Welding Engineering
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Module - 6
Designs of Weld Joints
Lecture - 02
Types of Joints and Welds

Dear students, this is the second lecture on of the module 6, which is based on the design of the weld joints. In the previous lecture means, that is the first lecture on the design of weld joints we have talked about then the role played by the weld joints. What are the modes of the failure for the weld joints, so that the suitable criteria can be decided in order to avoid the failure of the weld joints by those modes.

We have also seen that what a important thing should be kept in mind, while designing the weld joints for the critical applications. In this presentation we will be focusing first on the welding symbol a methodology step by step to show that how can we give, and write the information properly and systematically. So, that the same can be communicated to the shop floor people for developing the sound weld joint.

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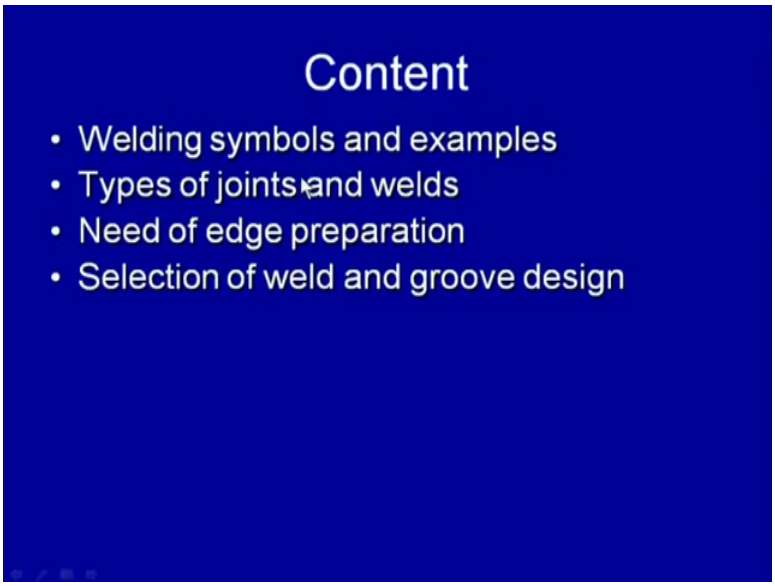

Thereafter, we will see few examples related with the welding symbols, and then we will see what are that common types of the joints, which are developed for developing the

assembly of the different kinds and thereafter we will see the types of the welds. At the end of the presentation we will try to see the need of the edge preparation, so as far as content of this presentation is concerned.

First the welding symbol methodology and few examples related with. Then we will go through the types of the joints and the welds, and then the need of the edge preparation and thereafter, we will see that what point should be kept in mind while selecting the suitable groove design for development of the weld joint. If possible then we will also try to see that how these groove designs affect the performance of the weld joint. So, you know that for showing the welding symbols, we need to draw first one horizontal line.

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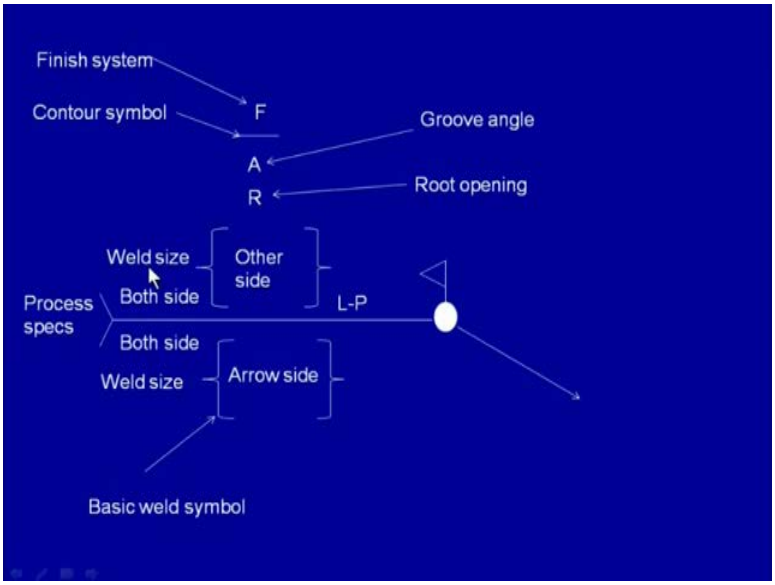

This is termed as the reference line and connecting to the one end of this reference line, we have one we draw one arrow line. So, this arrow line indicates the location or the side where weld is to be made, and when the when around circle is made at the junction of these two lines, this indicates that weld is to made all around the periphery of the two members being joined. When one flag is made, then this indicates that the weld joint will be developed in the field, not in the shop floor. Then above or the below of the reference line we can mention the L and P kind of features, which will be indicating the length of the weld and the pitch between the different welds which are being developed.

Then below the reference line, we can have the basic weld symbol which will indicate the type of weld to be made for joining, the two members or more members by the weld

joint. This kind of so, when the information is given below the reference line then that the basic weld symbol indicates the type of weld to be made, in the arrow side of the particular location. When the weld symbol is made above the reference line then it indicates that particular type of weld is to be made, on the other side of the arrow line, where an arrow is indicating the development of the weld joint.

So, we can have the welds in below the reference line weld symbols below the reference line, or above the reference line the arrow symbol below. The reference line will indicate the weld symbol below the reference line will indicate, the weld to be made in this side of the arrow and above the weld symbol above the reference line will indicate, the weld to be made on the other side of the arrow. We can have the weld symbol on both the sides, in order to show that the weld is to be made on both the sides of the arrow line where it is indicating.

Then we can have means in the back side of this in one side of the reference line, we can have the tail which will having basically, the two lines and this tail is basically used to show the information about the welding process to be used, or the specific welding parameters or the specifications which should be used for development of the weld joint. Like the weld joint will be the partial penetration kind or the full penetration kind. Then we can have means these other the symbols supplementary symbols to show the what kind of what kind of further processing of the weld will be done, like the kind of finish system which will be used it will machined finish, or the ground finish weld will be made.

So, the letter F like the kind will at the top will be indicating the finish system to be used, and then below this we will have the contour symbol which can have can be of the convex type contour type or the flat type which will be. So, this the flat type system will indicate that the weld bead is been machined of, and the joint at the top surface is flat. Below this we have the symbol of another symbol of which will be indicating the groove angle, which is to be made for developing the weld joint and below this further the groove angle will have the another number, which will be indicating the root opening to be used for while developing the weld joints. So, in both the sides like so, these big brackets indicating the arrow side. Other sides basically, in place of these we use the basic weld symbol which can be square or bevel or the double v, single v or that kind of the welds which is to be made for developing the weld joint.

In the left side of these symbols we mention the size of the weld, which is to be made. So, here if we see this L indicates in the right side we have information about the length of the weld and the pitch means, the centre distance between the different welds that indicating the pitch of the weld. While in the left side we need we to mention the size of the weld which can be in form of like the throat thickness, or the length of the weld in case of the fillet weld. So, this is how we can step by step indicates the various important information required to be communicated to the shop floor persons, for developing the weld joint successfully, we will consider one example here.

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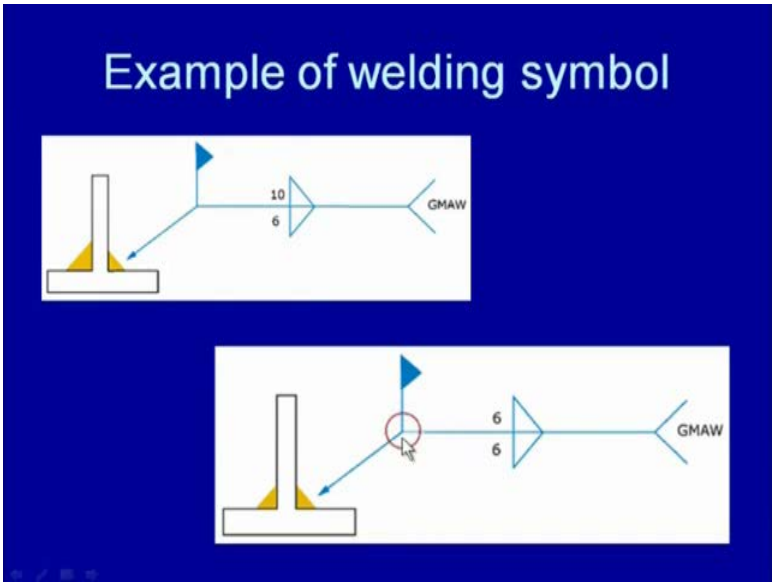

We will showing that say a T joint is to be made. So, which will require say the two types of the fillet means one side fillet is of smaller in size as compared to the other side. So, here we will be using the simple welding symbol, which is to be developed using the gas metal arc welding. So, if these T joint is to be developed using the two fillet welds, which will be developed with the help of gas metal arc welding process. So, we will be drawing first the horizontal line and then tail, at the tail we will be showing the process to be used. Above the reference line, and the below reference line we will be showing the weld to be made.

So, here this typical symbol triangular right angle triangle shows the, that the fillet weld is to be made, and then formation in the left side of this symbol shows the size of the weld to be made. So, the presence of the right angle triangle both above and below the

reference line, suggesting that the fillet weld is to be made in both the sides for developing the T joint. And here the arrow is indicating the location where weld is to be made.

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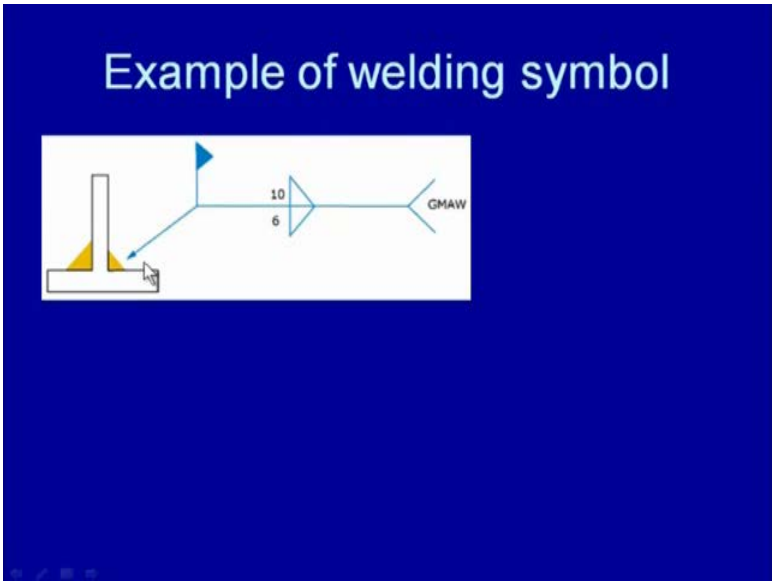

So, if we see here the weld symbol below the reference line showing the weld size of the six indicating the smaller weld, and while the weld symbol above the reference line indicating the weld size of the 10, which is to be made on the other side of the arrow. So, information regarding the weld symbol above the reference line indicates the weld to be made on the other side of the arrow line. So, arrow line is this indicating the weld to be made, smaller weld is to be made in the arrow side and the bigger weld is to fillet weld is to be made on the other side of the arrow.

Similarly, here is another example and this flag in this diagram indicates that the weld is to be made in the field. This is another case of the T joint where information regarding the welding process and the type of weld, and size of weld has been given here it shows the at the tail again it shows that gas metal arc welding is to be used. While the right angle triangle both above and below the reference line of the equal size 6, shows that the fillet weld of the equal size of the 6 mm throat thickness is to be made in both the sides of for developing this T joint. This weld will be running throughout the length there as represented by the that all around weld is to be made from this circle, and this flag is suggesting that this weld is be developed in the field this is another example.

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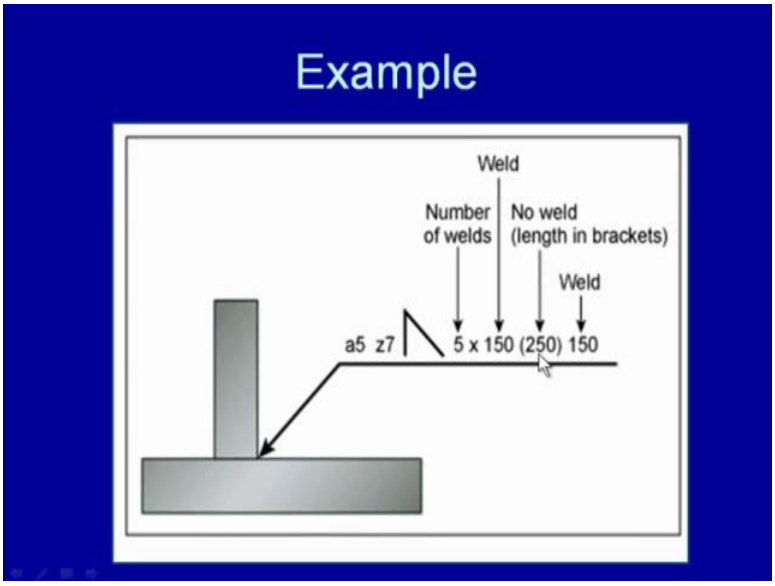

For developing the T joint, where more information has been given regarding the number of welds or the pitch of the weld which is to be used. And for example, here this is the arrow side, but the information this is the reference line and this is the arrow line indicating that weld is to be made, in this for joining these two members at this location, but since the most of the weld information has been given above the reference line suggesting that the weld is to be made in the other side of the arrow.

The weld and the information about the and these basic weld is suggesting that the fillet weld is to be made and here the a 5 is indicting that the weld means, the throat thickness of the 5 mm is to be made and the leg length will be of the 7 mm. The number of welds which are to be made is 5 and each weld will be of the size of 150 mm and then with the gap of the 250 mm, where there will be no weld. So, the spacing between the welds is shown in the bracket and then again another weld of 150 mm length. So, this is how means other information can be given in the inform of the welding symbols, so as far as development is concerned.

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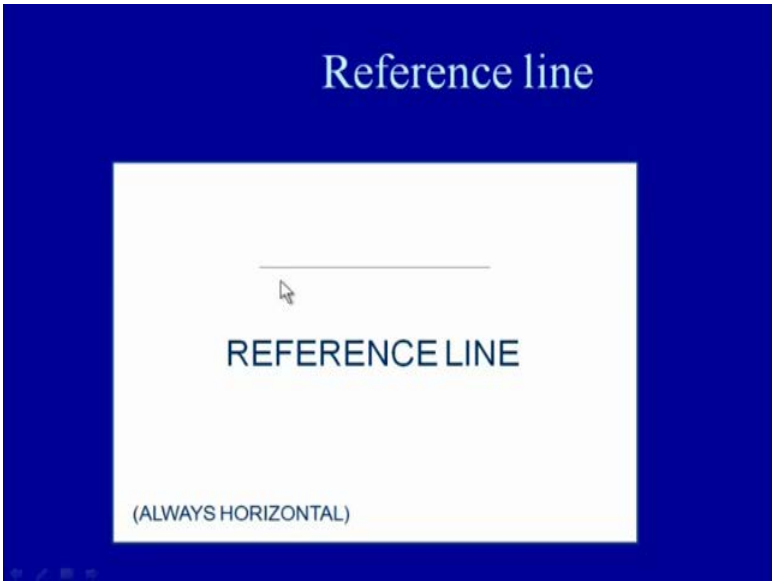

First we draw the horizontal line, which is the reference line it is always horizontal. And then we will make a arrow line and showing the location where is weld is to be made.

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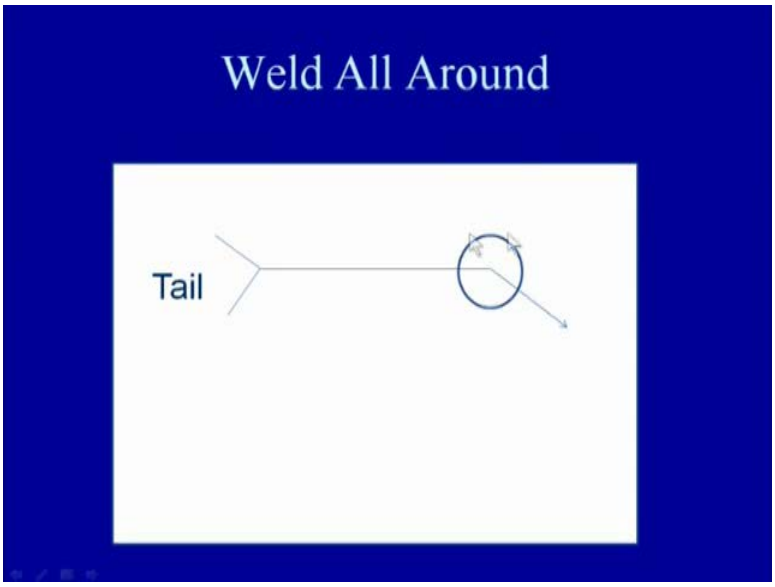

Then we make a tail and the tail will give the information about the welding process under the parameters, and the type of weld to be made like the full penetration weld or the partial penetration weld is to be made. And then the circle at the junction between the reference line and arrow line shows that all around weld is to be made, weld all around is to be made.

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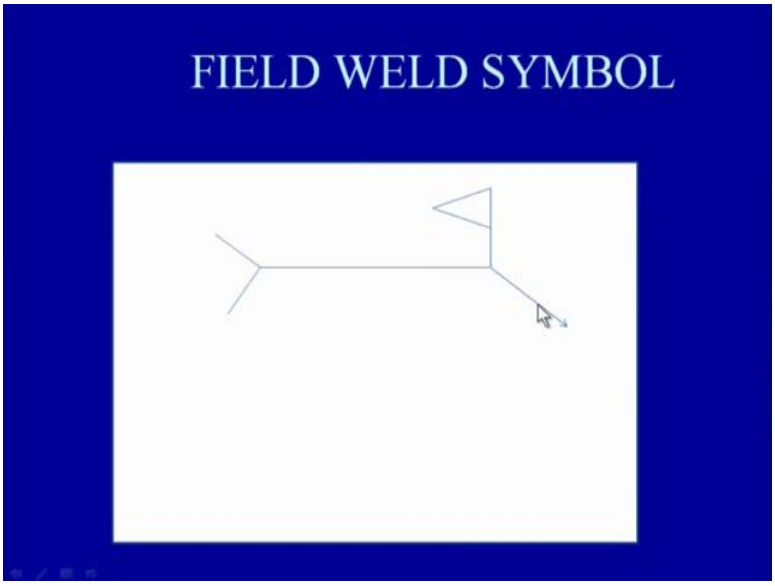

The flag indicates at the junction between the reference line, and the arrow line indicates that weld is to be made in the field.

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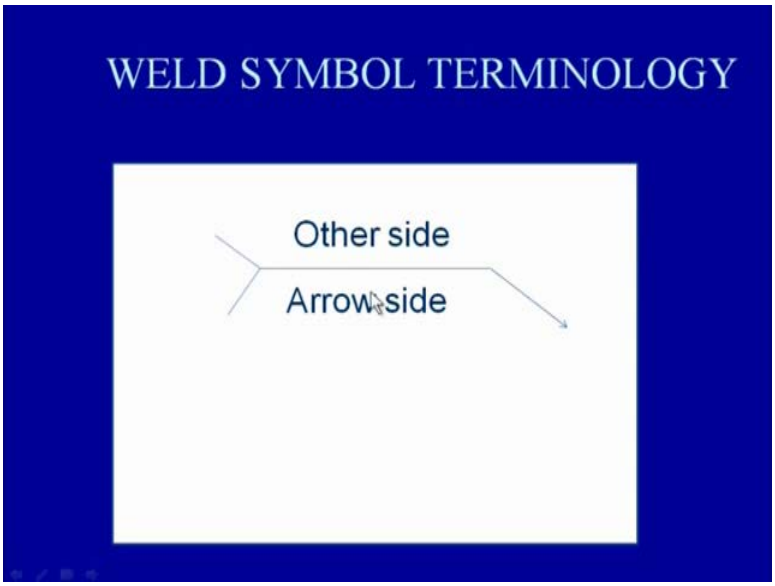

When the weld symbol is made in both the sides of the reference line means, the weld symbol below the reference lines suggests that a weld is to be made in the arrow side. The weld symbol another information above the reference line suggests that, the weld is to be made above in the other side of the arrow line.

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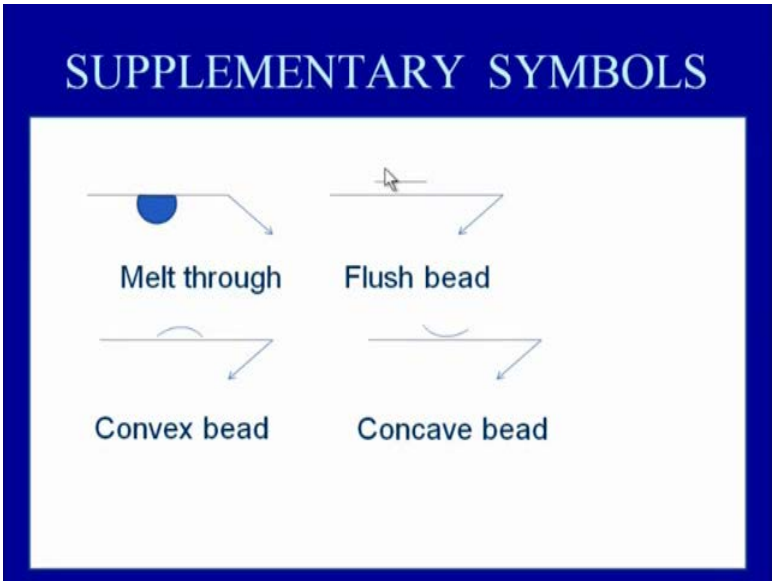

These are the other supplementary information, which information which are given like a melt through is to be achieved, for this kind of mean melt through situation is required then this kind of symbol is made with the reference line. When flush bead is desired means the all weld bead is to be removed, and flat surfaces to be obtained then of this kind of information is given using this straight line. And the for convex bead information in this form is given and using the curved line, and the for concave bead this kind of information is given.

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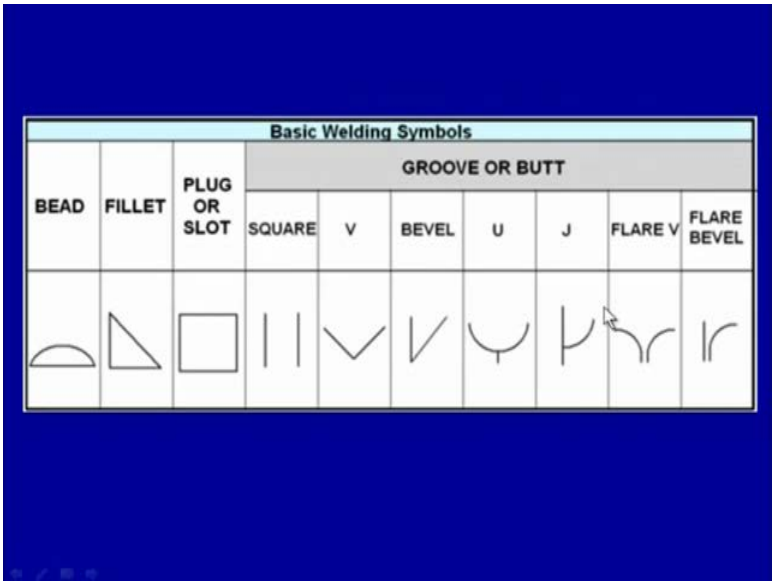

Then the common weld symbols, which are used to show regarding the type of weld is to be made, and the type of bead is to and type of the joint is to be made for developing the weld say. These are the three types of the weld like the weld bead is to be made then that the symbol of this kind is made, this weld bead is mainly used for hard facing, surfacing at the reclamation purpose and the cladding purpose, well the fillet weld is required for variety of the weld joints. So, the symbol right angle triangle is used for showing the fillet weld and the circular or the square shaped, the symbol is used for developing the plug welds or the slot weld.

Then the type of groove which is to be made will be indicated with the help of these two parallel, short parallel lines indicating the square groove and the V groove, V shape line are used for bevel groove this kind of symbol is used for J this kind of symbol is used. And while J, this is the symbol and for flare are these two curved means, the edges are prepared in this curved manner, and flare bevel only one side the flare is given to the edge of the plate, which is being prepared.

So, these symbols are basically used in combination basically used in the welding symbols to these are the weld symbols, which are used to show that what type of the weld and the groove is to be made for developing the weld joint. Now, in this section we will be trying to see, and present the different weld symbols for developing the different types of the joints, along with their presentations like say for butt joints.

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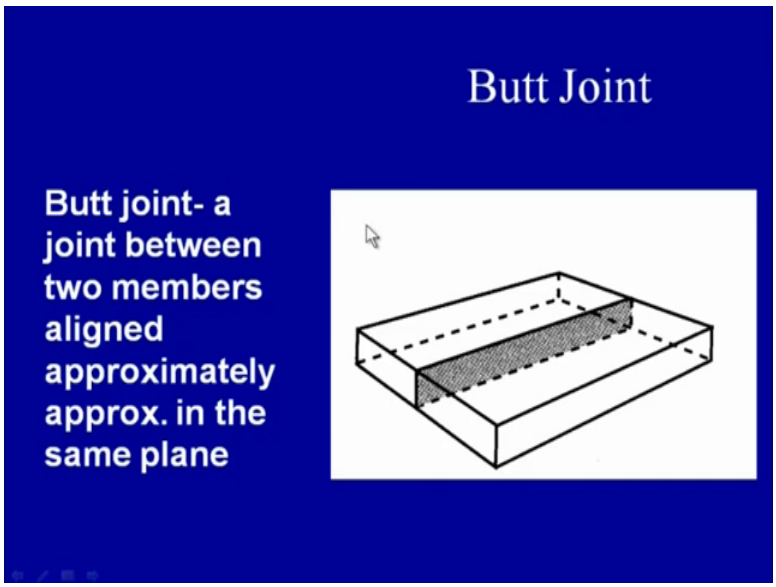

The plates are kept largely on the same plane and the edges are aligned together. So, a butt joint, a butt joint between the two members aligned approximately, in the same plane for developing it and then the kind of the joints.

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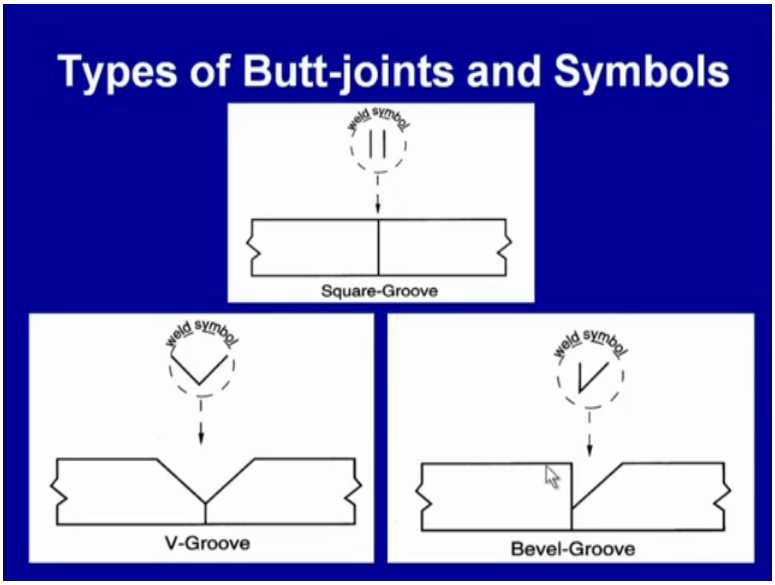

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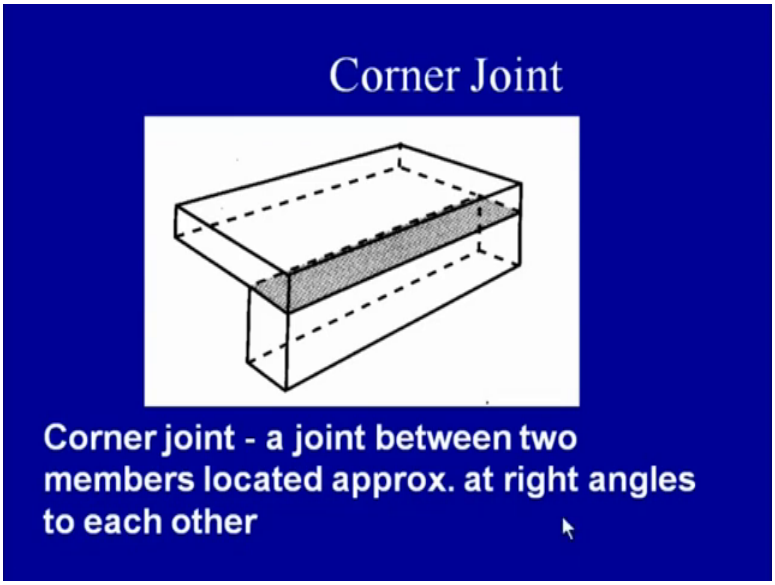

Which are used grooves geometry, which is used for developing the butt joint one is this square groove, where just the edges of the plates are made square with respect to each other. And the symbol for the square joint is with there's a square groove is shown with the help of these two simple short parallel lines. And then the V groove is made for

developing the butt joints, and the symbol for the V groove is indicated by this V shaped lines. Then the bevels then the bevel groove where the preparation is made just in one side of the plate, and another side of another edge of the plate is maintained a square. Then the corner joint here the plates to be joined here joint is made between the two members, which are located approximately at a right angle to each other.

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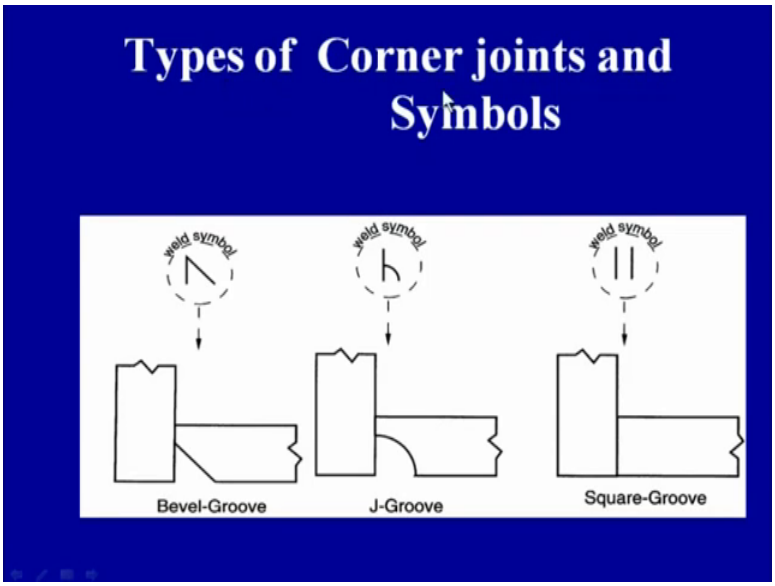

Different types of the grooves, which are used for developing the corner joints include the bevel groove where a one member is just made a square, and another is and bevel is made in another member. The weld is made in this the bevel groove a portion by depositing the weld metal while in, and this is the weld symbol for the bevel groove and the J for J groove for making the corner joint. The J groove geometry is developed in one side means, this kind of geometry is developed in edge of the one side plate to be joined with the another member, which is largely machined square machined.

For this square and the weld metal in this case is deposited in this portion of the groove. While for the square groove the edges of the plates to be joined for developing the corner joint are just made square by machining and no special edge preparation is required like the bevel groove. And the J groove for developing the T joint a joint between.

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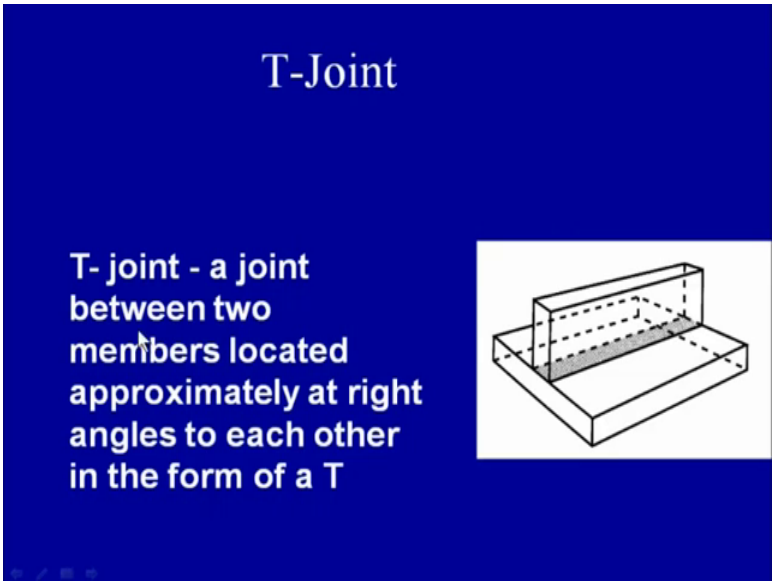

The two members located approximately at right angle to each other, in form of a T joint is made. The different for developing T joints different the kind of groove geometries which are used like.

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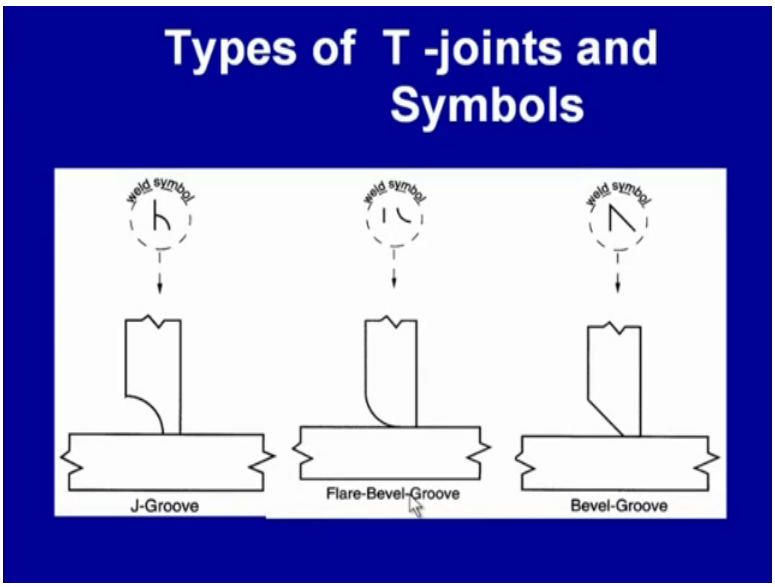

The J groove geometry is being made in the one member of the component to be joined, or this is the flare bevel groove, where the rounding of the corner of the one edge of the plate is done means flaring of the one edge of the plate is done. Then weld is weld metal is deposited in this portion of the weld for developing the T joint, and this is the bevel

bevelling is done in one side edge of the plate to be welded for developing the T joint. These are the weld symbols for the J groove flare bevel groove, and the bevel groove joints. Then the lap joint a lap joint between the two overlapping members is made and various geometries, which are used for a various grooves geometries which are used for developing the lap joint.

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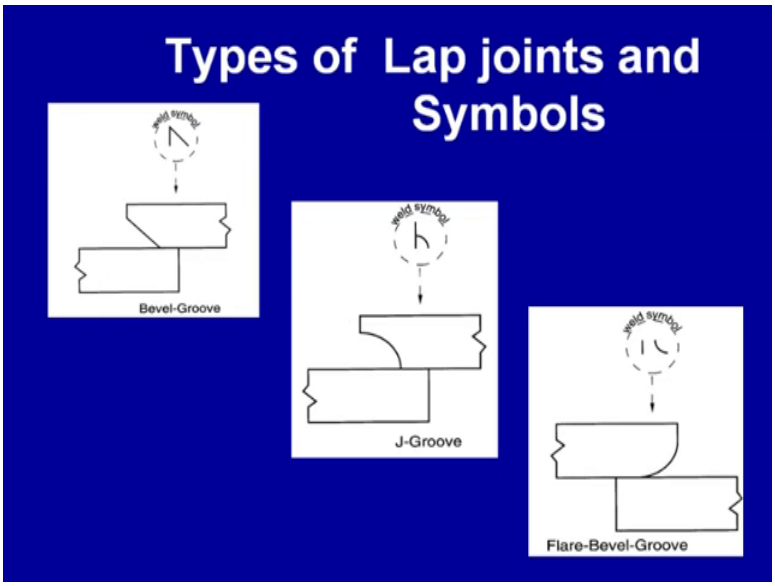

One is the bevel groove where bevelling is done in one plate, and the two plates are kept in overlapping position, and the weld is made in this portion of weld metal is deposited in this portion of this the groove. The J groove where the J geometry is made in one side of the plate out of the two plates, which are overlapping with each other and the weld metal is deposited in this portion of the groove. While for the flare bevel groove the that the two plates one of the two plates, which are overlapping each other flaring is done in one end of the plates, which and here the weld metal is deposited for developing the lap joint.

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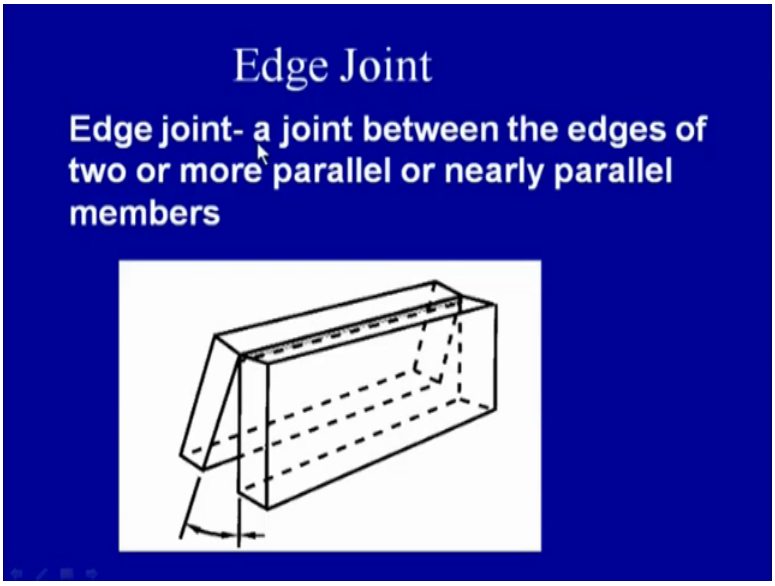

In case of the edge joint the joint between the edges of the two are more parallel, or nearly parallel members is developed. So, in this case the two plates are normally kept close to the parallel and angle is generally, between these two plates to be two plates or the two members to be joined by the edge joint is kept less than 5 degree. The weld metal is deposited by melting weld joint is developed by depositing. The weld metal at the edges of the two plates, where partial melting means the melting of the edges of the plates is also insured for developing the sound weld joint. Various geometries which are used groove geometries, which are used for developing the edge joints.

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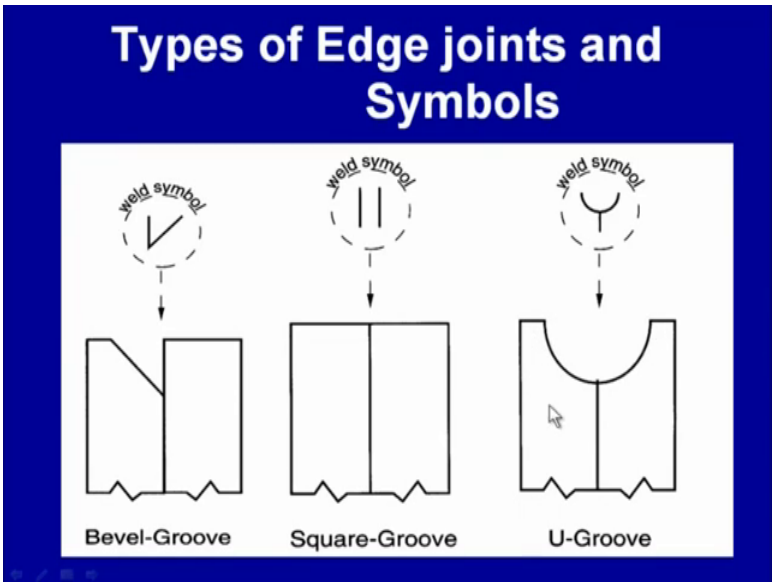

Like bevel groove, where one edge is one plate is bevelled for having sufficient area of the weld for developing the sound weld joint. While in case of the square groove just the two plates are kept in parallel position, and only the edges are brought to the molten state and weld metal is deposited for developing the edge joint. While in case of the U groove, the U groove geometry is made a half U groove in one side and another half is another side for developing for having the U groove. The weld metal is deposited in this manner, and for this kind of for developing the edge joint using the U groove geometry helps in developing very strong. Sound weld joint, because it facilitates proper melting, and the fusion of the component to be joined.

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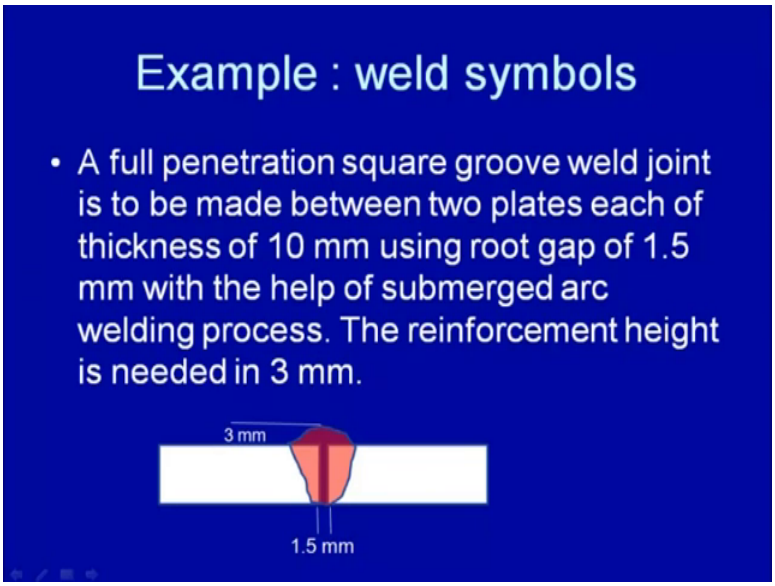

Now, we will see the two examples demonstrating the use of the welding symbols and how the welding symbols are developed. Say for one case where a full penetration square groove a weld joint is to be made between the two plates, each of the 10 mm thickness using root gap of 1.5 mm, and this weld is to be developed with the help of the submerged arc welding process.

Where the weld is having the reinforcement height is of the 3 mm. So, the weld we can show see schematically using this diagram, where the two plates to be welded and single pass square groove weld is to be made on the plates with the reinforcement of the 3 mm, and the root gap between the plates to be joined is of the one point 5 mm. So, how we can show these conditions using the welding symbols.

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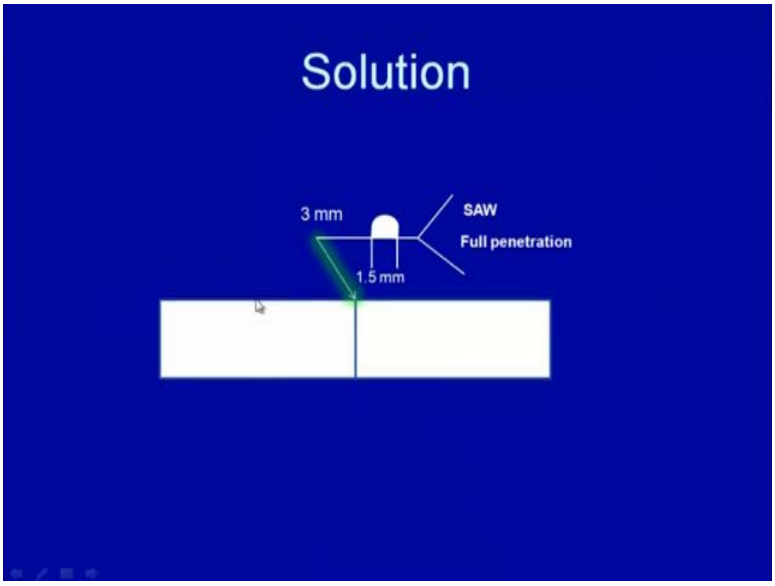

So, the solution is very simple where 2 plates to be joined is 2 plates are to be joined are shown, with the help of this arrow mark indicating the side where from the weld joint is to be made. Then horizontal reference line showing that the square groove weld joint symbol, and here this 1.5 symbol shows the kind of root gap to be made. The reinforcement height of the 3 mm is shown here and in this tail. We can see the submerged arc welding processes to be used and a full penetration weld is to be developed as per the requirement for developing the weld joint.

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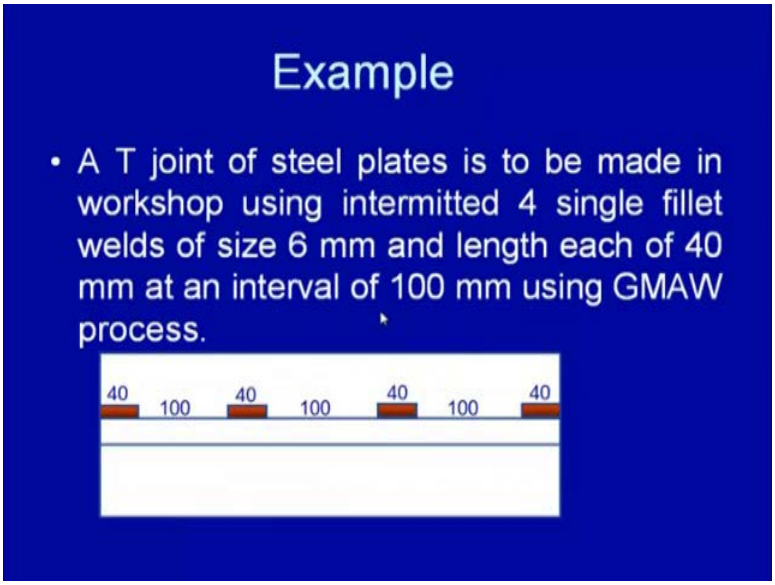

So, this is how we can show the different parameters using the different parameters required in a weld joint, and the welding conditions for developing the weld joint using the welding symbols.

Now, we will see another case where a T joint of the steel plates is to be made, T joint of the steel plate is to be made in workshop using not in the field, but in the workshop itself using the intermitted 4 single fillet welds of size 6 mm in length of the each weld is of the 4, 40 mm. These fillets are to be developed at an interval of the 100 mm using the GMAW process. So, this situation can be seen using that like the T joint is to be made. So, one the plate is in horizontal position and the another plate is in vertical position, and the 4 fillet joints fillet welds are each of the 40 mm length with an in interval of the 100 mm is shown is schematically here. The fillet size is of the 6 mm which has not been shown in this diagram, but schematically how using the welding symbols how we can show these the welding details.

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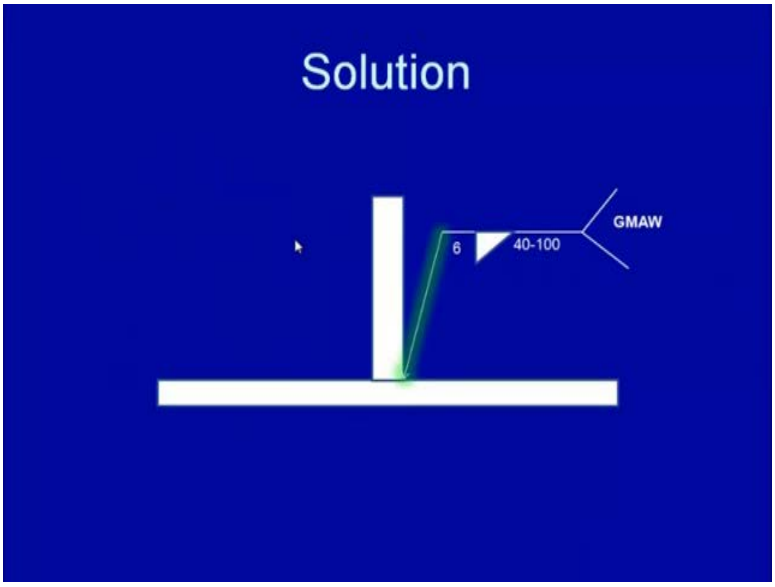

For developing the weld joint this we can show scheme of the T joint, and the welding side where the weld is to be made fillet welds are to be made, this symbol of the weld a fillet weld. The fillet weld size of the 6 mm and the length of the fillet weld is 40 mm, and the pitch of between the fillet welds that is the gap between the fillet weld is of the 100 mm. The GMAW weld is to be made there. So, that these details will be shown in

the tail. Now, we will see the different types of the welds which are commonly made for variety of the purposes.

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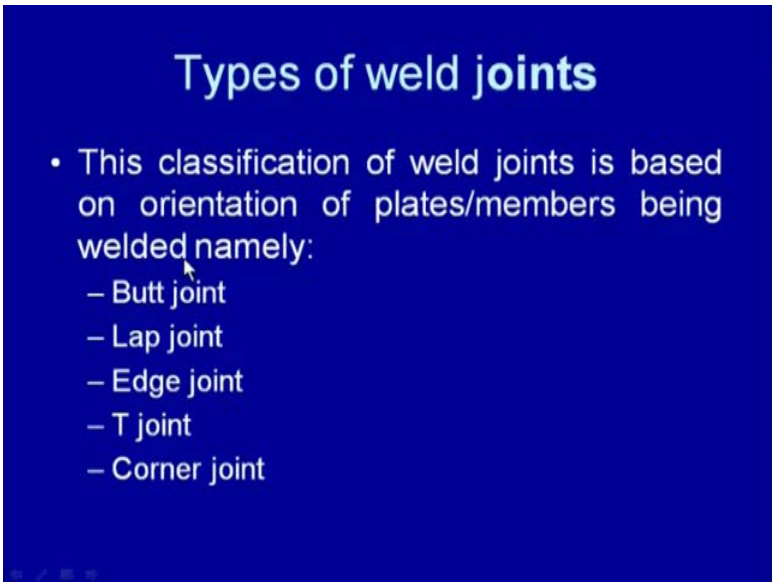

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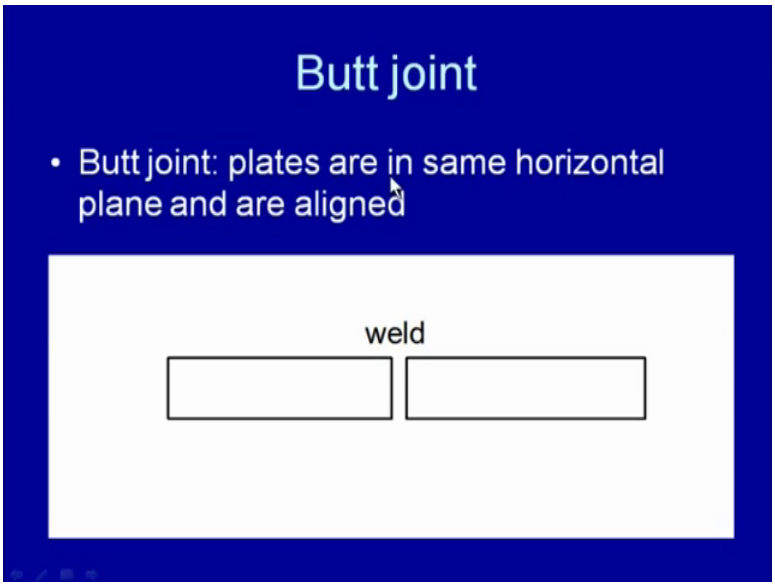

The classification of the weld joints is normally, based on the orientation of the plates to be welded. So, we have seen the type of the joints based on the orientation of the plates in earlier section. Here the types of the weld joints it is not the type of weld, but the type of the weld joints, and this classification is based on the orientation of the members, or the plates to be welded. These are butt joint, lap joint, edge joints, T joint and the corner

joint. So, for the butt joint plates are kept in the same horizontal plane and aligned together. Weld is made between weld by fusing by fusion of the faying surfaces of the two plates to be joined.

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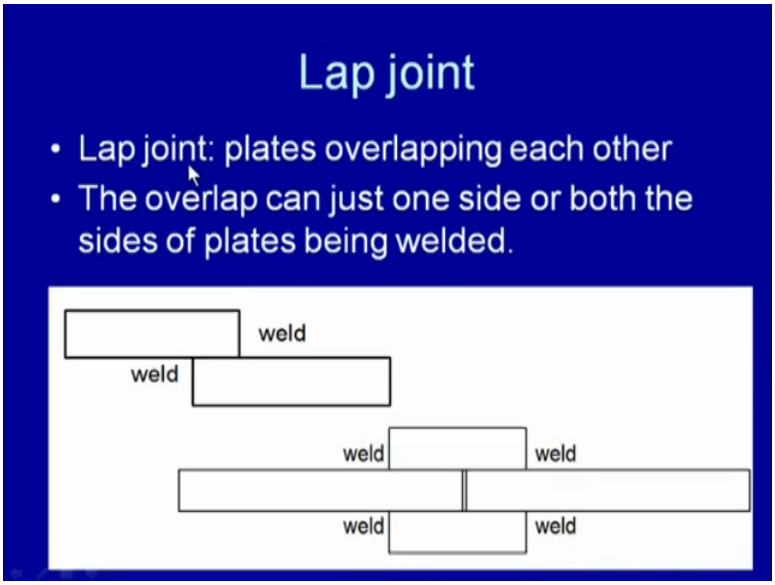

While for developing the weld joint plates are kept in overlapping position, with each other and the overlap can just be on one side or on both the sides and then weld is made. Weld can be made just by developing weld in one side or in both the sides, here the overlapping plates are kept in both the sides and the weld is made in all these 4 sides.

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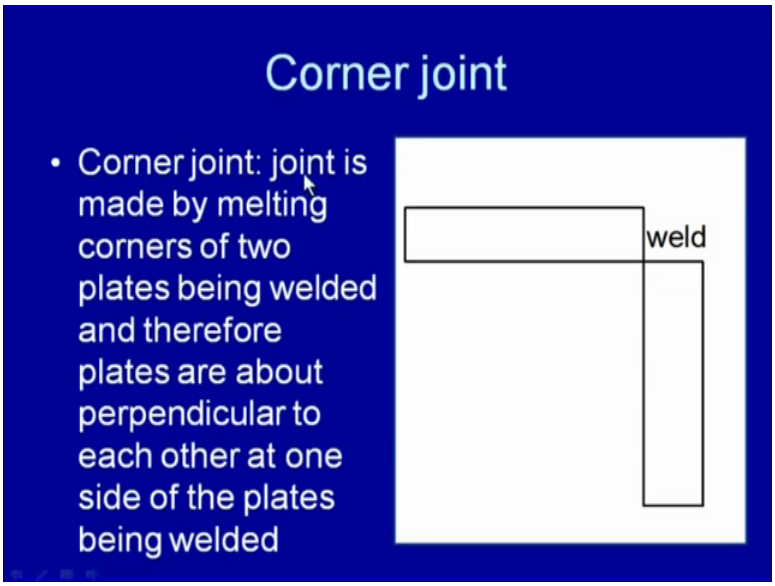

For developing the corner joint the plates are kept at approximately 90 degree with respect to each other, and the weld is made at the corner by developing the variety of the groove geometry groove geometries as described earlier. So, here for this joint is made these on this corner joint is made by melting the 2 plates being welded. Therefore, plates are about perpendicular to each other at one side of the plate. That the 2 plates to be welded are kept perpendicular to each other at one corner, and the weld is made by this kind of joint is made by depositing the weld metal at the corner of these two plates, and for this purpose various kind of the groove geometries can be used.

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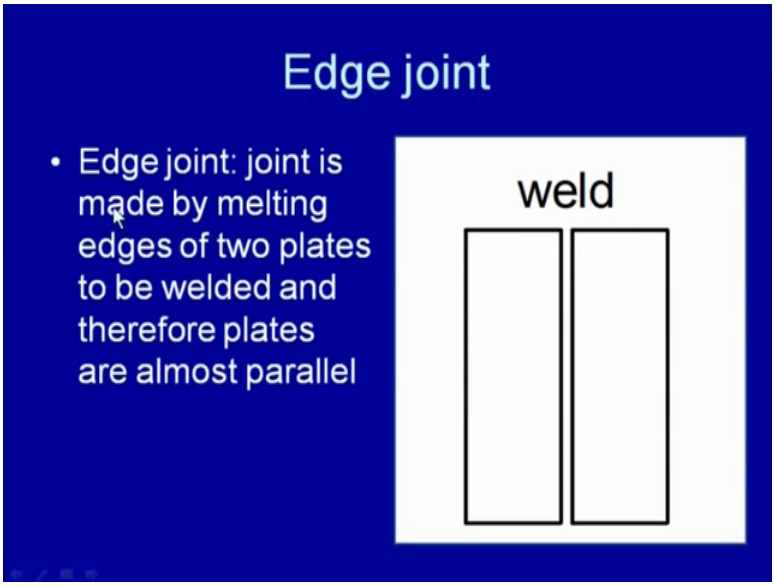

In edge joint the joint is made by melting the edges of the plates to be welded and therefore, the plates are all kept almost in parallel position and the whereas, groove geometries can be prepared for developing sound weld joint. In case of the T joint one plate is perpendicular to the another plate and the weld is made can be made either by making the groove, or just by depositing the weld metal in form of the fillet weld. Now, we will see the type of welds it is about the deposition of the weld metal, and depending upon the way by which.

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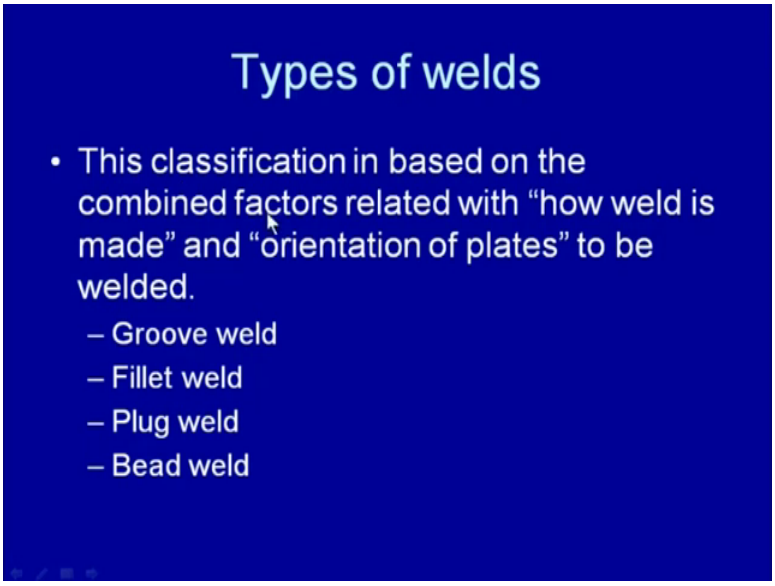

The plates edges of the plates are prepared and the weld metal deposited, the weld type of the weld can be classified on the basis of the combined factors, related with that how weld is made and the orientation of the plates to be welded.

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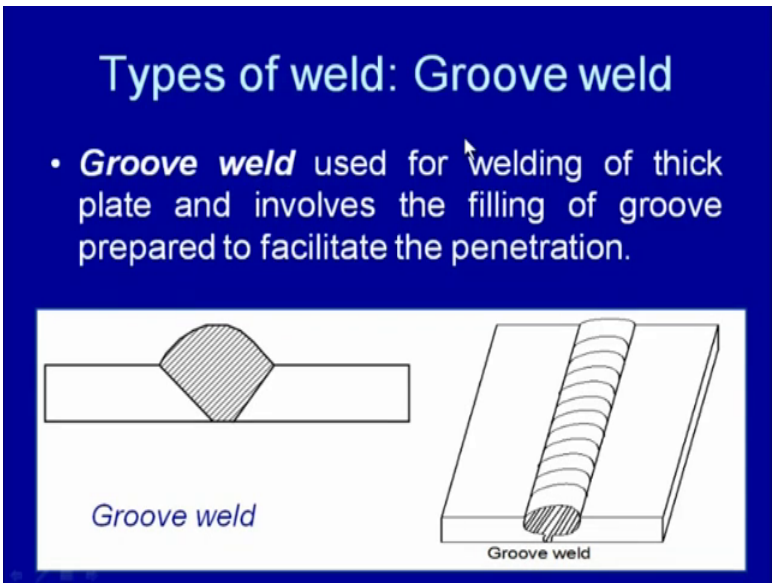

So, the groove weld, fillet weld, plug weld and the bead weld are the common 4, common types of the welds. In the groove weld the some sort of the groove is made between the plates to be welded, and then melting of the faying surfaces or deposition of the weld metal from the electrode helps to develop this kind of weld.

So, for the groove, groove weld is used for welding thick plates, which involves the filling of the groove prepared to facilitate the preparation. So, first some sort of groove is made between the plates to be joined, and this preparation of the groove helps in proper melting of the thick surfaces up to the desired depth for developing the sound weld joint. This kind of the groove can be used for developing the different types of the joints as we have seen, it can be used for T joint, corner joint, edge joint, butt joint.

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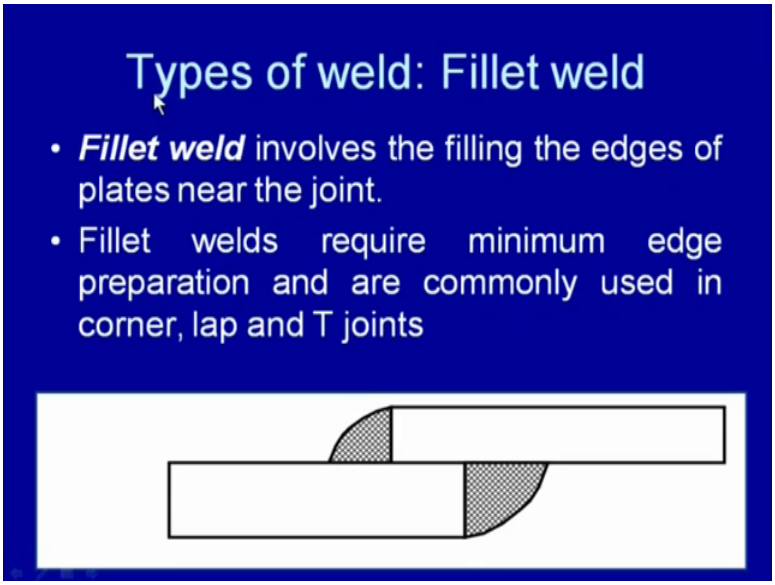

Then the fillet weld fillet weld involves the filling of the edges of the plates near the joint, like these are the for developing the fillet weld. Say for the overlap joint the weld metal will be deposited near the edges of the plates to be joined, the fillet weld require minimum edge preparation and are commonly used in common, in corner a lap and the T joint. So, weld metal is a simply deposited near the edge of the one plate or near the edge of the one plate and the on the top surface of the another plate, or simply melting of the surfaces of the two components can be insured for developing the fillet joint. For example, in the T joint the base metal is partially melted and the one edge of the plate which is perpendicular to the base plate is also brought to the molten state for developing the fillet weld joint.

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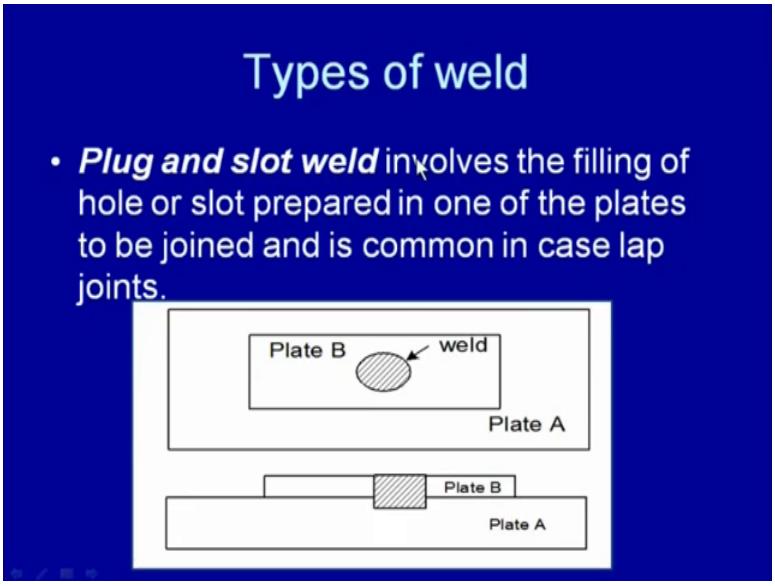

Then plug and slot welds the two types of the welds are largely similar type here, the two this kind of the weld is made in overlapping position of the two plates. And in the top and first one slot is made in the top plate and shape of this slot can be circular, or the square shape. A circular shape slot is made for developing the plug weld, and the square or rectangular shaped, as a slot is made in the top plate for developing the slot weld. After making the slot in the top plate it is kept over the another plate, and then weld metal is deposited from the top by melting the edges of the top plate, and a little melting of the bottom plates.

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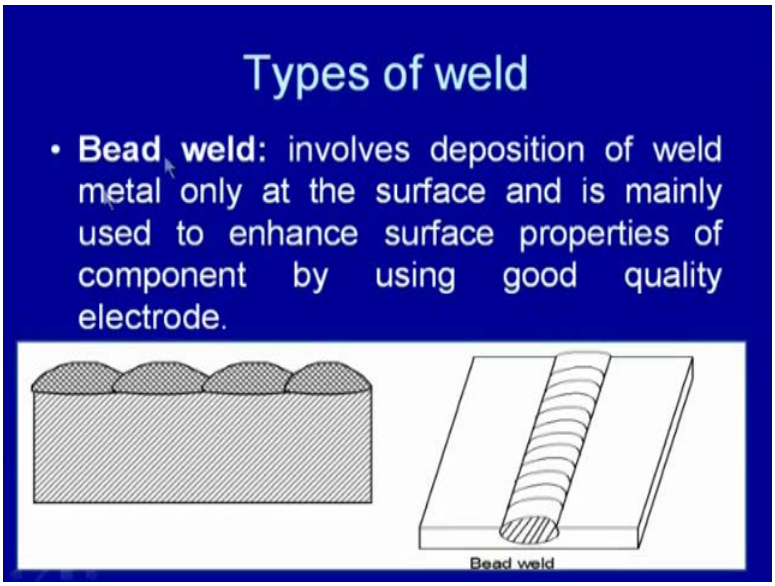

So, here the weld is made by melting the edges of the top plate as well as melting of the near surface layers of the bottom plate. So, depending upon the shape of the slot being made in the top plate, the plug weld we can define as plug weld or the slot weld. So, this is the case when the plug weld is being made, the first the whole slot is made in the top plate then it is kept over the another plate, and then fusion then weld metal is deposited from the top side by melting the edges of the top plate, and the top surface of the bottom plate. So, this is how weld metal is deposited for developing the plug or the slot weld.

The bead weld is the another type of the weld which involves the deposition of the weld metal only at the surface, and its mainly used to enhance the surface properties of the component by developing the good quality by using the good quality electrode. So, that so in this case primarily we have one base material, and the top surface of the base material is melted a little bit, another good quality material is deposited from the electrode. So, in order to maintain the good quality generation in order to have our production of the good quality surface by developing the bead weld, it is necessary that very little melting of the base material takes place.

So, that the dilution or intermixing of the electrode material with the base material can be reduced to the minimum level. Apart from enhancing the surface properties by depositing the bead weld, the purpose of the depositing the bead weld is also to restore the dimensions. Especially, when the top surface looses the material by the by the different weir mechanisms, so in order to restore the dimensions of the component sometimes the weld bead weld is deposited of the material same as that of the base metal.

So, as to restore the dimensions after machining the component, and sometimes in order to enhance the corrosion resistance of the component, the topper layer is developed by the bead weld using the corrosion resistant material for the cladding purpose. So, in case of the cladding basically objective is to enhance the corrosion resistance of the surface, of the base material by developing the weld bead of the good quality, and corrosion resistant material. Now, we will see the need of the edge preparation means, why we require that the edges are prepared during the before the welding for developing the sound weld joint. In order to understand this we will try to go through this.

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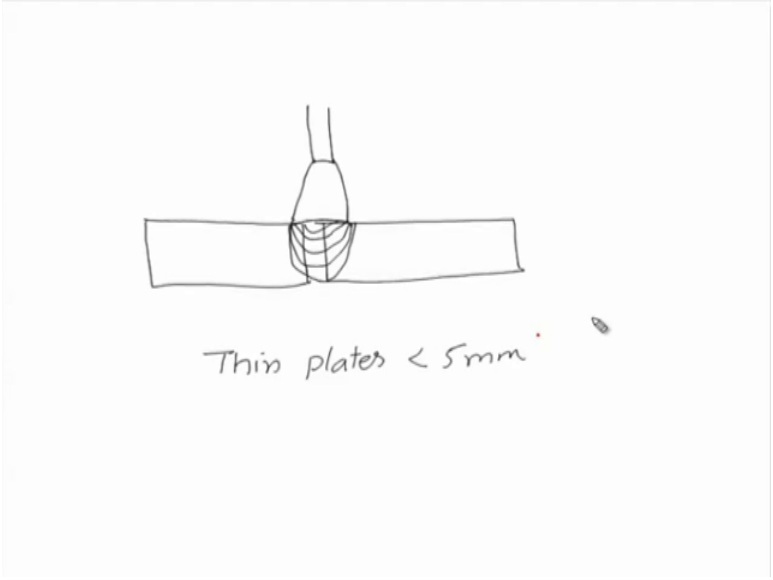

So, say the 2 the plates to be welded if they are thin say of the thickness lesser than 4 or 5 mm then application of heat using the suitable source of the welding say the flame, or the arc this the heat being applied using the suitable source will be able to melt the base material up to the bottom of surface of the plate, in order to ensure that complete melting through the thickness of the plate takes place.

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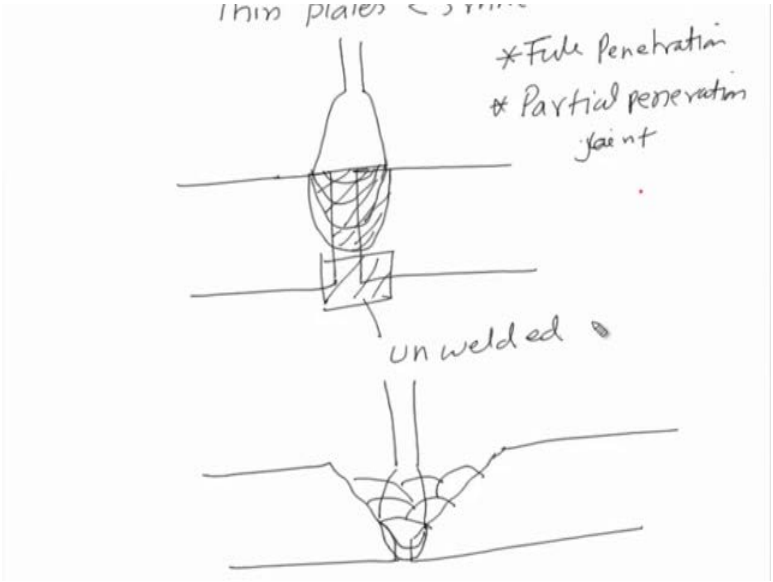

After that on the solidification sound weld joint is made. So, the application of heat for developing the weld joint from the top surface of the plate, where plate thickness is less

than 3 mm can less than 5 mm can facilitate the through thickness penetration, and can help in development of the sound weld joint, but in this the situations where the thickness of the plate to be welded is more under those conditions.

We can see that if this is situation where the thick plates to be welded then application of the heat from the top using the suitable heat source, may not be able to facilitate the melting through the thickness, but say melting only up to the certain depth is possible. So, in that case weld will be made only on certain portion only up to a limited depth, and this particular portion may be left un welded. So, if this is the portion which is left un-welded will be acting as a source of stress concentration, and will not be contributing in any way for strength of the weld joint.

So, in these situations where the plate thickness is more, and the through thickness melting is not possible by application of the heat from the top surface it becomes important to prepare the edges of the plates. So, that the heat source can be applied up to the bottom surface of the plate for melting, the faying surfaces up to the desired depth even in the root portion of the weld.

So, in these situations it is common that whether the some bevelling is done of the edges of the plates to be welded. So, when this kind of bevelling is done for of the edges of the plates, this will help us in applying the source of heat right up to the bottom. And that is how it with be able to melt the surfaces or the plate up to the bottom and then gradually, one by one the weld metal will be deposited in the other portions of the groove. So, here the preparation of the edges by bevelling them, or by making the U shape or J shape will help in providing the better access to the heat source. So, that the melting up to the bottom is facilitated and proper penetration is achieved.

So, for this purpose only the edges of the plates are prepared so that the heat source can be applied up to the up to the bottom, and the proper melting and penetration can be achieved for developing the sound weld joint. Because of this reason the thin plates can be welded without any edge preparation, where just the edges are made square and kept in butt position with respect to each other. It is applied from the top surface, but for the situations where the thickness of the plate is greater than 5 mm just the application of the heat from the top surface, may not be able to melt or melt the it is of the plates right up to the bottom, and this in turn can result in the partial penetration joint.

So, in those situations where application of heat using the suitable heat source helps to melt, melt the plates through the thickness results in the through results in the full penetration. Weld and for those situations where the melting with the application of heat melting only up to the certain depth of the plates take place, and thereafter development of the weld joint produces the partial penetration joint.

So, full penetration joint offers the better mechanical properties, and the load carrying capacity as compared to the partial penetration joint because. In case of the partial penetration joint the load resisting cross sectional area is smaller, and the un welded portion acts as the stress reserve and which facilitates the easy nucleation, or and the crack growth under the external load conditions and thereby it reduces the load carrying capacity.

So, it is not desirable to have the partial penetration joint especially under the dynamic load conditions while, this can perform successfully under the compressive load or the static loading condition. So, for non critical applications where the load is static in nature it may be sufficient to have the partial penetration joint, but for those situations where the load is dynamic in nature, the full penetration weld must be made.

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So, that unnecessary stress reserve can be avoided, and the full strength of the joint can be achieved. So, this is the basis for the preparation of the edges so, but there are many factors that dictate the kind of edge preparation which should be done, and there are

many other side benefits related with the edge preparation. So, the first and foremost important thing for the edge preparation is that.

That the proper melting of the faying surface faying surfaces is required for developing the sound weld joint, and when the heat is applied using suitable current in the arc welding, it controls the depth up to which melting can be done means the kind of penetration which can be achieved. The penetration which is considered as depth up to which the base metal is melted from the surfaced with the application of the heat for the full penetration. It is necessary that the through thickness melting of the plate is done. And once the through thickness melting of the plate is done, the full penetration joint can be obtained. This kind of the joint offers the full resisting cross sectional area, which is possible for a given plate thickness. It avoids the possibility of having this stress razors in form of the partially un melted portion left between the plates.

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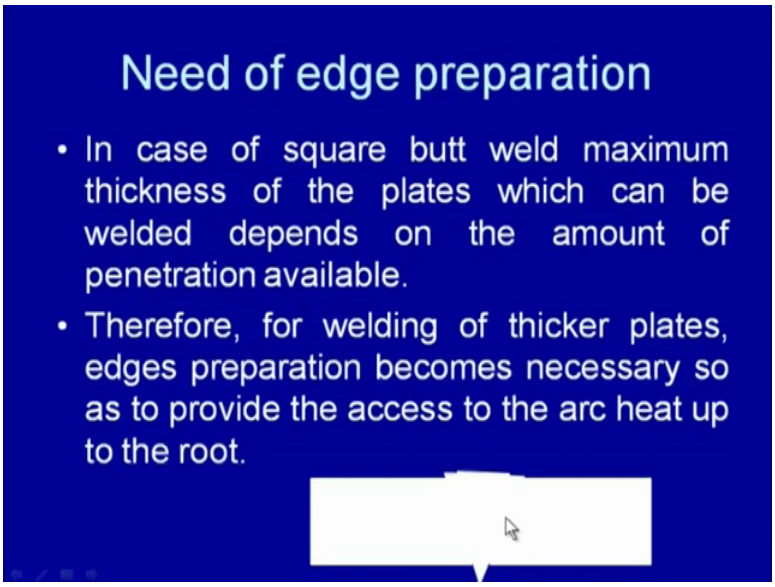

So, in case of the square butt weld maximum thickness of the plate which can be welded depends upon the penetration, which is available. For example, if you are just putting the square edges of the plates to be welded together by fusion of the edges, then the amount of the then the depth up to which the plates can be welded, will be governed by the heat that is being applied for melting the faying surfaces. So, if greater is the depth up to which melting is possible it will allow us to use the butt square, but welds without edge preparation for thicker plates.

So, the maximum plate thickness up to which this square butt weld can be used will be governed by the kind of a penetration, which will be available for a given process and welding conditions. For example thick plates like 20 to 25 mm a thickness can be welded in single pass using the submerged arc welding process, while the other low heat input processes will not be will to offer that much penetration. Because of that they will be able to weld up to the lesser thickness, in the single pass and therefore, they will require the proper edge preparation. So, the maximum thickness which is normally used for developing the through thickness full penetration weld by the square for developing the square weld means, for means using the square butt the thickness limit is the 5 mm.

Therefore, for welding of the thicker plates edge preparation becomes necessary so as to provide the access to the heat source, or to the arc up to the root of the plate to be welded. For example, if these are the 2 plates to be welded together having the square butt position. So, application of the heat from the top will be less if heat is applied and if melting is very little bit then only the near edges, near surface edges will be melting. If we increase the heat input then the depth up to which melting will be taking place, that will be increasing. So, it will be required to melt means if we require greater depth of the penetration then the further heat input is to be increased, but there will be a limit on the extent up to which heat input can be increased by a given process.

So, in order to facilitate either it will be required to prepare the edges of the plates. So, that the heat source can have the access up to access of the heat up to the root of the plate to be welded, or like in case of high heat input processes like submerged arc welding. Application of the very high heat in put can result in the melting through the thickness of the plate for developing the full penetration joint.

But this kind of the weld is possible only using the high heat input processes up to the thickness of the 20 or 25 mm thick plates of the steel, but always it may not be possible to use such a high heat input processes. Therefore, the edges of the plates are frequently required to be prepared so that the proper access to the heat of the heat source can be provided up to the root of the plate being welded, if we see the edge preparation.

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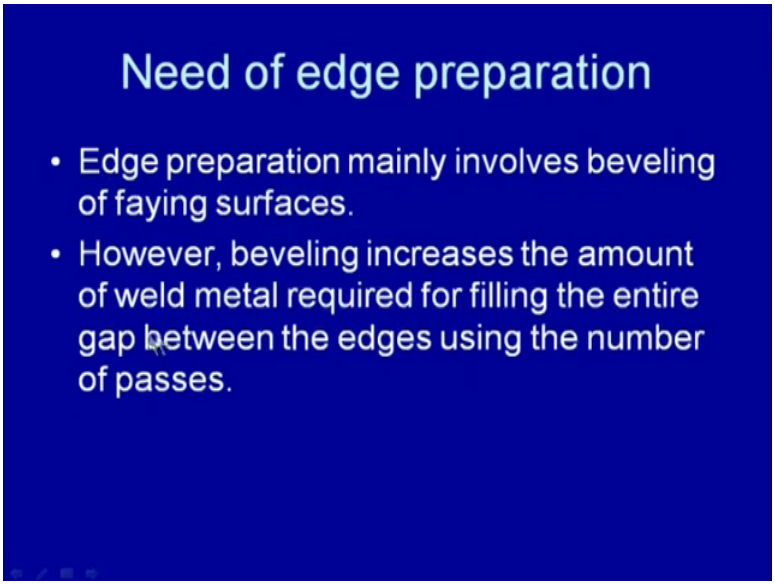

Mainly involves the bevelling of the faying surfaces, our bevelling increases the amount of the weld metal that is to be deposited for filling, the entire gap between the edges of the plates to be welded using the number of passes. So, if we see here in case of the square groove the amount of the weld metal that is to be deposited, will be the minimum. The moment we go for bevelling of the edges of the plates to be joined together, it will simply increase the amount of the weld metal to be deposited, for developing the weld joint and which will simply increase the time required for developing number of passes.

So, keeping in this contradictory requirement of like edge preparation will be required especially in case of thicker plates, but the moment edge preparation is done it increases the amount of the weld metal, which is to be deposited and that is why some sort of the compromise is striked. In order to have the proper edge preparation in such a way that it permits the access to the heat source up to the root of the plate, at the same time it requires the minimum amount of the weld metal to be deposited and in view of this.

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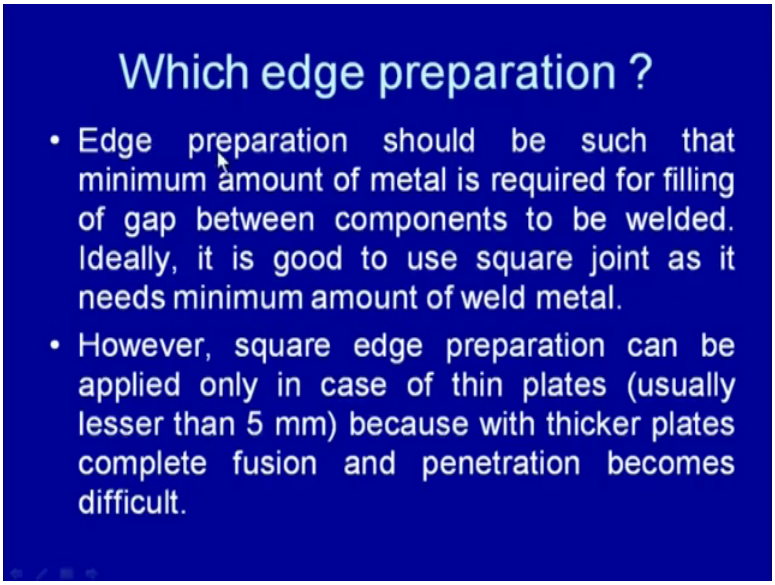

Edge preparation should be such that minimum amount of the weld metal is required for filling the gap between the components to be welded and it is ideally, ideally it is good to use this square joint as it requires the minimum amount of the weld metal, but at the same time whatever edge preparation is used, it should provides the required access to the heat source so, that the melting up to the root of the plates can be achieved.

However, the edge preparation can be applied only in case of the thin plates usually, lesser than the 5 mm because with the thicker plates the complete fusion and penetration becomes difficult, and that results in the partial penetration joint. So, in view of above means we can have this square, but a joint or square, square groove or we can have that the bevelling of the different kinds like the V, single V, single U, single J or double V double U, double J flare groove.

So, there are variety of the edge preparations which are possible, but which type of edge preparation should be done that will be based on the fact that what kind of the heat input is available from a particular process. So, that the through a thickness penetration can be achieved. What is the size of the electrode, which is to be used because it will affect the access of the heat source up to the root of the plates to be welded. Further it will be based on the thickness of the plate.

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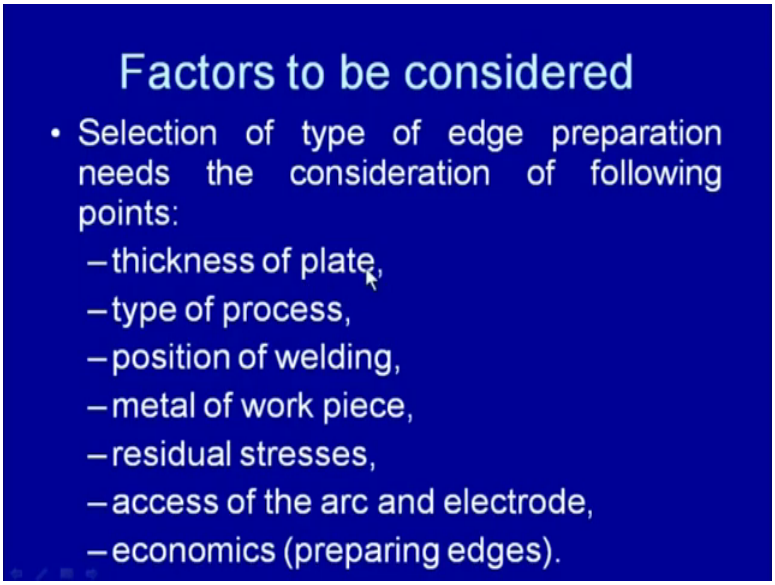

Because it affects the volume of the weld metal to be deposited, and the position where welding is to be done. So, the various factors that should be considered while selecting suitable edge preparation will involve thickness of the plate, if the plate is thin then square groove is used. For the thicker plates where the weldment is to be deposited, weld metal is to be deposited for developing the joint. We can go with the a single V or single U depending up on the thickness say up to the 10 to 12 mm single U, or single V is used, but for further thicker plates say 20 to 25 mm or greater thicknesses the double V and double U groove geometries are used for developing the weld joints.

So, that the weld metal amount to be deposited can be reduced, as compared to the single V and the single U grooves. The type of the process will affect the kind of the penetration which is possible using a particular process. So, a high heat input process like submerged arc welding will be capable to have the deeper penetration in single pass, while the low heating process like SAW or SMAW and the GTAW due to the limited heat input they will not allow to achieve the greater penetration. The position of the welding position of the welding affects, the way by which the weld groove can affect the tendency of the weld metal to fall down that will dictate that which type of the groove should be used so, that this kind of tendency can be reduced.

Then the metal of the work piece residual stresses state means, if we want to reduce the residual stresses then it is preferred to go with the single V, and the single U groove

geometry instead of the single V and the J, V and the J single V single U kind of the geometries and then access of the arc, and the electrode means the diameter of the electrode. And how what kind of access is available to the arc that decides, which type of groove geometries to be used. Finally, the economic aspects like in some of edge preparations are costly to work with like it is difficult to get the J, and the U groove geometries as compared to the simple V groove geometry, and the square groove geometries.

So, but the V groove geometry requires the greater amount of the weld metal to be deposited, as compared to the J and U. So, the total economic related with the machining of the edge preparation, and the weld metal to be deposited will also dictate the kind of groove geometry is to be used. If the edge preparation is possible with them for a given plate thickness using the different kind of the groove geometries, then economics will dictate which kind of the groove geometry is to be used. So, now in view of this presentation I would like to summarize the presentation.

In this presentation first of all we have, we saw that how step by step we can represent the welding symbols, which will be playing an important role in developing the sound weld joint because through this we try to communicate the information, regarding the weld regarding how, and what are the important things for the development of the weld joint to the shop floor people. Thereafter we saw that what are the different types of the joints which are commonly used for developing the various kinds of the assemblies, and what are types of the welds and what is the role of the edge preparation? What factors to be considered for selection of the suitable kind of edge preparation?

So, now in the coming presentation means, the next presentation we will be talking about that the different types of the edge preparations which are available. What are the various types of the groove geometries available? What are the various plus and minus points related with the each kind of the groove geometry, which dictate its selection under the different conditions?

So, thanks for your attention.