this one that will touch the shaft here and as already oil is inside, oil will be inside.

So, that will lubricate this portions this part will remain fixed and the shaft will rotate no dot will be allowed to go inside oil will not come from the outside also, I shall discuss about the details of the sealing in the next slide as I told you and this whole unit now they are put like this ok, as you see that everything is inside I slightly distorted neglected that one. So, it apparently it is showing gap here and it is showing that overlapping here, but it would be in proper place and then the, this part is over this portion is completed.

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Next let us consider the seal what is the oil sealed, this a view of the oil seal the half photographic view as you find here that this blue portion this is some metal stiffener, metal stiffener ok.

And outside that these are sealing elements may be rubber night ride rubber and some synthetic material which will not wear easily as well as it should not have any reaction

with normal lubricant oil and inside the air this is the tube sort of things this my might be a tube sort of I mean some synthetic material which can act as a spring or simply the metal spring. It is something like that if you think of the spring used and scream that sort of spring, the it is closed and that is that put here and this stiff this is flexible say maybe 2 millimeter upward and 2 millimeter downward no problem. So, we can choose the shaft size accordingly there is a nominal dimensions.

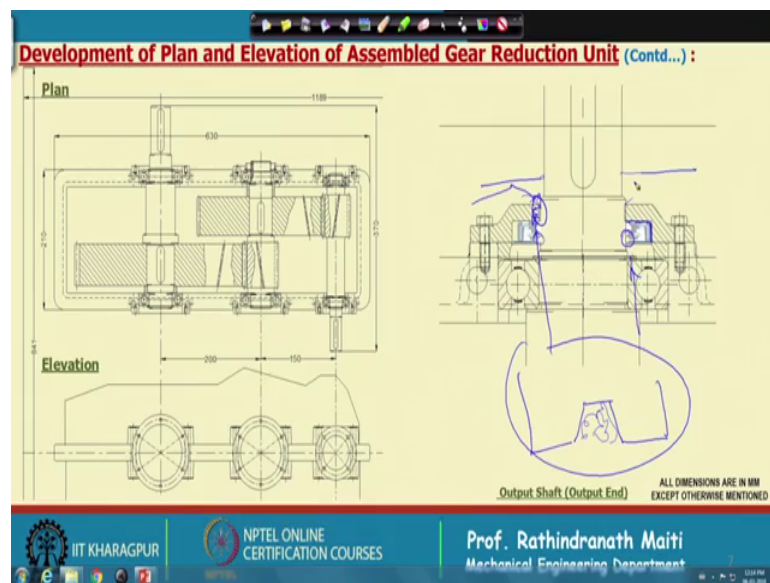
Say suppose it is 24 millimeter in that case we can make the shaft ideally 24 millimeter, but if it is made 23.7 or 24.5 the same shear we work all right. Now, if we look into the more details as it as you see here this is the width of the seal, when you find a catalog manufacturers catalog of any standard these are standardized also you will find that this is the outside seal that we will sit on the cover and this is the seal width and this will be the inside diameter, this is called sealing edge and this is the spring groove. Here is spring is put then garter spring it is called this is also a dust leaf is there, this is simply touch on the shaft and here this will touch with pressure, this is sealing element and this is reinforcement ring, this is usually metal it has to be metal and this is outside diameter ok.

Now, one important issue is here if we look into this suppose the it will put in such a way this sides should be the inside of the gear box and this is outside, because due to the if there is any pressure while vapor pressure or anything that if is oil try to come this will be slightly compressed inside and this contact point will be tightened further. So, that oil will not be able to go, on the other hand dust this will prevent just to not allowing dust to come inside some features. So, this is not there only this point is there, but that will work, now if we look into the size of the seal if you remember in lastly what we have done in input shaft we have taken the bearing is 25 millimeter we have taken 6205; that means, 5 into 5, 25 millimeter.

So, we have 2 option after that bearing sitting if you look into the catalog we have 22 millimeter shaft dia nominal shaft dia and 35 millimeter seal outside diameter and seal width is 7 millimeter that is available or we can go for a little hair size 24, 37 and 7. In our design we have chosen 24, 37 into 7 here itself I mentioned for the output shaft in the lastly what we have taken or in final decision, we have taken their 6209 that is the diameter on which the bearing is sitting that is 45 millimeter.

So, next to that one is 45 is available next to that 42 is available ok. So, we have taken 42, but we have taken 22 into 72 into 80 there is a smaller size also 42, 68 and 8 you will find in some other bearings, if it is the bearing outside diameter is small we have to go for small size outer dia sealing in that case perhaps we could have taken 42 into 60, 8 into 8, but in this case we have taken 42 into 72 into 8. So, this bottom one for the input shaft and here this bottom one for the output shaft.

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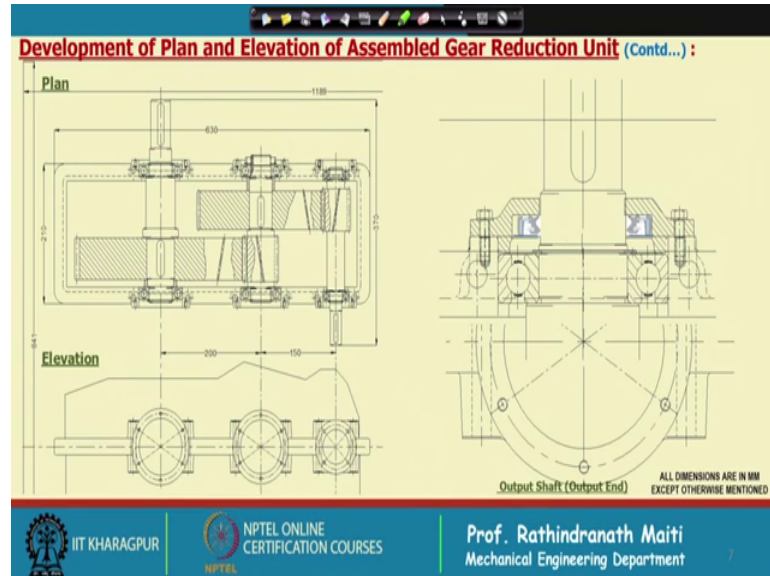


Now, output shaft in the same way, if we look into this this is the cover and then we put the seal now this is not properly drawn ah, but the seal will come inside you can put the seal. Again you can notice it that this is inside, this is the inside of the gearbox we should not put in the reverse way then there will be problem dust will come inside oil will go out. So, that care must be taken and this will sit here if you look into this oil seal, simply it is precipitated inside the cover and if we look into this cover also in this cover their usually a gap will be there.

Sometimes in the cover itself a another group is put like this, like a trapezoid it is something like this groove made on the cover here, here and that groove is filled with grease that is another application not to allow to dust come inside ok. But, care you have to take care of that, during inspection you can put further a little bit grease just keep in mind outside there will be coupling maybe you have to use a grease gun to put the grease

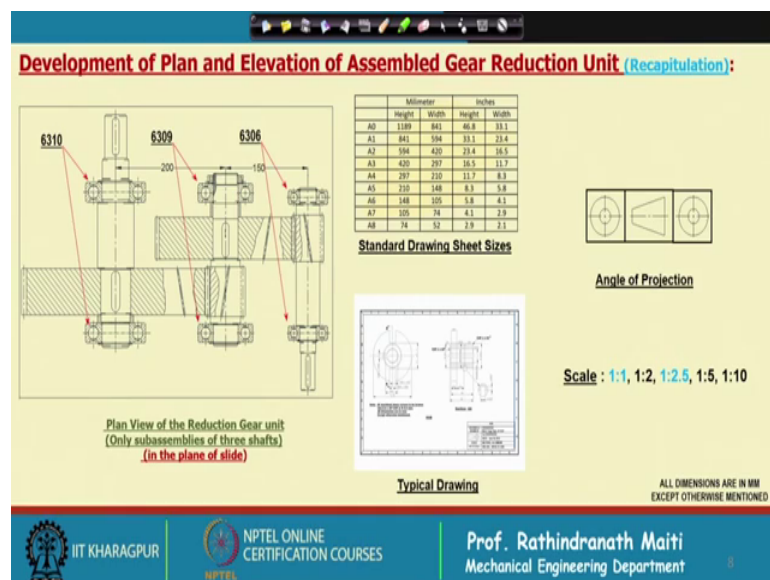
here ok. So, in that way we maintain the sealing of oil not to go outside and dust not to come inside.

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Then this is just we have shown the elevation part of the this one, this elevation half elevation that it will look something like this from this side ok.

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So, here I think in the last slide again I mentioned that we have taken this view in third angle projections and in probably in the next part we will go into the details of the housing in further details how the other components what should be there in this



gearbox. So, this is this is all drawing as as you find here still it is mentioned that 6310, 6309 and 6306 instead of that we have taken 6205 here, that is 49 25 millimeter dia inside and here we have taken 6208. So, 40 dia width here and outside diameter is also let less and here we have taken 6209, 45 millimeter dia.

So, in this lecture what we have learnt in the this first we after assembling the drawing, I mean making the sub assembly of the shafts then all calculations. If necessary we change the sub assembly we change the drawing accordingly and then we go for little plan drawing and after planning or at the beginning of the planning when I choose the upper cover and lower cover or lower housing of the gearbox then we have to think of machining that one.

These are either made of cast iron or fabricated in any case we have to fast machine, on the planning machine the surface of upper cover and lower cover and we have to make a marking there for bolt holes we have to make the bolt holes also for the location we have to make the dowel holes and then we can put together, we can tighten the bolts and then we can put it into the boring machine for making the holes for bearing sitting at 2 sides.

Also we make the bearing housing outside machining. So, that the cover can be put there, after that the drilling tapping everything is done then that is cleaned and kept asides for the further work. So, here this is just the drawing size have been shown and we have taken the a 0 size drawing. So, that we can make a 1 is to one scale. We have used the scale 1 is to 1, this is better always better if you can draw something 1 is to 1. If you cannot if we if we cannot accommodate all the view in this one size drawing then there are two of sense you can use other views in other drawing sheet or else you can take the next scale may be 1 is to 2, 1 is to 2, 5 is preferred by some people or 1 is to 5.

Normally one is to 10 is not done for machining unless it is a huge machine ok. So, this is the end of this lecture and we will go into the next lecture and we will still continue on plan and elevation of the shaft.

So, thank you.