Fundamental of Welding Science and Technology

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Module - 1
Lecture - 3
Parts of weld joints and welding symbol

Today, I am going to deliver a lecture on Part of weld joints and welding symbol. I have already discussed about different types of classification of welding process, different types of welding edge preparation, different types of joint geometry. So, you are aware about all these thing; that means, you are aware about all the different welding processes, you are also aware about all the different types of welding joint also. Now we will see what are the different parts of a weld and how the welding symbol?

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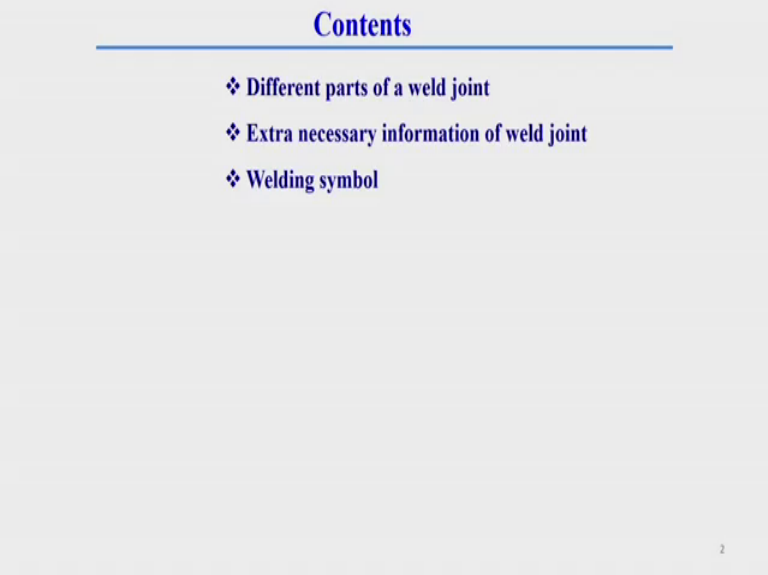

So, this is the content of this present lecture. Here I will discuss about different parts of a weld joint then extra necessary information of a weld joint. That means, what are the some other apart from this part of weld joint, what are the other necessary information required for weld joint. And here also I will discuss about what are the welding symbol, how it is look like for different types of weld joint also.

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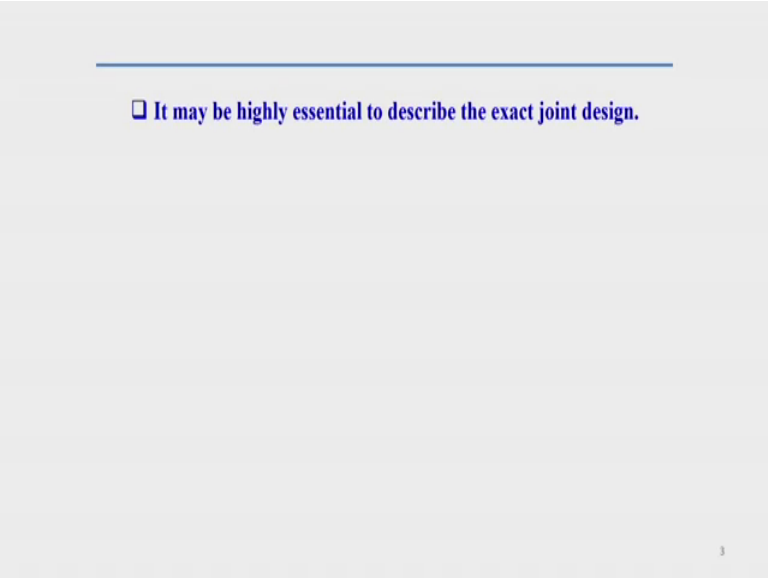

So, generally it is highly essential to describe the exact joint design. So, to know the exact joint design this different part of weld joint is highly essential. Generally these different part of these weld joint different part of a weld joint is highly essential especially once you will be in industry. This as special futures of weld joints and it is elements is highly essential part to generally for designing a weld joint. So, to know so here generally knowledge about this a different part or different element of this weld joint is highly essential especially when you will be in industry.

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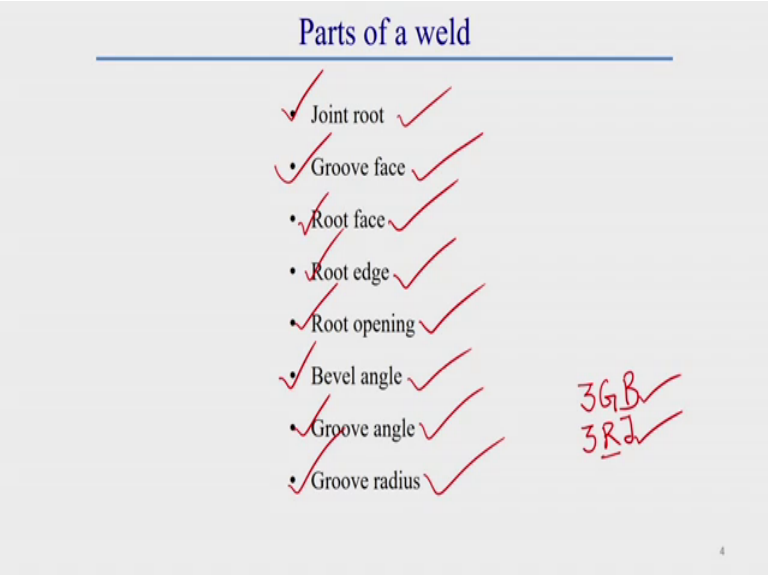

General this part of a weld joint generally here one things you can easily be able to see in a particular weld joint especially for butt joint. Especially for butt joint which is widely applied in industry generally there you will see so many different part of a weld joints are there. Here we almost 8 different part of a weld joints are there; this is the different name this is the name of that different part of weld joint. Here you will see there is a part whose name is joint root, there is a part whose name is groove face, there is a part whose name is root face, there is a part of weld joint that name is root edge, then another part is root opening, then another part is bevel angle, groove angle and groove radius. So, around eight different part of a butt joint here are there.

Here generally one things you can easily be see easily be able to see from here. Here to means remembering purpose for this eight different element name. Here you can see there is three r, three general element which they start by r three different element like these and this we say started by r. So, there is three r then are generally which is a started by r. And other three element like groove face groove angle and groove radius also started by a g. So, another one is started by V and other one is started by j. So, from the to for remember purpose here one things you can just for remembering purpose you can remember this thing in g. They have three g b is there 3GB 3GB. This term generally easily be able to recall was just I am telling you can recall this thing or remember thing in this way also 3GB 3RJ are there.

So, 3GB means 3G which the 3 elements we say started by first or is G and 3 element of this weld joint are there which is started R. And rest of the thing 1 1 1 1 element is started by B another element is started by J. So, now, this about this individual element, I will describe in detail in subsequent slides.

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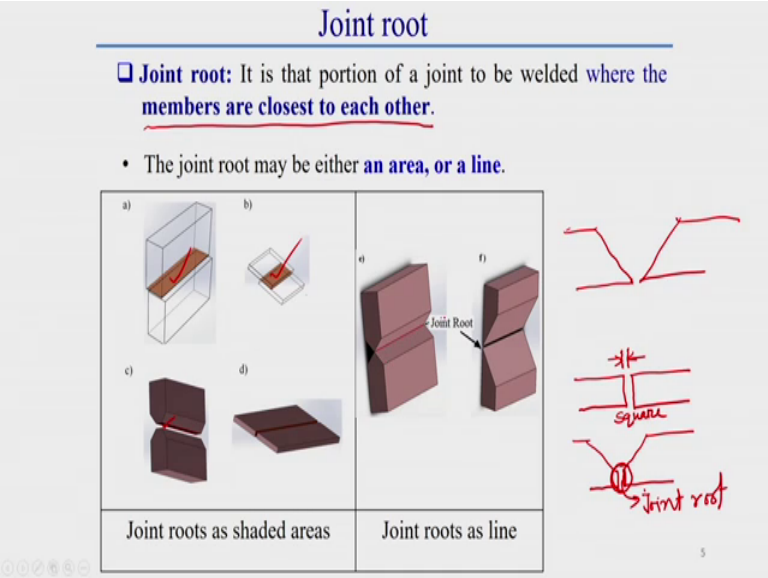

Here first of all we should know what is joint root joint root is generally it is that portion of a joint to be welded where the members are closest to each other. Here generally this is very important terms generally it is that portion of a joint where the members are closest to each other. Here one things you can easily see for butt joint these are all related to especially for butt joint. Here in case of butt joint you can easily see if it is a square groove butt joint generally then you can see. Here generally this face or you can say weld preparation or weld edge generally weld edge is generally closest to each other that the entire face of the weld is closest to each other. So, this is generally called joint root for these for these butt joint.

If it is a bevel types of joint or bevel types of edge preparation is there if it is a bevel types of edge preparation there, then it is closest portion here a generally a closest portion to each other are generally this portion. So, this portion is called generally joint root this portion is called generally joint root. Here generally the closest portion is enter weld joint reason in case of generally a square butt. In case of a square edge preparation or a square butt generally you can see this is the closest reason. So, this is generally called joint root.

So, joint root can be a face or it can be an area or joint root can be a line also. When it will be a line; if the edge preparation as if the edge preparation is if the edge preparation have generally 0 is can be a it can be a area or it can be a line also. If this if this region

have 0 0 width if this region is 0 width there you see there is there is no chamfer region is there is no chamfer region is there. So, this region is called here generally this is a line here this is a line from this figure you can easily be able to see this sometimes can be an area or sometimes can be these joint root can be a line.

Here you see in this a square butt generally this is a area like this is a in case of lap joint also these joint root portion is a area. In case of double b or double bevel angel edge preparation generally these joint root is a area here where there is a generally in case of a square here also generally joint root is area. Now, but here where you see generally joint root of 0 width generally if this joint root have 0 width here you see these joint root have 0 width here width is 0. So, here we can see it is a line so here also it can be a line this is for single V butt joint and this is for double V butt joint also it is a line.

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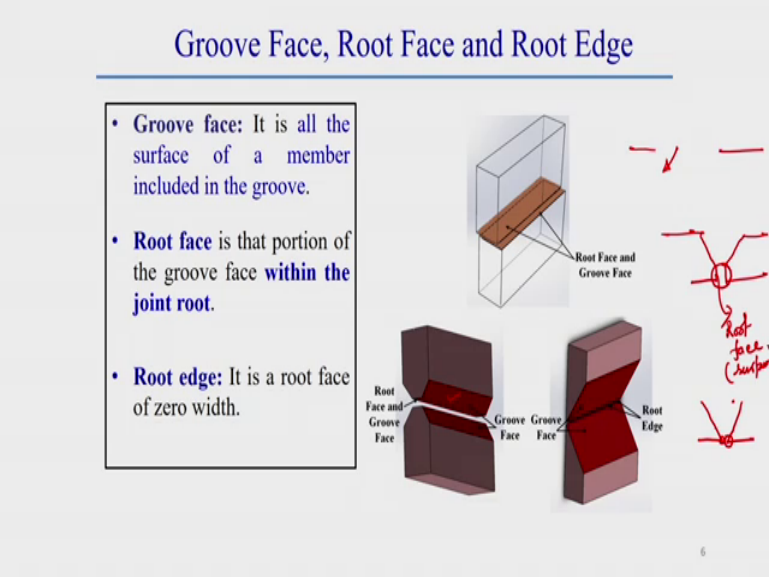

Now this the other element like groove face root face and root edge. First of all what is groove face? Groove face it is all the surface of a member included in the groove. Generally what about the groove; that means, entire groove whatever the groove are there groove face means all the surface area included in the groove that this is a groove where both side beveling is done. So, whatever the surface area here everywhere whatever the surface area are there this entire surface area is known as generally groove face. What is root face? Root face is that portion of the groove phase within the joint

root; that means, root face is the area which is at the joint root in this region generally root face are there.

So, root face we can draw like this way root face we can draw like this way root face generally whatever the surface area we get at the joint root. That means, closest to closest portion of each other region whatever the surface area we are getting that is generally is called root face here generally we are getting root face here. Whatever the surface whatever the surface we are getting here that is generally called root face ok. Now, root edge root edge actually it is the root face if this root face have 0 width if this root face have 0 width here you see is this root face here this root face as 0 width if this root face has 0 width, then this is called generally root edge.

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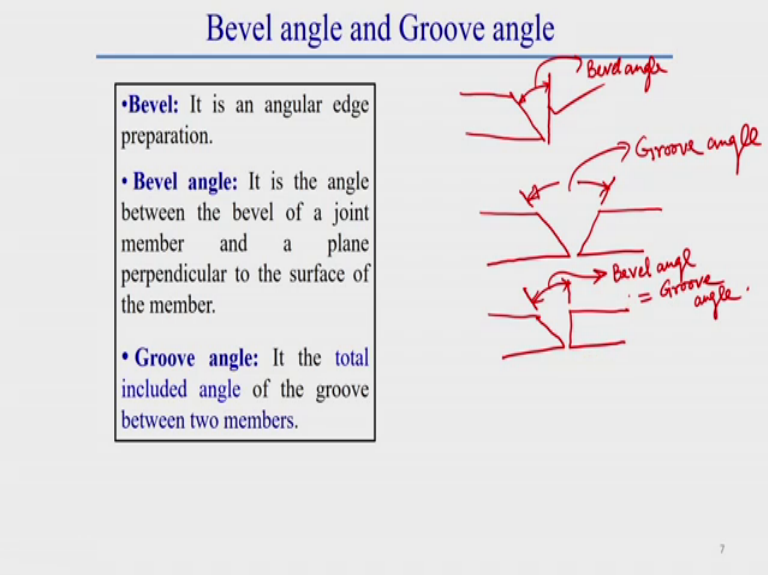

Now, bevel it is an angular edge preparation which is generally look like this. Now bevel angle is the angle between bevel of a joint member and the plane perpendicular to the surface of the member. That means, this is a bevel and I a plane we have to take which is generally to perpendicular to the surface of this member is called generally bevel angle. So, bevel angle is the angle between the bevel of a joint member and a plane perpendicular to the surface of the member this is called bevel angle bevel angle. And this edge preparation is called bevel edge preparation. Now what is groove angle groove angle generally the angle it is the total included angle it is the total included angle groove angle is the total included angle of the groove between two member. That means, this is

the total included angle of the groove between two members; that means, between two member whatever the total included angle we are getting that is called groove angle groove angle. So, we got the idea about bevel groove angle and groove. Now in case of a butt joint which have a bevel edge preparation and a square edge preparation in this case what we can see here generally bevel angle. Here generally one things you can easily be able to see here from here; that means, here generally bevel angle and groove angle are same groove angle are same. So, here in case of generally one piece of the plate is subjected to bevel edge preparation another piece is a square edge preparation. If it is then, there case generally it is bevel angle and groove angle are same

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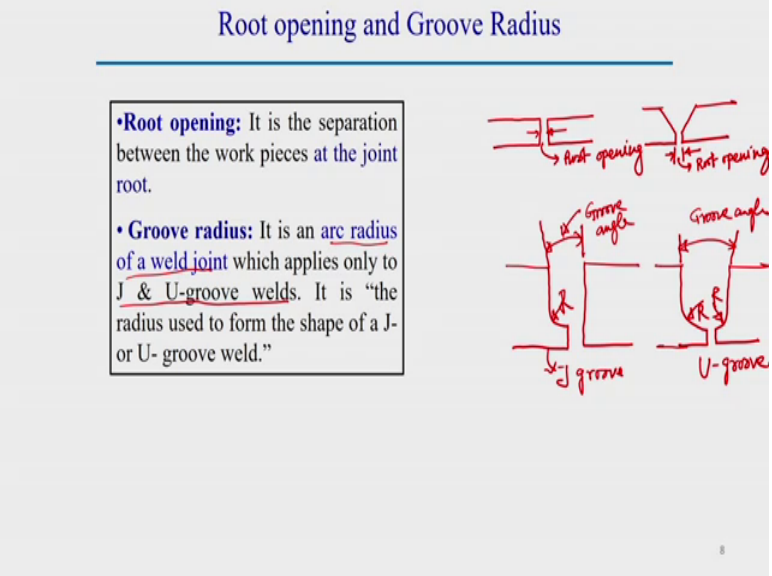

Now root opening and groove radius this is also another two element of a weld joint. Then a root opening it is the separation between the work pieces at the joint root. That means, at the joint root what about the separation is there that is called generally root opening like what happens in case of a square butt joint; the root opening is the root opening is this is called root opening in case of a square butt joint this is called root opening. In case of bevel types of edge preparation the root opening is the gap between two member at joint root this is called generally root opening.

Why this root opening and other thing required. Generally, this root opening these bevel angle edge preparation these are generally required for joint design and for it is for the weld joint extends requirement. And for the pooper fusioning and all the purpose

generally these joint root joint root opening different element is required in a weld join joint. Now a groove radius it is an arc radius of a weld joint generally groove radius is a arc radius of an weld joint which apply only to J and U groove weld.

It is the radius used to form the shape of J or U groove weld generally this groove radius is a arc radius of a weld joint. Where it is apply it is applied either J or U groove of the weld. Like lead this let this is J groove edge preparation and let us another can be it can be U groove edge preparation. So, here generally in this case what is this groove radius in this case groove radius is the radius which general used which generally used to make this J. This is generally J groove J groove edge preparation this is generally a groove edge preparation this one and here generally U groove edge preparation groove edge preparation.

So, here generally a radius r is used radius r is used edge ideas are is used to form this. This U this r is used generally radius r is used this true to form this J groove or to form the U shape to form the J shape or to form the U shape this radius generally provided here. So, here one thing so you can see you can observe here generally in case of J groove also here whatever the angle we are getting this angle between these two here also you can see here generally this angle is called groove angle which of g J groove also this is called groove angle. And in case if U groove U groove U generally here this angle whatever the angle we are getting here this angle is called generally groove angle.

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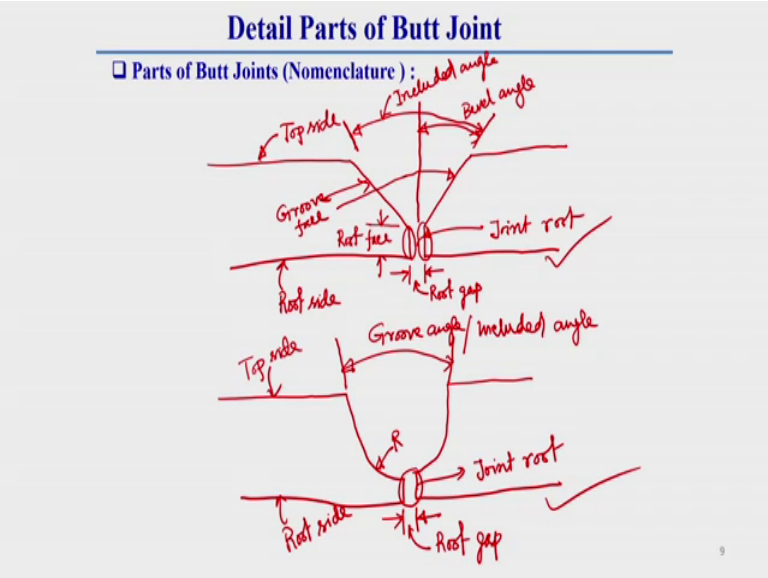

So, now we will go to the another element of the. So, now, we have already discussed about different part of a weld joint. Now we will see in a in a single in single butt joint what if the different part of weld joint in all the all the all the joint element now I will show in a single joint. Like let this is a butt joint here I will show you in detail about all the element of a butt joint.

Now, here this gap between two member generally it is called I have already explained is called root gap. This closest portion of this element this is called generally this portion is called generally closest portion of this element this and this closest portion of this element this is called generally joint root joint root. This is generally called joint root whatever the face we are getting here. At joint root this space is called root face this is called top side, this is called a root side, the angle between a bevel and a perpendicular plane angle between a bevel. And a perpendicular plane is called bevel angle and the angle of two member ; that means, this and this is called included angle included angle is called included angle.

Now we will see in case of a J groove how it is look like in case of a J groove or U groove what are the different element of a butt joint are there; that also we will see. Generally in case of J U groove or J groove generally here also this is called joint root this is called joint root this is called joint root. Now here also generally all the surface here this surface this surface all the surface is called generally groove face all the surfaces generally called groove face. Here also generally this is called joint root in the case of U groove joint root. This is called root gap, root gap this is called root this is called generally groove radius this is called groove radius. Here this is called general whatever the angle here we are getting this is called groove angle. These groove angle also sometimes called included angle these groove angle also sometimes called included angle.

So, this is generally for butt joint for a bevel V types of groove all the different element. And this is for generally U butt U groove butt joint of different types of element. This is called generally top side and this is called generally root side root side. So, this is a different part of a butt joint and it is nomenclature.

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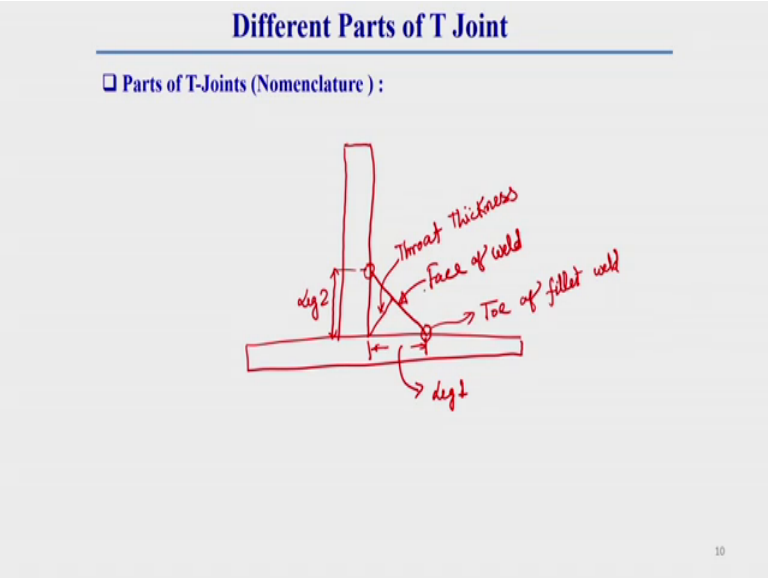

Now, we will see what is the different part of a T joint also. That way that means, in case of a T joint what are the if we do the welding then what are the different part of part are there. In case of a T joint the different part of different name also; like this let this is a inverted T here once we do the weld welding then this T this shape of the welds trianguler in nature which I have already discussed in detail.

Here the different part of this weld joint are we can describe like this from here to here this is called leg 1 leg 1 part from here to here. Here to here this is called leg 2. Generally this face of the weld this is called face of the weld face of weld the perpendicular distance from this face to corner of this joint perpendicular distance from the face to this point from here to here this distance is called generally throat thickness. Throat thickness throat thickness and here this point and this point are these very important point generally this point have a name this point is called toe of fillet weld fillet weld. So, these are the general different nomenclature of a T T joint. Here generally this is from here to here this is called leg 1 this is leg 2 this is generally perpendicular distance from face to this corner point is called throat thickness and this is called face of the weld. And to important point is this and this location which is called two of the fillet weld.

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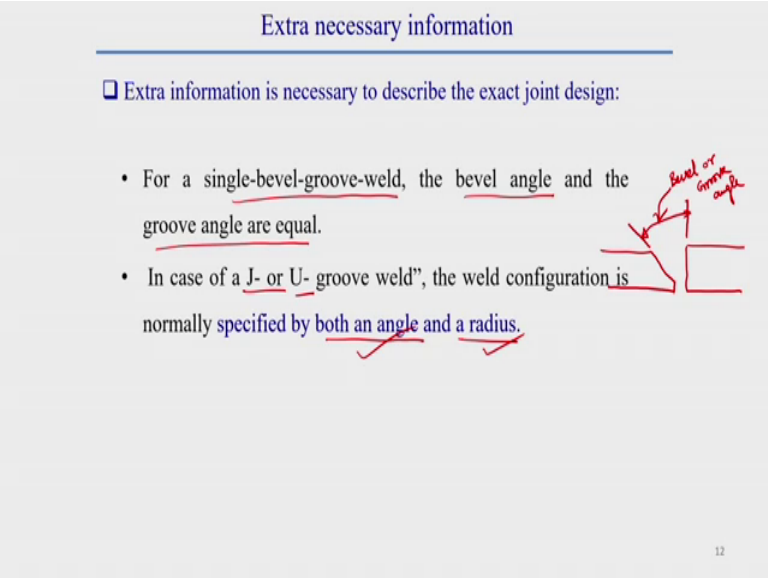

This extra necessary information is highly essential for a weld joint. For a single bevel groove weld the bevel angle and the groove angle are equal. That what I have already explained in detail like a single bevel angle means if one piece is bevel other pieces is a square edge preparation this is generally called [sim] single bevel groove weld. Here whatever the welding is done this is called single bevel groove weld. Here generally whatever the angle between these two member this is generally called bevel angle bevel or generally this is called groove angle.

I have already told about this thing in previous slides; that means, bevel angle and groove angle is same for single bevel groove weld. And other things now in case of a J or U groove the weld configuration is normally a specify both angle and radius. Generally here generally this bevel groove the specification or configuration or generally this is in case of U and J groove configuration this configuration is normally a specified. Once it is a bevel groove edge preparation there is generally required to specify this weld joint by angle only. But if it is a J or U groove there both angle and radius is required to specify the weld joint. These two thing is highly essential for J and U groove once we know this angle and radius of this U or J groove then what happens if it is provided in a specification then we can easily able to make J and U groove.

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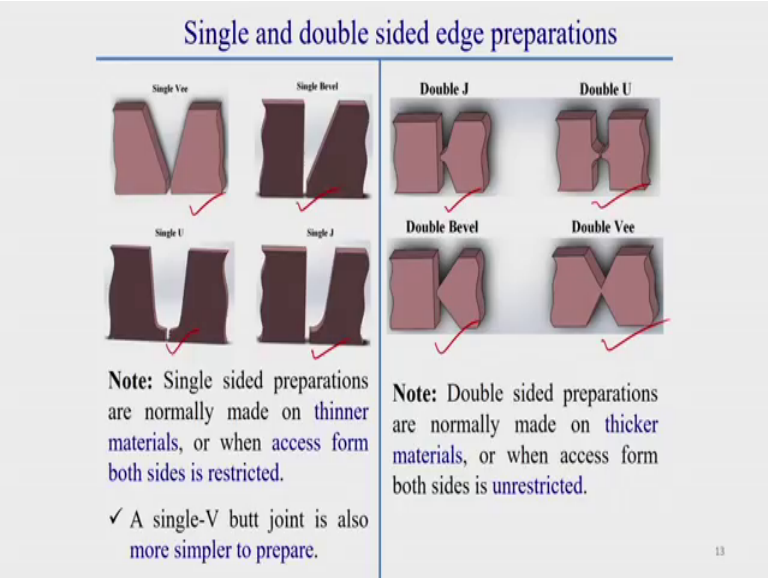

Now, these are also some extra information which is very much essential for welding purpose. Like single and double sided edge preparation. Generally; the single sided edge preparation one the edge preparation is done one side only. And this is the double sided edge preparation which generally required to prepare in both side of the weld joint. Now where the single side welding is required to apply and where this double side welding is required to apply that we should know.

Generally the single side edge preparation required to apply for thinner section especially if the plate thicknesses is thin type thin type thinner section. If there is especially the plate thickness if it is thin then they are generally single site edge preparation is sufficient to weld properly. That means, weld material deposition will be popular if the weld plate thicknesses single. And if there we will make single types of edge preparations.

And another important things also is required here sometimes for little bit thicker section also can be required to put single sided of edge preparation. Because there if the access from both sides restricted for double sided welding what are the thing required where generally we have to first do the welding on top side to do the welding in bottom side we have to invert the plate; to invert the ones we go for invert the plate if the welding a structure is very heavy then which it is very difficult to invert. Then in that case also in for heavy sections generally sometimes though there is required double sided edge

preparation, but what happens there we can do some a special care by putting single sided edge preparation.

So, what we got from here single sided edge preparation normally use for thinner material thin section. And we should keep it in mind it this single side edge preparation also require where both side is restricted; That means, only we can do the welding from one side there generally single sided edge preparation is used. V butt joint is more simple to prepare or a square joint is more simple to prepare for single type of edge preparation. This U and J groove little bit complicated compared to this single U or these single V single V or single bevel groove edge preparation.

Here single V butt joint side by side a square edge preparation butt joint is more simple to prepare compared to J or U groove edge preparation. Now this double side edge preparation normally made for thicker material or were generally access from both sides is unrestricted. So that means, we can invert the plate as per our requirement very easily. So, what happen and if the plate thickness is little bit thicker little bit more thick then there generally we should use double sided edge preparation.

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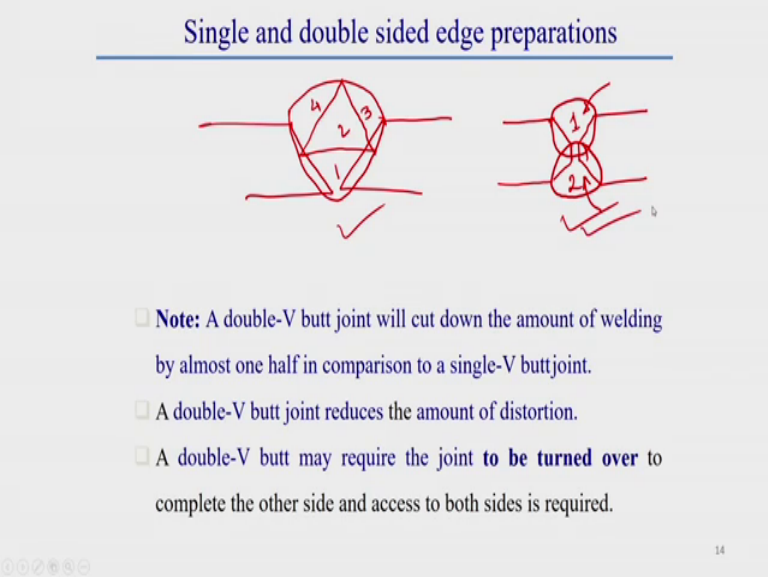

Now, we will see what are the material weld material required these are also some if we do the single edge preparation then what are the effect we can get. If we do the double sided edge preparation, then what are the effect we can get from in a welding a structure. Generally in case of single side single types of bevel or single types of groove edge

preparation we do the welding like this. Generally we do the we make in case of single V groove butt joint.

Generally once we do the welding we get a bit shape we sees weld bit shape which is look like this. But in the same plate thickness if we do have double edge preparation double edge preparation. Then here generally how the welding is required how the weld bit shape will look like the weld bit shape will look like the weld bit shape will look like; this is one side generally this is another side. So, generally this is weld deposition pattern for double sided. This is weld deposition pattern for single sided edge preparation. From here one things we can easily be able to see here in case of single edge preparation. The material required to do the welding is the material required to do the welding is generally let us this is 1, 2, 3 let this is 4.

Let this is your 1 let this is your 2. So, whatever the this 1 and 2 weld pass whatever the material is required here almost twice of this double sided edge preparation. So, in case of single sided edge preparation the weld material required is almost double the double sided edge preparation weld material. And here lot of advantage also is there in case of double sided edge preparation that I will explain in later. Generally a double V butt may require the joint to be turn over to complete the other side and access both side of the I have already explained in detail. So, here just I am giving you some extra information in case of single sided edge preparation for doing welding in same thickness plates. Here generally the weld material require is almost twice almost twice then the double sided edge preparation weld material.

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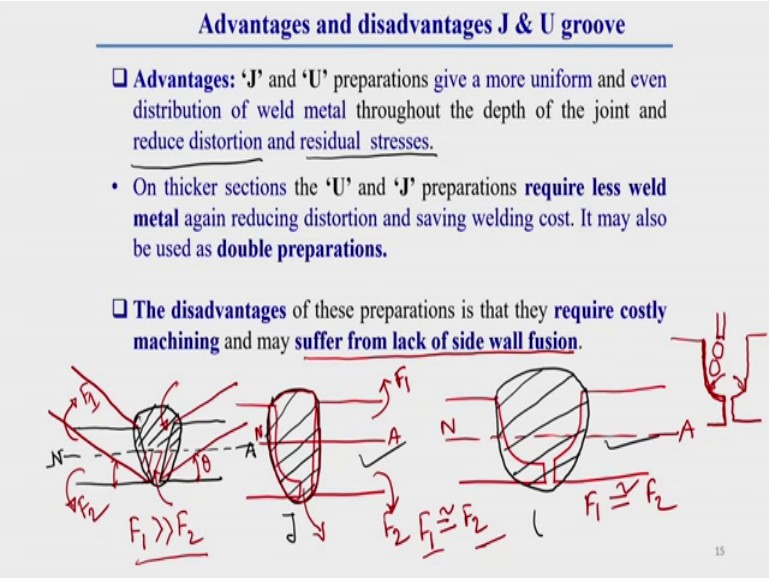

Now, advantage and disadvantage of J and U groove. Generally J and U groove edge preparation give a more uniform and even distribution of weld material throughout the depth of the joint. And here generally reduce the distortion and residual stresses how it is that I will tell. Once I will draw this I will explain in detail. Generally this is the advantage and disadvantage of J and U groove here one things we can observe that in case of J and U groove. Once we do the welding then the weld bit shape look like this weld bit shape look like this. So, here now we will go what is the advantage and disadvantage of J and U groove. Generally in case of J and U groove once we do the welding let this is the J groove welding and let this is a U groove welding.

Now, once we do the welding once we do the welding in J groove or U groove then one things we can easily be able to see from here. If it is a if it is a J groove welding here if we will do the welding the weld bit shape will look like this. Here also generally weld bit shape will look like this. Here I have shown here a little bit bigger way, but this thing generally bigger way I have shown here. So, here one things you we can see this black color one generally represent the weld bit shape geometry.

Now, so the advantage of J and U groove here the generally weld deposition is through the entire thicknesses uniformly distributed one things you can easily be able to see in case of J or U groove generally distribution of welding throughout the thickness of the plate is uniformly distributed. Due to this uniform distribution of weld material general

in case of J or U groove we get less distortion. And here also we get less residual stresses which generally reduce the distortion as well as here generally reduce the residual stresses.

Here these double edge preparation or this U or J edge preparation also sometimes require both side also. Now here why this due to this uniform distribution of weld material why the distortion is less that also we should know. Let us in case of a welding once we do the welding once we do the let us this is a V bevel groove butt joint here generally how the deformation is take taken place in a in a butt joint or angular deformation is taking place in a butt joint that we should know.

Generally once we do the welding the weld bit shape is look like this. Here generally this plate along this plate thickness there is a neutral axis. So, if we consider about this neutral axis here we are getting top of the neutral axis we are getting this much of material this up this much of material and bottom of this bottom of this bottom of this neutral axis generally we are getting this much of this much of material.

Say here one things we can easily be able to observe generally in case of top side generally weld material or molten material is more compared to this bottom side one. Due to this difference of molten material about neutral axis generally the forces once we done this molten material solidifies once this molten material solidifies. Generally this molten material create a sinkers force about this neutral axis like what happens; this top molten material on it is solidify generally it create a synchronous force which let us the magnitude of sinkers forces F 1 due to this volume of molten material sink.

Now, let us bottom side bottom side molten material once it is shrink let this create another force let this is F 2 in this direction. Now if this F 1 and F 2 this F 1 and F 2 depends on what this volume of molten material solidification. If the volume of molten material solidification will be more then this sinkers force will be more. If the volume of molten material solidification is less then this sinkers forces will be less. So, here one things you can easily be able to see that here this top side molten material more than these bottom side molten material about neutral axis. So, here generally F 1 is far greater than f 2.

So, due to this variation of sinkers force about neutral axis top and bottom side generally what happens this plate is bent this plate is bend this plate is bend like this. Because

these due to this top variation of top sinkers force where the force magnitude is more along that direction this plate will bend. So, due to this generally there are each generated a angular deformation; that means, this much these types of angular deformation is taken place in a welding a structure. Now this welding angular deformation or distortion this theta value will be more if these variation of molten material on top side of neutral axis and bottom side of neutral axis is more then they then this theta value is also more increase.

But in case of this J or U groove one things you can easily we able to see in case of J and U groove about neutral axis generally neutral axis for a butt joint in passed through almost middle section of the thickness of the plate. So, here one things you will be able to see due to this uniform distribution of weld material through the thickness of the plate due to this uniform distribution of weld material here generally about neutral axes at top side and bottom side molten material reposition is almost same.

So, here whatever the top sinkers force F 1 and F 2 generated this F 1 and F 2 is almost equal to F 1 and F 2 is equal in this U groove also almost due to this uniform distribution of weld material reposition this top side and bottom side here also is also almost F 1 is equal to F 2 due to this less variation of F 1 and F 2 or you can we can say here due to this F 2 and F 2 almost same that is why here generally welding deformation is almost nullify here and already distortion is a very small. And due to this even distribution of weld material here generally residual distortion also this residual stresses also generate less.

But the main disadvantage of these types of edge preparation U or J groove edge preparation. Generally here generally to make this J shape or U shape generally these types of edge preparation to make this radius this shape costly machining operation is required. And another defect can occur due to this U or J edge preparation that is suffer from lack of side wall fusion. So, as this side wall is almost a state in nature. So, here generally this molten metal droplet receiver general deposited in this region whichever it is generated deposited in this region. There is a chance of lack of fusion of this edge this edge there is a chance of lack of fusion this is that main drawback of the U and J groove weld welded joint. But the it has advantages here generally less residual stress less weld material and less distortion is occur in case of J and U groove edge preparation.

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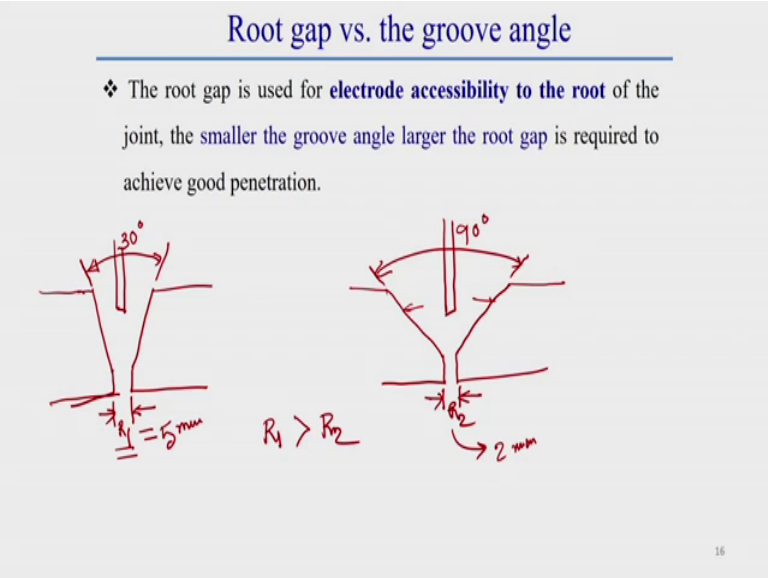

Now, here some other information is also required that is root gap versus the root opening. Once we will go for root gap verses root opening here one things we should know; why root gap is required to put. Root gap is required to put for electrode accessibility and for pauper welding fusion. Generally root gap it as observed that with lesser groove angle with lesser groove angle if the groove angle is less generally this root opening should be more. How it is thus I am giving you example, let us I am showing just here I am giving example let us for a 30 degree groove angle that is for a 30 degree groove angle for a 30 degree groove angle and let this is for a 90 degree groove angle for a 90 degree groove angle. So, for a 30 degree groove angle generally whatever the root opening we should provide that should be led root opening here let us R 1 and let us hear the root opening is R 2.

So, what it is called if the groove angle is less than this root opening should be more; that means, here generally R 1 is greater should greater than R 2. Because so here generally groove angle is less so here the groove angle is more so here better accessibility of electrode. Generally whatever the electrode we are providing here it can be easily accessible. But in this case this electrode to generally because here there is a gap between this face this face. So, so better accessibility is decker though the if the groove angle is if the root gap is less also.

But in this case for better accessibility of the electrode generally the better accessibility of the electorate this root gap should be more, this root that should be more. So, what it is called generally for better electrode accessibility and better fusion generally this root gap is increased with decrease of groove angle. So, here are generally I am giving a field; that means, what should be the, what should be the root of opening for 30 degree angle for a particular thickness for 90 degree. Like if a if for a 30 degree for a particular thickness plate for a 30 degree angle if the root opening is 8 mm. Let us just if the root opening is 5 mm the root opening is 5 mm then we can reduce this root opening here is almost reduced to almost 2 mm. That means, here this root opening we can reduce from 5 mm to 2 mm; that means, almost 2 to 3 times reduction of roof opening is possible by increasing in the angle around 2 times 2 3 times from these things we can easily observe. So, from here we can get a very interesting idea that the higher root higher the groove angle lesser should be the root opening and why it is required that I have already explained in detail.

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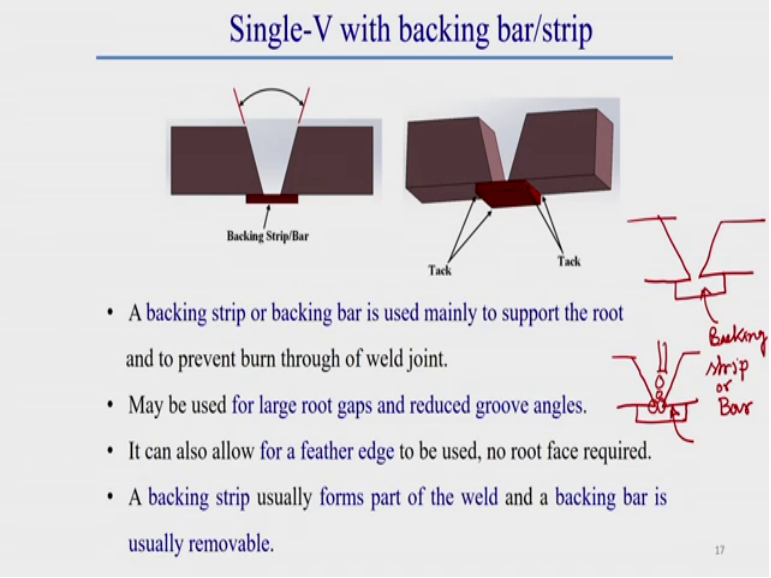

Now, here another extra information which is very much essential to know that is generally backing bar or backing strip. We should know what is backing bar or backing strip generally a backing bar or a baking stiff is used mainly to support the root. Generally in this root I have you know about every element of a welded joint. So, here the root is this thing generally to support this root this backing bar or backing strip is used backing bar or backing strip is used strip or bar is used.

Now, when this is called backing bar and when this is called backing strip that we should know. Generally this backing bar or backing strip we can use in a feather like edge preparation feather like edge preparation. What is feather like edge preparation means if the joint root have 0 thickness; that means, if the joint root face have no root face is required here you see there is no root face then that is called generally in feather like edge preparation. So, in case of feather like edge preparation it can also allow for a generally by providing this backing strip for backing bar we can eliminate the root face. That means, in a feather like feather like edge preparation also this backing strip or backing bar can we use.

Now, what is the difference between these backing strip and backing bar. Backing strip generally forms the forms the part of the weld; that means, after welding it also will be a part of that weld joint that is it is not replaceable backing strip; that means, backing strip is not replaceable. But backing bar which is removable; that means it is recyclable. That means, we after welding we can remove that backing bar from that from the root and we can reuse it so this is all backing bar. So, backing strip is a it is a form backing strip forms part of the weld, but backing bar is usually removable which can be recyclable also.

So, this thing you can backing bar generally used to prevent band through also. Because if this will not provide these backing strip will not provide there is a chance to come out this molten material through the gap of this root through the gap of this root. So, so to prevent this band through this backing strip or backing bar this required to use.

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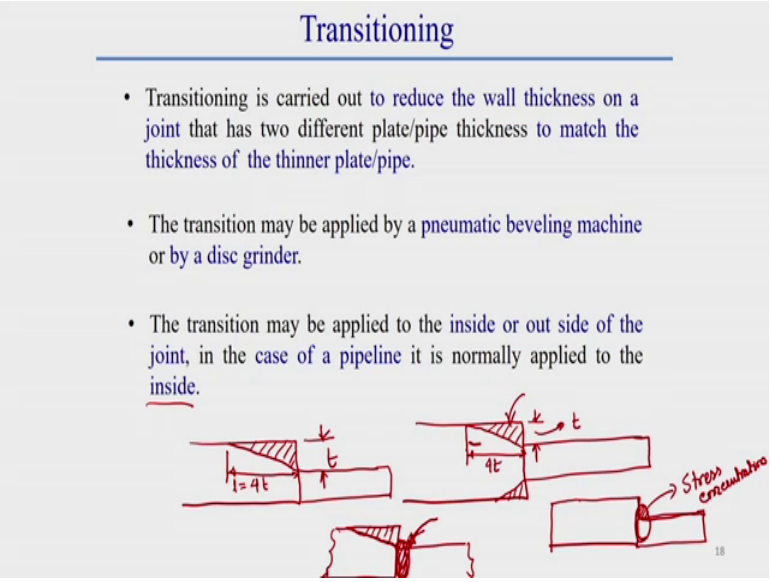

Here another important extra information is required that is called transitioning this transitioning is a very important part generally where we use two different plate thickness. Generally transitioning is required to use where generally we use two different pl plate ent plate thickness to be welded they are generally we use transition here one things we can see that transitioning is generally transitioning is a very important.

Transitioning is carried out to reduce the wall thickness generally one a joint that has two different plate or pipe thickness to melt the thickness of the thinner plate to melt the thickness of the plate generally reduction of these thickness. That means, this much of thickness we have to reduce here how to reduce that thickness that we can that idea we can get from this transition; this reduction of this material which about the material. We are removing from these things that we can remove by pneumatic bevel beveling machine or this can be removed by grinding machine this can be removed by grinding machine.

Generally this transitioning how to apply this transitioning that we should know this transition from where we should start this removal of material what should be this length of this. What should be the length from where we should start our tapering that where should be tapering of or removal of this material that we should know that idea, we can get from this transition. In term here one things we should know if this thickness reduction is T that let us here this thickness reduction it T then did this length from where

we should start transitioning should be minimum forty 40 length. That means, we should start this tapering from forty length at from that joint region.

40 length 4 times 4 times 4 times of T we want this weld location. So, generally why it is required that also we should know generally this transitioning maybe applied inside or outside; that means, this removal of material sometimes we can use inside or this removal of material sometimes we can use outside also in case of pipe welding this transitioning always used inside.

But in case of butt weld like here this is a two plate which we are going to in case of two plate which have different thickness we are going to weld. Generally here transition is done like this top side and bottom side. So, top inside and outside we can do the welding this let this is outside this is inside sometime this transitioning can be done let this two plate to plate which is placed in this way. In this case generally bottom side there is no thickness reduction is required where here generally there is a requirement of thickness. So, here generally transitioning is required to do only one side only. So, we have to remove this portion of the material from here. So, what should be the length of this portion of the material the this portion of the material this length should be at least 4 time of the thickness of the material removal 4 times of the thickness to be reduced. Generally this length should be this length should be 4 times of the thickness to be reduced.

Now, here another one things you can observe that why this transitioning is required generally transitioning is required to increase the fatigue life of a structure. Generally what happens if there is a observe change of a structure if there is a observe change of a structure like what happens here two different thickness plate are there two different thickness of plate are there. And if we do the welding here if we do the welding here you see one thing.

So, you can easily be observed there is a abrupt change is there so if there is a abrupt change. So, if you do the welding here there is a chances of the stress concentration you know this thing; that means, where there is a abrupt chance there is a chances of the stress concentration. So, if there is a there is a stress concentration. So, what happens there is a chances of fatigue crack. So, and so due to the fatigue crack there is a chances of failure die structure with less fatigue life.

Now, if we do transitioning over here like two different plate thickness transition if we do the removal remove the material. And if you do the welding here generally these abrupt change will not be there if we do the welding here abrupt change will not get here if we do the welding. Here in this region if we do the welding here generally abrupt change will not be there because we are removing this material and which makes a tapering. That means, slow change of here generally slow change of shape is there slow change of shape is there due to this thing generally here abrupt change is not occur. So, here generally a stress concentration will be less. So, if the stress concentration will be less here we will get more fatigue life and there is a chance of less fatigue crack growth.

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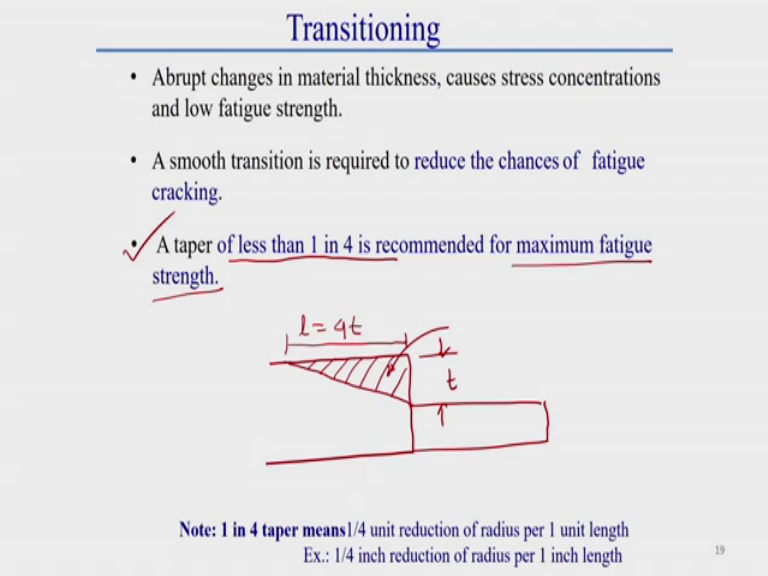

Now generally there is a term used in transitioning that is called 1 in 4 general a taper. Generally in case of a transitioning 1 in 4 is recommended for maximum fatigue life generally a taper of less than one in 4 this always keep it in mind less than one in 4 is recommended for maximum fatigue life. What does it means what I have already explained 1 in 4 is recommended means. Let this is a fatigue thickness this is one plate this is a another plate 1 in 4 means let this thickness reduction is let us the this I have to reduce; that means, these I have to reduce.

So, this radius reduction or thickness reduction I have to make I have to do. So, do to do this thickness reduction from where we should start beveling or removal of metal the removal of material we should start from a distance removal of this material. We should

is form a distance which is at least 4 T beyond this region that is why here it is put like these; that means, we should start our these beveling or we should start our removing this material portion this portion of material.

Then this portion of material we should start at a distance 4 time of this reduction of thickness we should it is this length should be 4 times of the thickness reduction T. That is why a taper of less than one in 4 recommended for maximum fatigue level; that means, if it is if this length is minimum 4 times the thickness reduction T then we will get maximum fatigue strength that we have that is observed experimentally also. That is why this transitioning is a very important part once we go for doing welding in case of two different thickness plate these types of transitioning is made for two different thickness plate.

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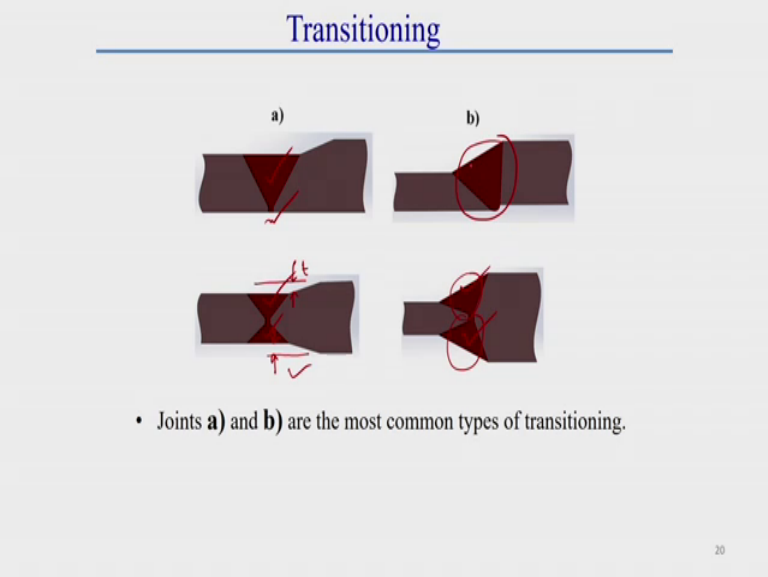

This is generally a common types of transitioning like this transitioning can be done like this here first of all is done after that here then only welding is done this transitioning can be one side this transition and can be both sides also. Here you see these sides generally thickness reduction we do thickness reduction is required to do. And similarly this side also thickness reduction is required to do this side let this is.

So, what happened both side you wants to go for both sides thickness generally then generally beveling can beveling can be reduce because if you do you do it from one side then this thickness reduction will be more if we do from both sides this thing thickness

reduction from both sides wide generally each side this thickness reduction will be less. So, we can start this tapering from less length if you do it for both side transitioning.

Now this transitioning here also can be done this transitioning after doing we can do the welding operation welding here this is for both side here also we can do the welding here this here and here. Generally we did the welding. So, these are the things generally commonly used transitioning process in case of two different plate thickness.