Fundamentals of Manufacturing Processes
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Lecture - 30
Metal working processes: Press

Hello, I welcome you all in this presentation related with the subject, fundamentals of the manufacturing process and we are talking about the metal working processes and we know that the metal working processes can be placed in the two categories - one is where the bulk material deformation takes place and another, where the sheet metal is deformed.

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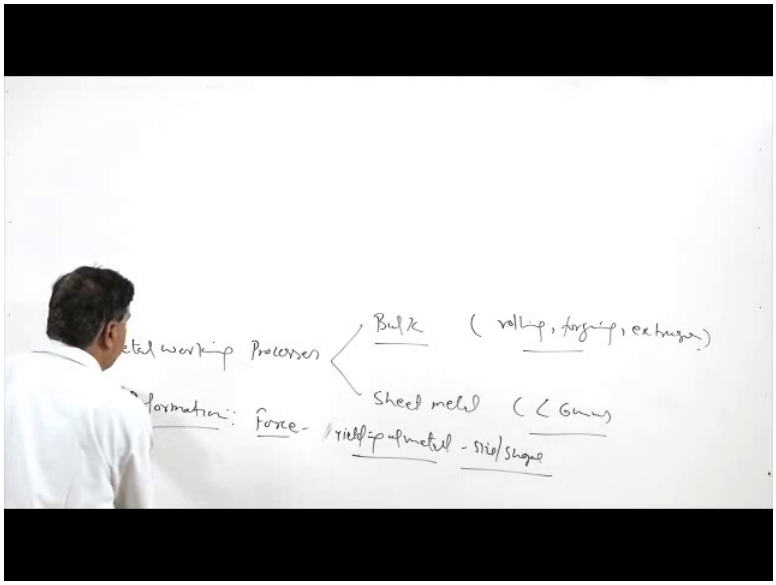

Sheet metals normally, less than those of less than 6 mm and the bulk material deformation processes like rolling, forging, extrusion, all these fall in the category of the bulk material processing.

So, since the approaching, this process is the deformation based, whether it is bulk material or the sheet metal. So, for the deformation it is necessary to apply force. So, that, it exceeds the yield strength of the metal and, or you can say the yielding of the metal takes place or the deformation of the metal takes place, in order to get the desired size and shape in the product.

So, for application of the force in these processes so that the deformation can be achieved normally the presses are used. So, in this presentation I will be talking about, that the press, which are used press, its types, its classification, the selection, what we need to consider.

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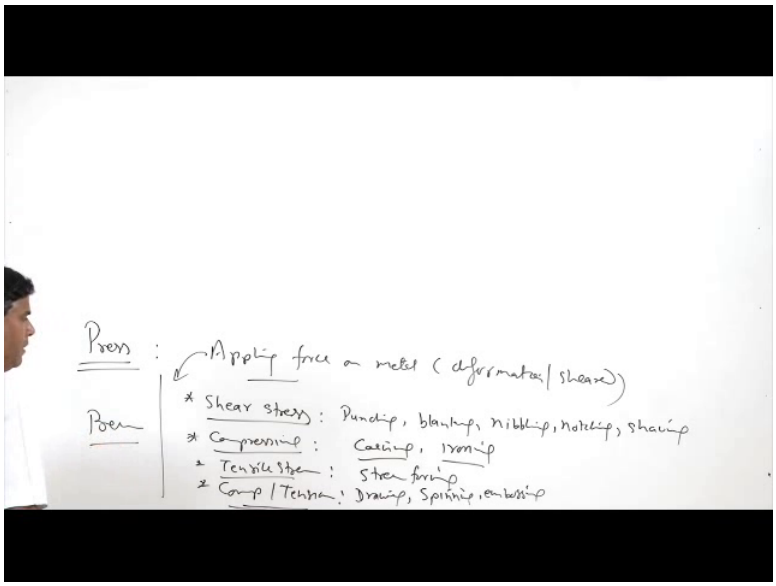

So, the press is a primarily used for applying the force on to the metal so that, either the deformation is achieved or it is sheared off. So, shearing helps to facilitate the removal or the cutting. So, for the presses are primarily used for applying the forces in the metal. So, it can induce, means the presses are used to induce the shear stresses, compressive stresses, tensile stresses, or the combination of the compression and the tensile stresses. So, there are different processes which will be using these. This kind of the stresses, like shearing stresses is sheet metal processing, are used for the operations like punching, blanking, nibbling, notching, shaving, etcetera.

So, there number of the processes while compressive stresses are used for the operations like coining and ironing. So, in case of ironing basically thinning is achieved in the case of the coining the coins are developed and the made in case of the tensile stresses, means those processes, sheet metal processes, where tensile stresses are induced like the stretch forming while the processes, where both combination of the tension and compression is used, involves the drawing.

So, sheet metal drawing is one where cup shape products are used, than spinning and embossing. So, these are the processes, which will be inducing, which will be using. The verity of the stresses induced through the application of the force and the force is applied with the help of the suitable presses.

So, for the purpose of applying the suitable force, during the sheet metal operation, suitable press need to be selected. So, how to select?

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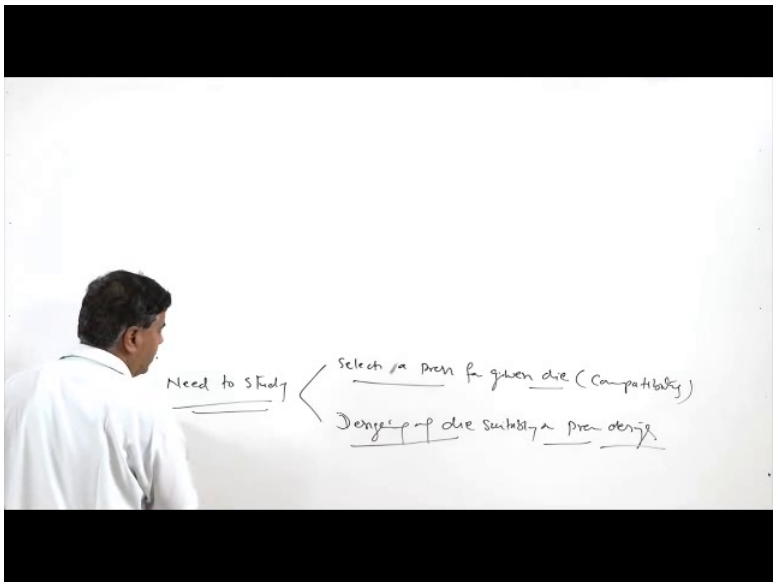

So, what is the need to study about the presses? If we are aware of the presses then it helps in two ways; one it helps to select a press for given die, which is to be used for the sheet metal operations. So, basically, it looks after the compatibility aspect of the die with the press. So, this is the case; when we have the number of the presses and one is to be chosen.

Another one is the case when, means the study also help us in designing, the designing of the die suitably as per the press design. So, we can select the suitable press for the given design. If we are familiar with the kind of presses that we have or if we are familiar with the presses, then it also helps in designing the suitable die. So, it is either way like a suitable press can be selected for a given die, or suitable or the die design can be developed, if we have press, or we are aware of kind of press which is there. So, better understanding about the press helps in selection of the presses as per the comparability

with the die, or it helps in designing the die in such a way that, the die is compatible with the press.

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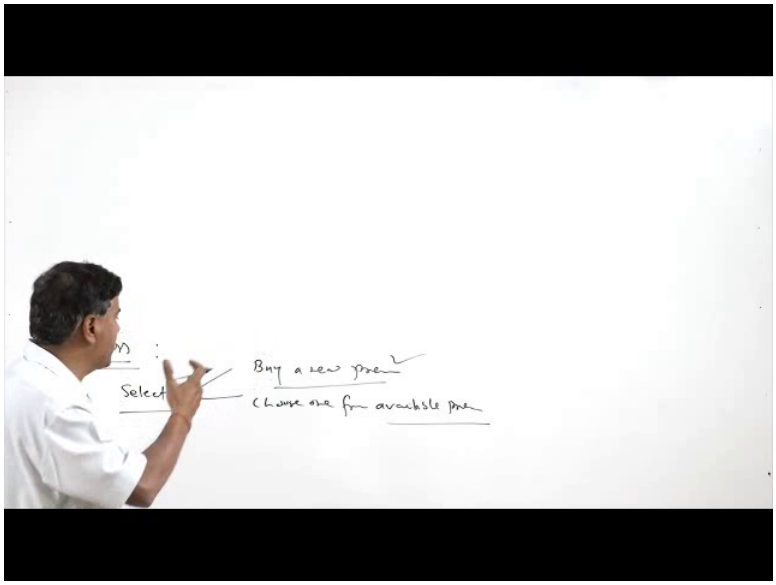

Now, we will see that under what conditions we need to make a selection like, we are, if we do not have a press and for a particular application, we need to do buy a press, then buy a new press, then in that case, we need to choose the one from the available options as per the purpose and the second selection is made when we have the number of the presses and one is to be chosen for the given purpose. So, that your press is compatible with the die. So, choose one from available presses. So, these are the two different situation in one case, we need to buy. So, we will go for such kind of press, which will be compatible with the die and another one, if we have number of the presses, then suitable press can be selected.

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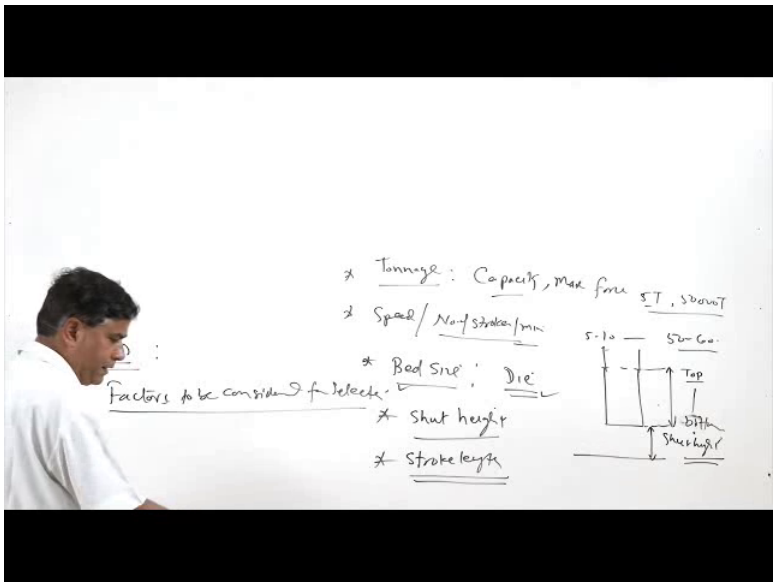

So, what we need to consider when choosing a particular kind of the press. So, the factors that we need to consider factors to be considered for selection of the presses, includes verity of the aspects and which includes like the first is tonnage. Tonnage of the press is about the capacity in terms of the maximum force, that a press can apply. So, depending upon the metal, which is to be processed or thickness of the sheet, which is to processed or the requirement of the forces. Suitable press of the suitable tonnage is selected, which may be like vary from 5 ton to like 50,000 tons capacity. So, as per the requirement to the press of the suitable capacity, or the suitable tonnage can be selected.

Then the speed or it is also termed as the number of strokes per minute. So, like a for certain operations like deep drawing operations we need the slower movement of the ram while in some other presses we need the higher means the faster movement of the presses. So, the number of the strokes per minute is another factor depending upon the speed at which the RAM movement is needed. So, which in turn is identified through parameter the number of strokes per minute like these may be like 5 to 10 or 50 to 60 or even more. So, depending upon the kind of the number of strokes per minute required suitable kind of the press is selected another factor is the bed size as per the size of the job or the component which is to be made that we need to use the suitable die.

So, the die will be placed on the bed of the press. So, the press is a selected it has a sufficient space for accommodating the die. So, die will be placed on to the bed. So, that

bed area or the bed size will which is to be used for making the sheet metal or the product of the desired size. So, accordingly die is made under the die must be accommodated into the bed of the press. So, this bed of the suitable size of suitable area need to be selected then another one is the shut height shut height in a shut height is one of the parameters like the ram and this is the bed. So, RAM will be moving up and down. So, in the lower most position what is the gap in the lower most position of the ram what is the gap between the bed and the ram this is called shut height and this determines the size of the job which can be accommodated in a given press.

So, the shut height is another parameter then the stroke length stroke length indicates the extent of the movement of the RAM like from its uppermost position is this and the lowermost position is this then the this movement is called the stroke length. So, you can say the top level to the bottom level. So, whatever is the movement of the. So, the top to the bottom whatever is the movement of the ram in a stroke that is called a stroke length.

So, it will be determining the maximum the depth, up to which RAM will be able to get into the sheet, or it will also be determined like in the drawing process. It will determine the maximum depth which can be achieved through the particular stroke. So, it is the extent of the movement of the RAM, from its movement, from top to the bottom and there are other factors also related with the presses that need to be considered, is also the number of the presses which are to be used.

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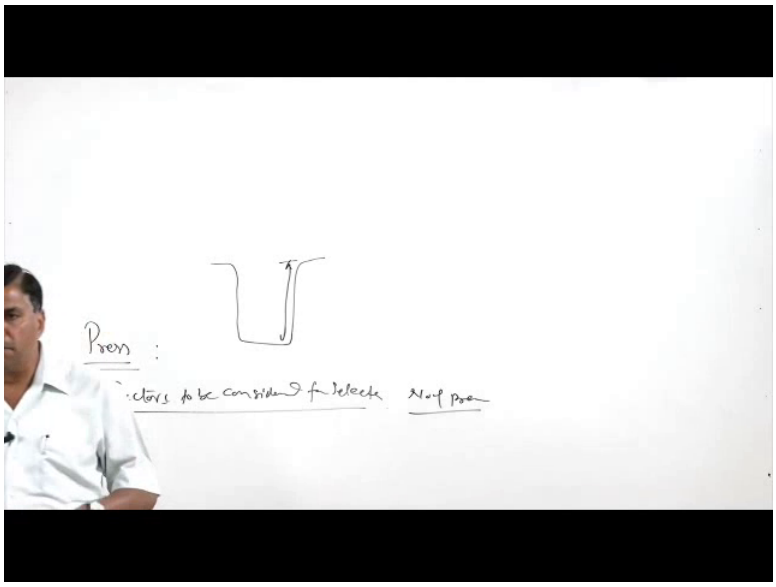

So, depending upon the kind of the production, which is involved, it is like the, if the number of the sheet metal operations require, number of the presses.

So, we need to decide which kind of the presses press will be selected. So, that it can serve the purpose of the sheet metal operation which is desired. So, the number of presses required for the job is the another consideration.

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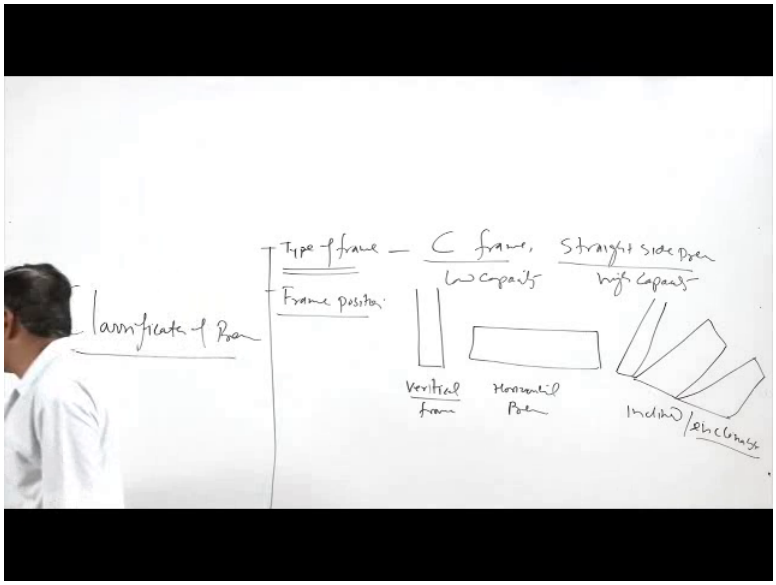

Now, we will see the classification of the presses classification of the presses. So, the classification actually helps in to see the press in the different ways. So, they are different, a factors based on which presses can be classified and if you understand the presses press designs press functioning in the different ways then, that will help us in understanding the capabilities and the kind of limitations, which can be there related with any presses.

So, the classification of the presses is based on the number of the factors. One is the type of frame. Then there are two types of the frames, which are normally used. One is called C frame press and another is the straight side press. A straight side press is used for the high capacity and C frame presses are used for somewhat lower capacity.

Then another factor is the frame position, means whether the frame is the, what is the frame; frame is the main member of the press which will be accommodating the prime mover or the drive mechanism it will be housing the bed and all relate, all the

components, which will be ensuring the proper rigidity as well as the relative movement of the different parts in the press operation. So, the frame is very important part of the press and it takes all the loads, which will be acting due to the dead weight or during the operations whatever the forces are generated. So, during the whatever, the forces are generated during the operation of the press. So, all that is accommodated by the frame only.

So, the frame position, so the frame is very crucial and important part of any press. So, the frame can be oriented vertically like this. It can be oriented horizontally or it can be inclinable, means it permits the setting of the frame position at the different angles like this. So, like, there are three types; one is vertical, vertical frame press, horizontal press and inclined or inclinable presses. One which allows us to set the frame at different angles and incline the press, will have the setting at one particular angle. So, this is the difference in the process of the means the frame position. The classification based on the frame position, it is common to have the vertical presses and horizontal presses, are used only under the specific conditions and the same is true for the inclined presses.

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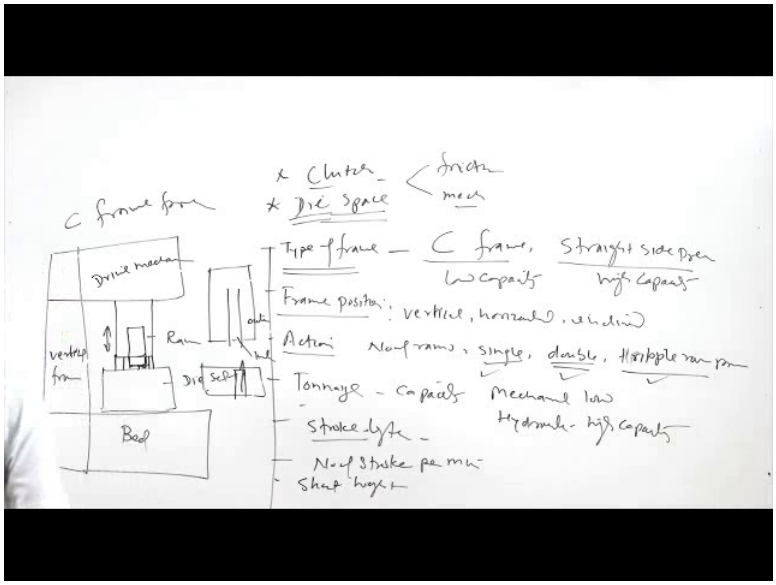

So, we have the vertical press, horizontal press, inclined press, these are the types of the presses. Then we have the action, action is about the number of the RAMs, which are there. There can be like single RAM press, double ram press or triple RAM press. So, I think it would be appropriate, if I can make the general structure of the press, of one

particular kind of the press, like say any press will have one vertical frame like this, and it will have one bed and at the top, it will have all the drive mechanism.

So, this is one type of the press you can say the C frame press. So, at the top portion of the C is the, here it houses all the drive mechanisms. This is the vertical frame and this is the bed now. The up and down movement of the RAM. This is the RAM, which will be used to on the bed. We can have the job on which or we can have the die set, through which the force will be applied on to the sheet metal.

So, the basically the RAM movement helps to apply the force in control, way through the die set on to the sheet metal. So, that the desired processing of the sheet metal can be achieved, which may be in form of like shearing, punching, blanking, nibbling, notching, or it may be embossing coining, etcetera. As I have already mentioned earlier.

So, in this case if you see there is just one RAM. So, action, single action, a number means a classification, based on the action is about the number of RAMs, it has. Single RAM press double RAM press and triple RAM press. So, in case of the single RAM press, there will be just one RAM, which will be moving up and down in case of the double RAM, press there is a, in there two RAMs and so there is one outer RAM and then there is a inner RAM. So, in the inner, RAM will be moving inside the guide ways of the outer RAM. So, first of all in this case, normally the outer RAM moves and holds the sheet metal and then inner RAM comes into the action.

So, this is what happens, in case of the double RAM normally, it is a single RAM, but there can be double RAM. In case of the double RAM, the second RAM will be inside the outer RAM which, and the outer RAM is basically, used to hold the sheet metal and in case of the triple RAM, normally in case of the triple RAM, the double RAM presses. It is similar to the double RAM plus. So, this is the outer RAM and this is the inner RAM and like say, this is the bed and the third RAM comes from the bottom side, which will also be applying force into the sheet metal.

So, in this case three types, three RAMs are used, in case of triple RAM press. So, for more complex operations to be carried out in one go, triple RAM presses are used, otherwise, double RAM presses mostly used for the drawing kind of the operations and then single RAM presses are used for like punching and blanking, etcetera.

Now, coming to the other classification, other factor based on which, classification can be done, is the tonnage I have already explained this. It is about the capacity of the press. So, like mechanical presses or of the low capacity, while the hydraulic presses are used, for the high capacity, then we have the stroke length. I have already explained this stroke length and then number of strokes per minute and then the shut height. I have already explained this shut height parameter and then and the one more, like the die space, it to die area. It will be governing the size of the bed on which the die can be accommodated. Another RAM can act on and there is one more like the clutch a based. The classification based on the clutch like, the two types of the clutches; mechanical clutches and the friction clutches.

So, these are the different factors based on which presses can be classified. So, now, we will be going through sequentially the different. These are the presses with the help of the diagrams. So, as I have said, the sheet metal is extensively carried out for making the number of sheet metal. Operations are carried out for making the variety of the products.

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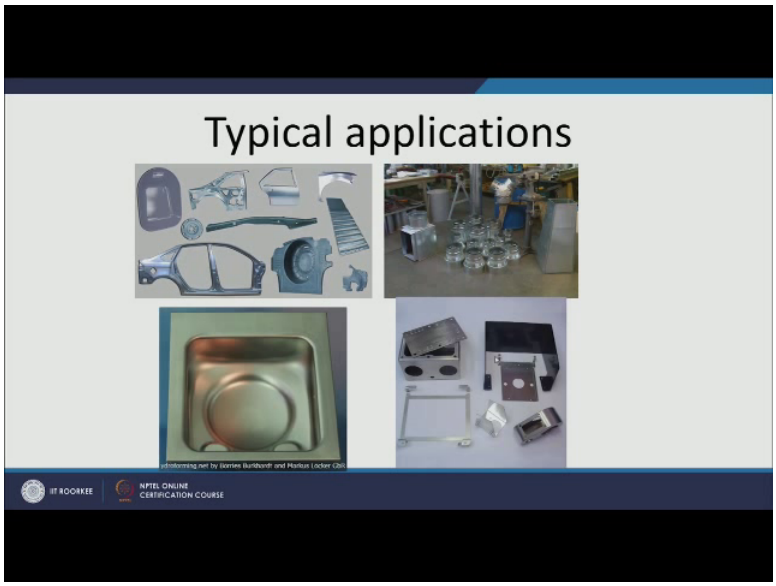

Which can be seen like automotive parts domestic utensils and like the bin and these are the like computer cabinets and the parts made using the sheet metal operations this is about the purpose.

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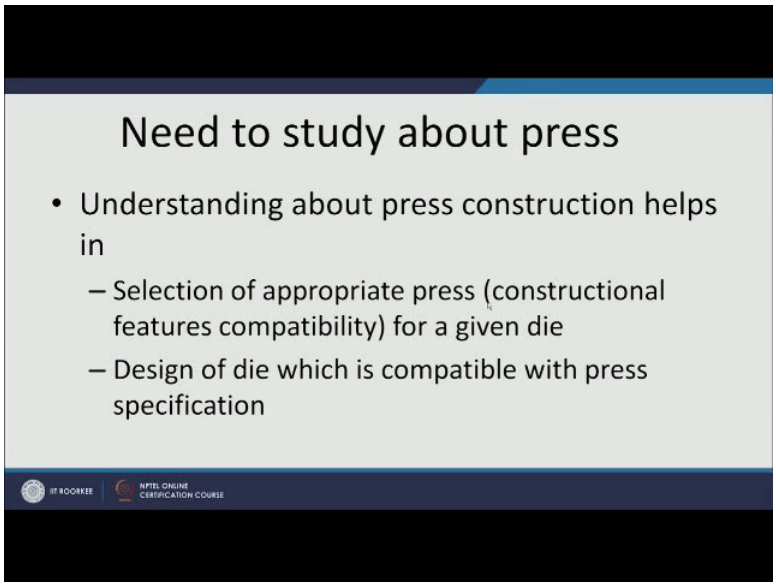

I have already explained need to study about the presses about the selection of the appropriate press for a given die or designing the die, which is compatible with the press of a given specification.

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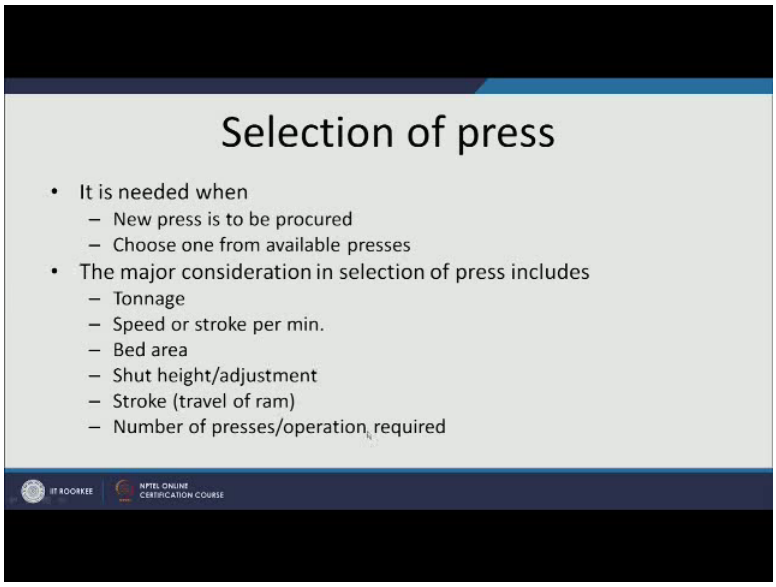

So, when the selection is needed to for buying a new press or choosing one from the available presses, the factors that we need to consider includes these like, the tonnage the speed or the number of a strokes per minute the bed area shut height the stroke that is the

travel of the RAM and the number of the presses, that are required for given set of the operations.

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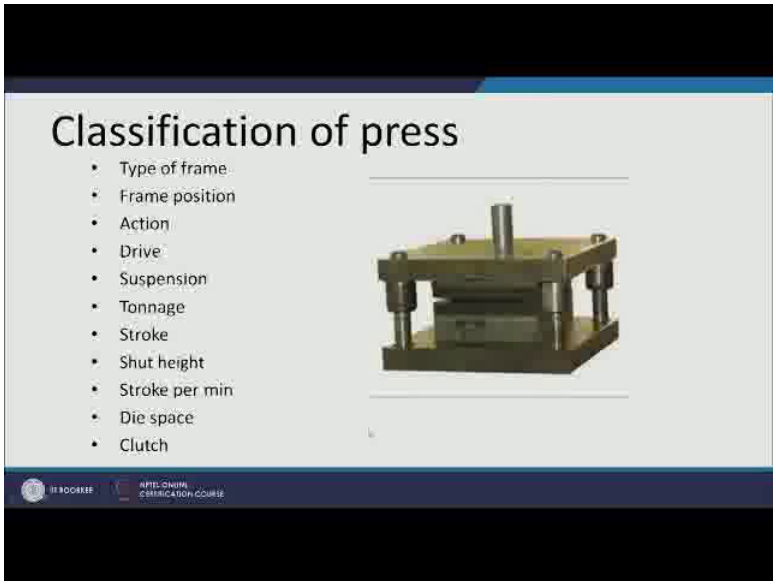

These are the different factors; I have already just mentioned the type of the presses frame position action the drive I have not included. So, those things will be covered Now, the drive it is about the kind of the mechanical drive or the hydraulic drive systems which are used for a move for facilitating the ram movement then the suspension system like how many points are supporting the ram there can be single suspension or there can be two suspension system or four suspension system it is about the number of points through which RAM is supported.

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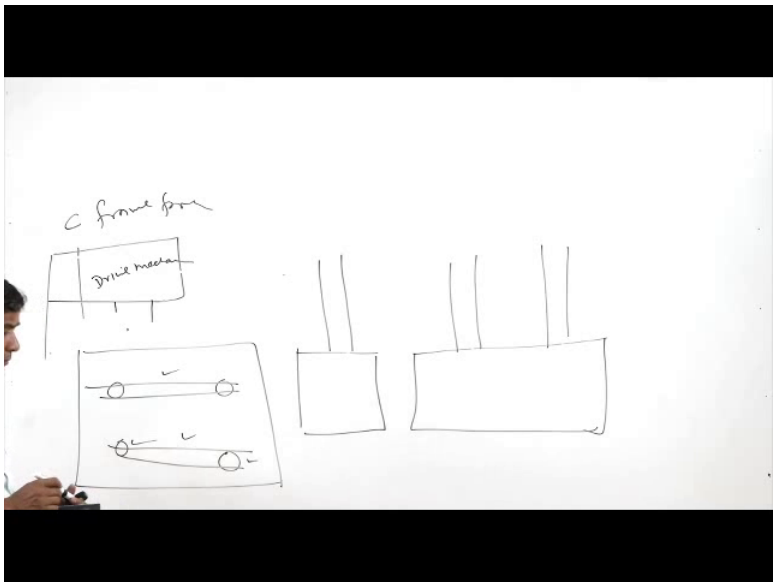

So, like if the RAM is smaller in size, then just one point of the suspension is applied. if the RAM is very wide, then the RAM can be suspended with the help of the two connecting rods, like this and in the top, if you see RAM is not just of the width, but its length is also more than the RAM, can be suspended from the you, using four connecting rods, which will be powered through the two crank shafts. So, like these are the two connecting rods and these are the two crank shafts.

So, in case of the depending upon the size of the RAM, there can be single suspension, double suspension and four point suspension systems, which can be used then tonnage, as a billet expend that is the maximum capacity, maximum force, which can be applied by the press the stroke is about the length of the movement or the travel of the RAM, from the topmost position to the lowermost position shut height the stroke length is number of strokes, per minute the die space and the clutch.

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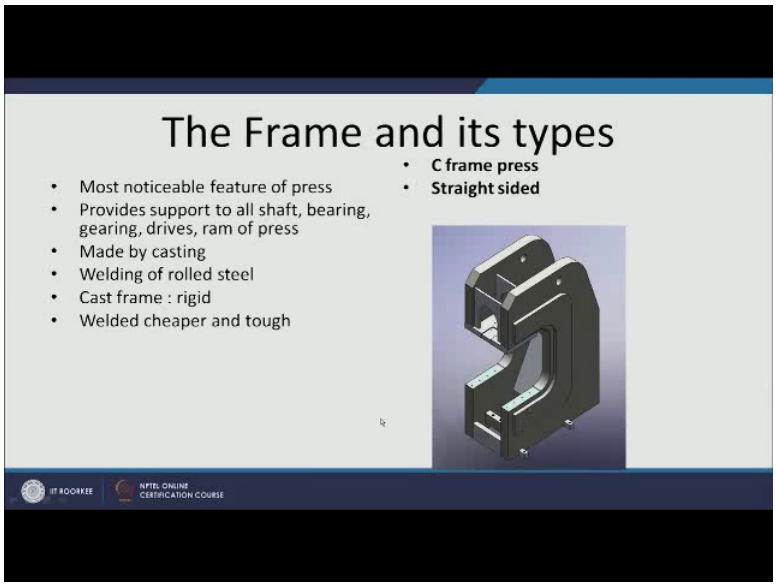

So, as I have said the frame is the main part, in the press, which takes all the forces houses all the components like shafts, bearing drives and the RAMS, these can be made you either by the cost frame can be made, either by the casting or by welding of the roll steels. So, the cost frames are more rigid as compared to the welded frames, but the welded frames are cheaper and they are tougher. There is one typical diagram for the C frame press. This is of the C structure, the top portion will be used for housing the driving mechanisms and the lower portion will be used for accommodating the bed. Two diagrams, which are showing the C type of the frame and the straight sided vertical frame, C frame and the straight sided vertical frame.

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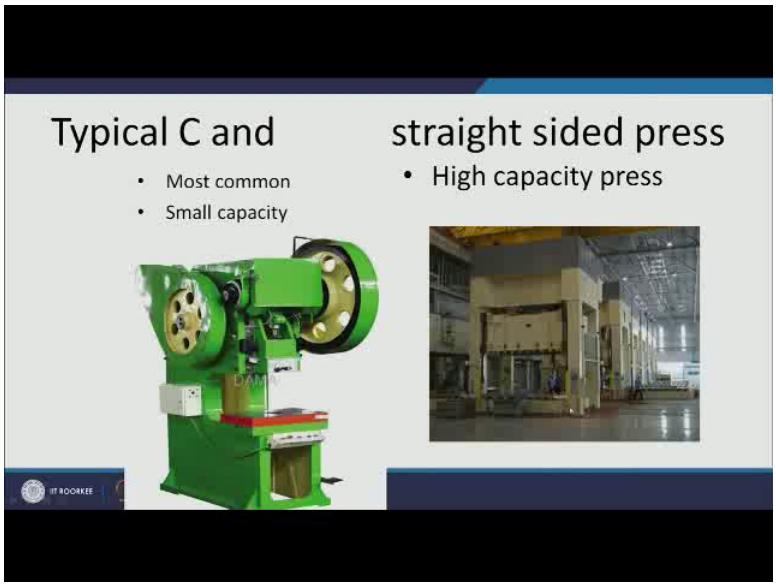

So, in this case also the both. The frames are the vertical, but in this case, it is C structure. Here, the top level is showing the drive mechanisms. This is the bed and this is the RAM movement, which will be moving up and down and very high capacity presses, for which the straight sided presses are used. Like this is one typical press having the four sides, which are straight and this is very large size Ram, which will be moving up and down and this is the bed of the press.

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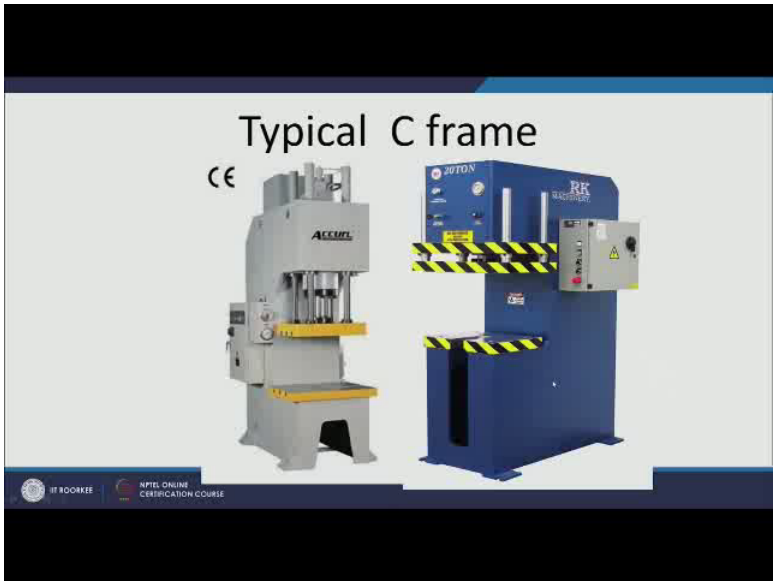

This is again the C type of the press, the two different types of the presses of the C type. So, a straight sided presses.

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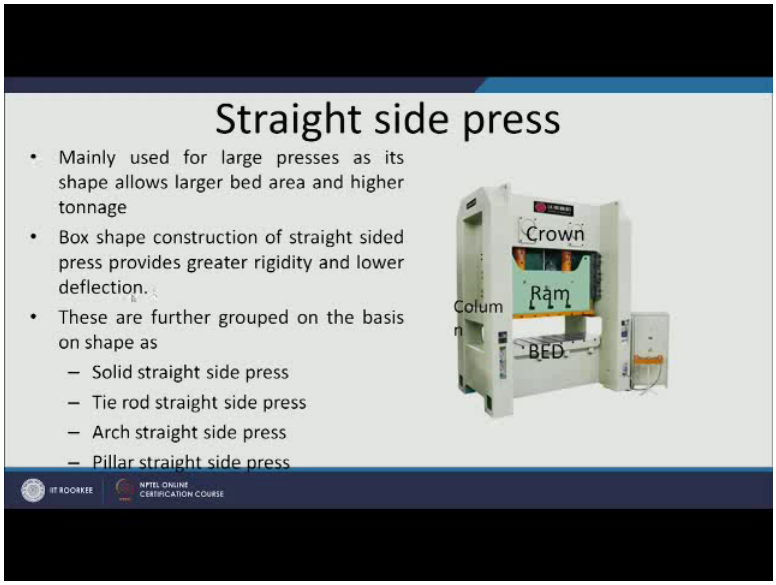

These are mainly used for the large presses, as it allows the large bed area and the higher tonnage. These are box shaping construction and provides a greater rigidity and low deflection and their further classifications related with the straight sided presses, like solid straight side press, tie rod, tie rod straight side press then ARC straight side press and the pillar straight side press.

So, they likewise it can be the presses, can be classified in the different ways even for the straight side presses also.

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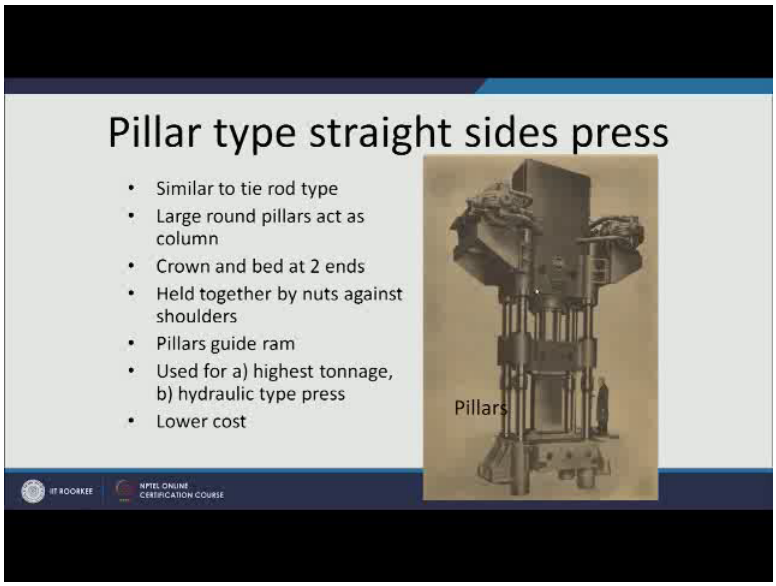

This is one typical straight side press, where the pillars are used. These are the normally, hydraulic hydraulically operated and used for the very high capacity or very high tonnage.

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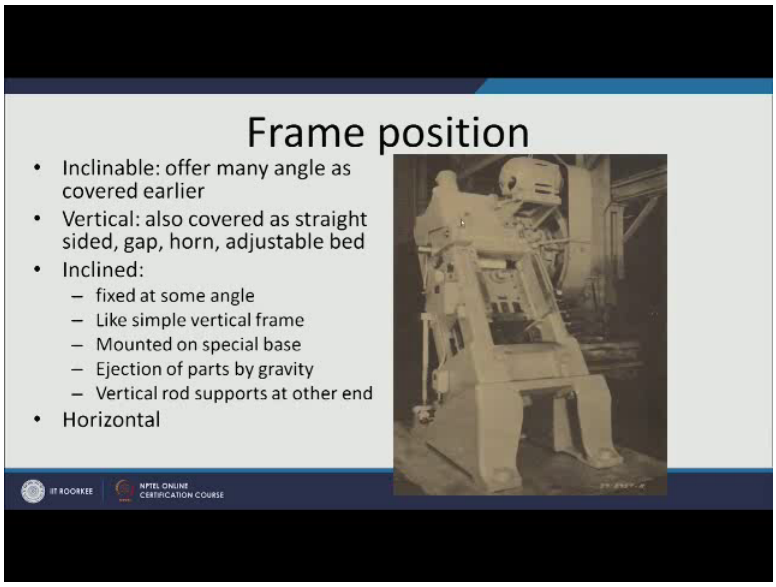

This is the classification based on the frame position. Here this is the like say inclined press, where the frame of the press is inclined and the base of the frame is mounted over the inclined base. So, that the frame is inclined at a particular angle.

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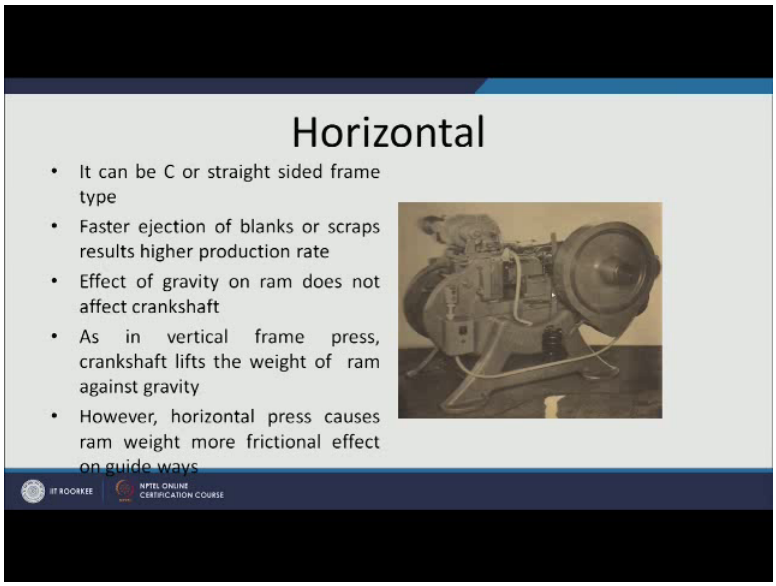

And this is the horizontal press, where the RAM movement is the horizontal and this is about the number of fractions here.

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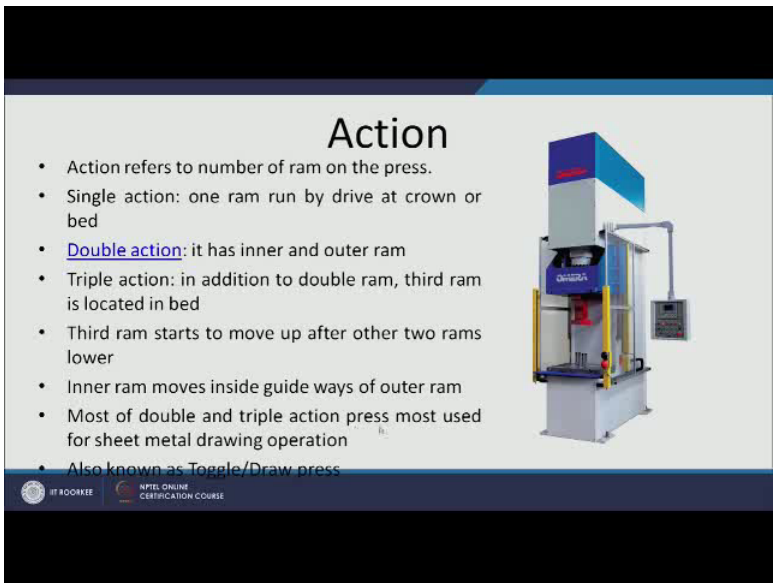

We can see this is the double action, the press, where there is a RAM and then there is a inner RAM.

So, basically, the single RAM, a single action has 1 RAM, double action has the 2 RAMS, one is inner and another outer RAM and in case of the triple action, it is similar to the double RAM, but third RAM also comes from the bottom side, that is located in

the bed. Third RAM is starts moving up, after the first two RAMS are lower down to its lower most position and the inner RAM moves inside the guide ways of the outer RAM, a most suitable for the double RAM and the double and triple action, presses are most suited for the sheet metal drying operations.

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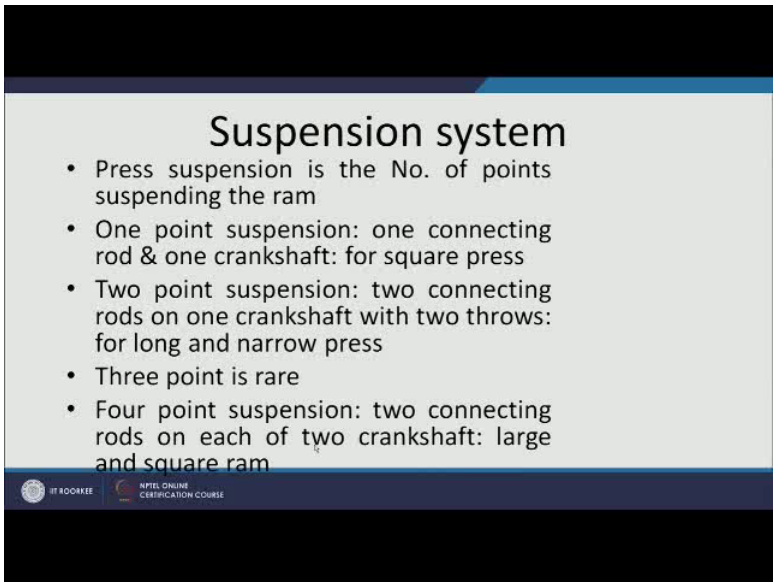

Suspension as I have explained the number of points from which RAM is suspended, there can be single suspend. Single point suspension, two point suspension, and three point suspension, and four point, but three points are very rare, four point suspension are used with the help of the four connecting rods and wherein, these will be mounted on the two crankshaft. So, two connecting rods on each of the crankshaft, these are used for very large and square shape RAM.

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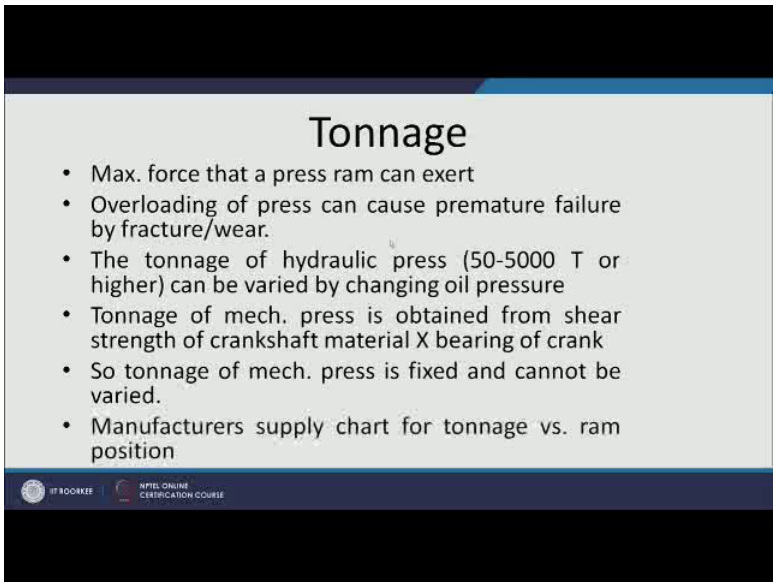

The tonnage about the maximum force that RAM can exact into this, can very significantly from 50 to the 5,000 ton for the hydraulic tonnage, while a hydraulic presses, while it can be, for it can be of the lower tonnage, for the mechanical presses like 5 10 ton presses.

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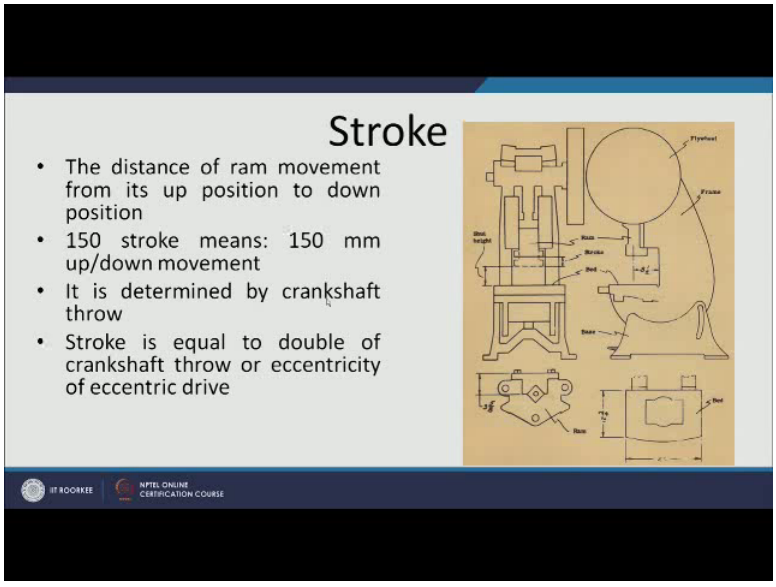

Stroke as I have said, it is about the distance travelled by the RAM from its top position to the down position, the stroke means the 150 mm movement in either up or down movement.

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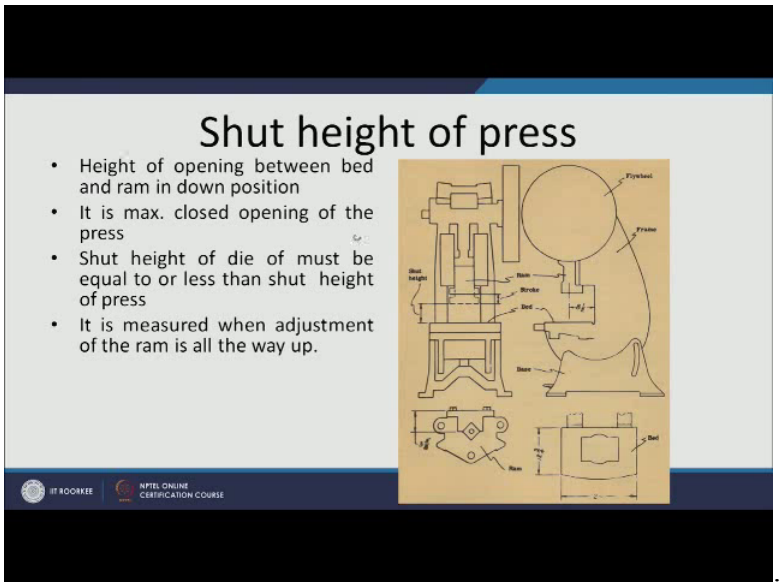

And it is determined by the crank shafts shut, height is about the distance between the RAM, in its lower most position to the bed. So, this height determines the shut height and the shut height of the die must be equal to or less than the shut height of the press. It is the maximum closed opening of the press.

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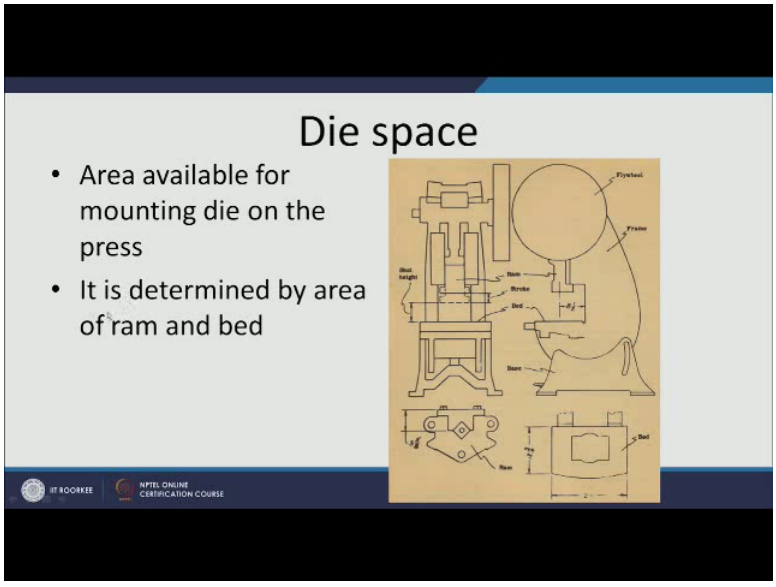

The die space it determines the maximum area available in the press where in the die can be accommodated. So, area available for mounting the die, on the press and it is determined by the area of the RAM, the bed.

Now, here, I will conclude this presentation. In this presentation I have talked about the purpose of the presses and the different technical factors, based on which the presses can be classified, but for better understanding of the presses as well as designing the dies, as per the design of the presses means designing the die, as per the construction or the structure of the presses. If we understand the press in better way then probably the selection of the presses will be better and will be in better position to design a die. So, that it is compatible with the presses.

Thank you for your attention.