Introduction to Machining and Machining Fluids

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Lecture – 02
Introduction and Importance of Machining

Now, I am going to discuss the chapter one-part a, that is introduction to machining.

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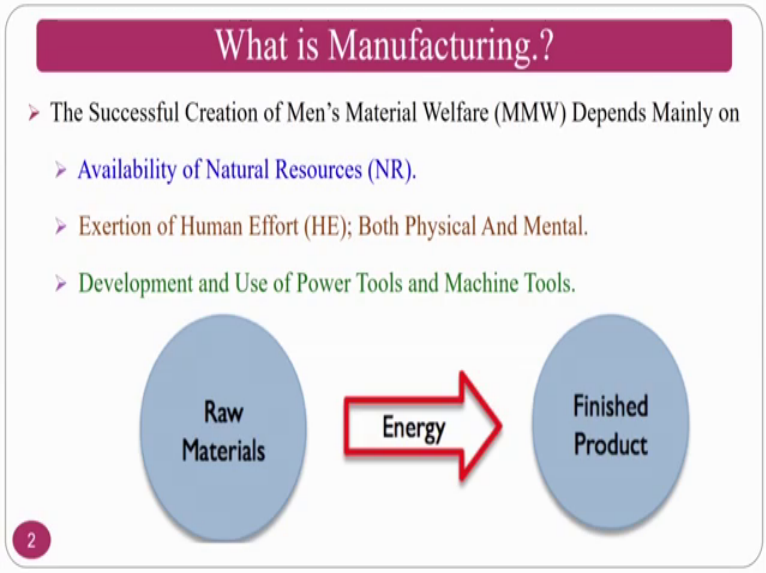

So, the machining comes under manufacturing process. So, first we have to understand what is manufacturing. So, normally the manufacturing process is nothing but, just conversion of raw materials into the finished products. Assume that I want to make a 10 mm rod from a raw material of 15 mm rod, or 12 mm rod just you how to turn it to the required shape. That is called the raw material is 15 mm rod, and the finished product is 10 mm rod.

So, that is the conversion of the raw materials given raw material into a finished products using some energy is nothing but the manufacturing. So, the this is normally the successful creation of mens material welfare depends mainly on availability of natural resources. And exhaustion of human efforts both physical and mental, the development of use of power tools and machine tools. Normally the third point comes under the manufacturing.

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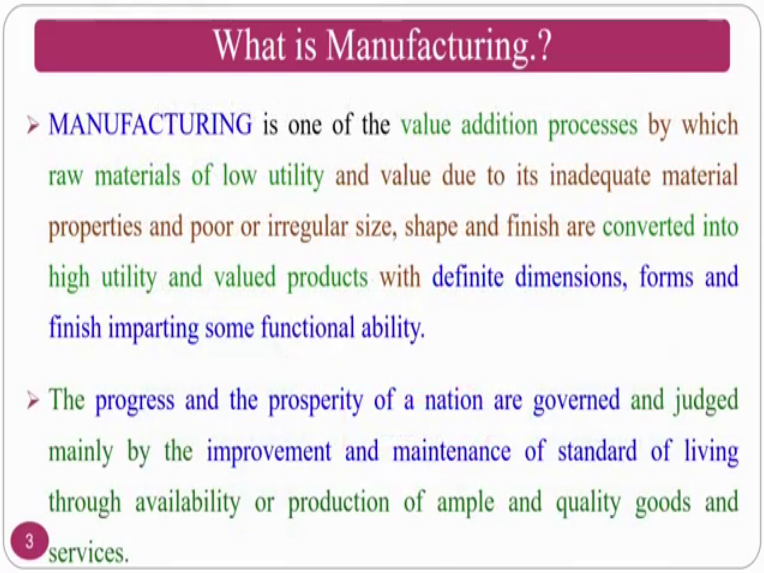

So, though the manufacturing can be defined in many ways, some people manufacturing call it as a production engineering also ok. So, manufacturing and production both are synonyms ok. So, some text books they follow production, some text books they follow manufacturing; however, both are the same. Manufacturing is one of the value addition process by which raw materials of low utility and value due to inadequate material properties and poor, or irregular size shape finish are converted into high utility and valued products with definite dimensions forms and finish imparting some functional ability.

That means, you have a low value material that is called raw material. So, in order to improve in order to convert into the high value-added product, you how to make use of the manufacturing process so that you can change according to your requirement the shape size and the finish requirement that you are doing and all those things. The progress on prosperity of any nation governed by the judge mainly by the improvement and maintenance of standard of living through the availability or production of ample and quality goods services; that means, so, manufacturing is one of the source which improves the GDP of any nation.

So, the living standard of the people ok.

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So, what is manufacturing? The manufacturing converts as I told in the earlier slides you have a raw material, you can see the raw material normally, this is a box site, this is the raw material. So, this raw material converts to the product. So, the box site normally the box site is used as it a ore of aluminum, and you can make the body of the car. So, in that in that way you can do this one. So, another one you can see the gold ore converting into the ornaments. So, you are using the external source of energy, you can convert the ore into the product ok.

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So, various diversity applications whenever you see the manufacturing is a broad spectrum, you can use in the aerospace, you can use in the biomedical, you can use in the construction, you can use in the daily utilities you can see the biomedical, stance are manufactured by advanced machining processes and conventional machining processes and all those things, you can construct the bridges and all those things.

This is how the major classification of manufacturing can be 4, but there are many more things.

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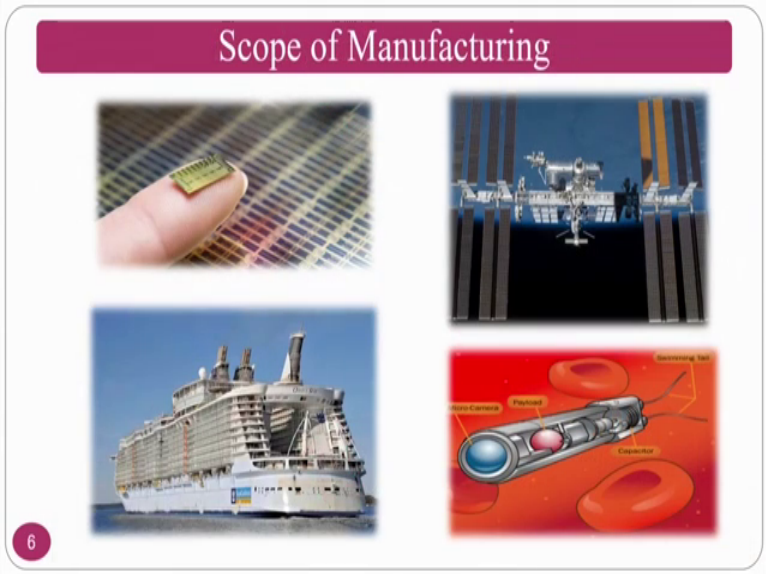

So, scope of manufacturing you can see in the marine industry, in the bio medical industry, aviation industry, and astronomy and silicon fabrication and all those things.

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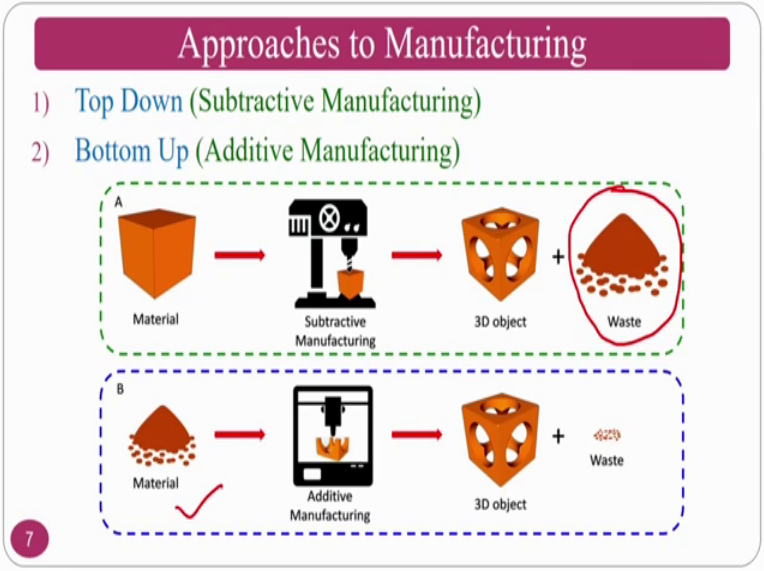

So, there are 2 approaches in the manufacturing. One is top down approach and bottom up approach, as you can see.

So, top down approach; this particular course normally deals with top down approach. That is called subtractive manufacturing, but there are other way of manufacturing, that is call the bottom up approach, that is additive manufacturing. So, if you take a material or raw material and you do the machining process and all those thing, where you remove the material as per your requirement and gives the product. That is called subtractive manufacturing and if you see the if you take the metal powders, and construct using 3-D printing or select 2 lasers centering are powder metal edging and all those things that is called bottom up approach. In the top down approach, you take a bigger material assume as a I already explained you is a assume that I want a 72 mm rod where the raw material 80 mm. So, you do turning it; that means, that you have a big material or raw material, you are just turning it to the required shape and the chips are your waste as you can see here.

In the bottom up approach, you take the normally the metal powders as your input, and you do the 3-D printing or any additive manufacturing now a day's people talk about the 3-D printing. So, for example, 3-D printing you just feed this powder, and it will print it to as per your requirement. So, the waste is slightly minimum compared to subtractive manufacturing. Where I as already told you, the chips are in the turning process is a

waste. And in the subtractive manufacturing this is waste is very high amounts. That is why people are now moving towards bottom up approach where you take the particles and construct the product.

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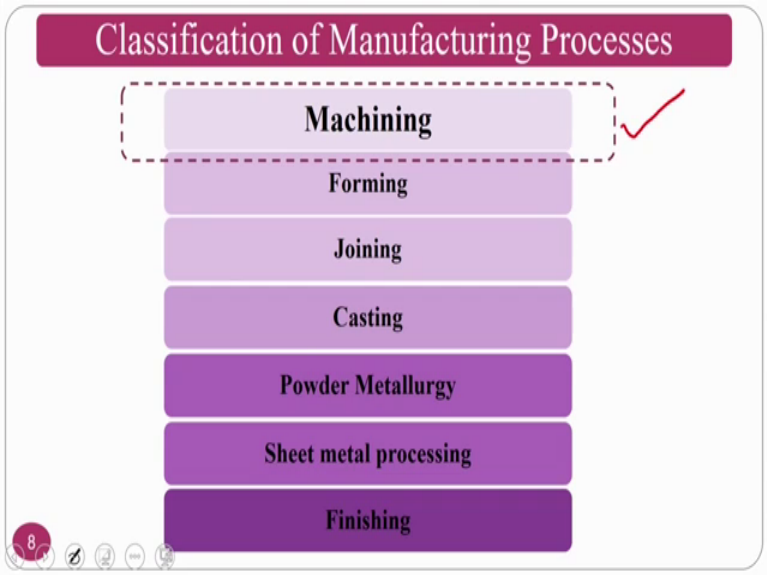

The classification of manufacturing process if you see, there are variety of manufacturing process. The starting with machining process, forming joining casting powder metallurgy, sheet material processing and finishing so many still more are there as the world progresses the new materials are coming to the world. And people are finding new manufacturing processes; however, in this particular course, we completely deal with machining processes only.

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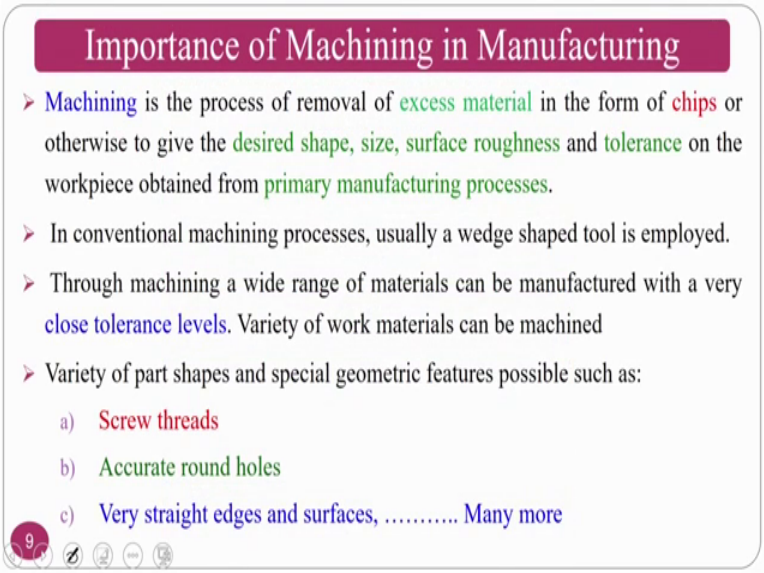

So, importance of machining in the manufacturing. First, we should what is it is importance and what is it is role in the manufacturing arena. Machining process is as I said it is a removal process of excess material. Take in a one block of material to the required shape, you remove the excess material and get the desired shape size, what are the surface roughness requirements, and the tolerances that is specified by the customers and all those things.

So, normally there are 2 types of machining, one is conventional machining, and advanced machining. This particular course deals with conventional machining process where single point cutting tool and multi point cutting tools are used. So, machining deals with wide variety of materials with the close tolerance. Variety of work piece materials if the work piece materials are go on changing the tool material also go on changing.

Because in the conventional machining process, the tool hardness should be much much higher than the work piece hardness, that is why as the world progresses new work piece materials are coming to counter it to machine those new materials, we are continuously researchers are searching for the new cutting tool materials.

The varieties of parts and special geometric features, some of the examples are screw threads, round holes or straight bed surfaces many more are there. The manufacturing is there is no limitation. It is having a huge shape sizes features and all those things ok.

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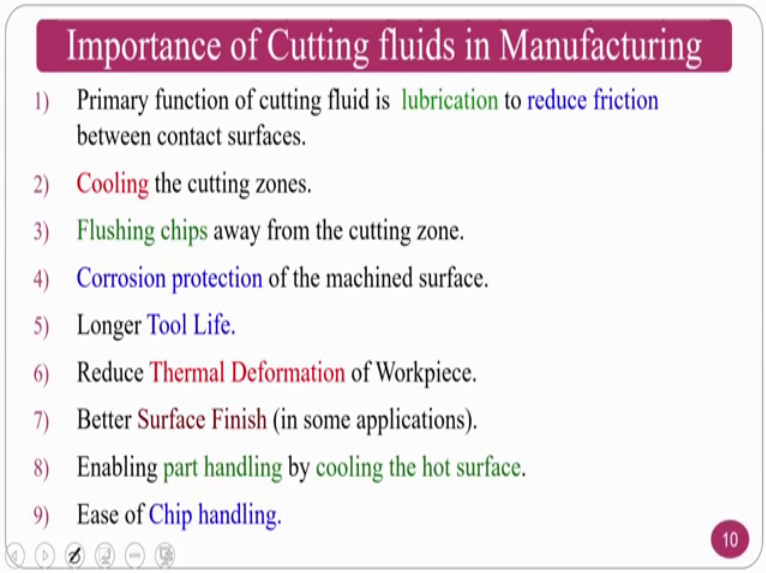

So, the other part of this course, also deal with cutting fluids. Basically, the cutting fluids are used for 2 purposes. One is cooling and lubrication. So, normally this is the basic functions of cutting fluids is lubrication and cooling. Apart from it, if you see in many other applications like drilling, it has to drill through the big holes or small holes. So, flushing the chips is also one of the function. The additives that are using in the cutting fluid, helps in many ways that is corrosion inhibiter used to prevent the corrosion, the lubrication and cooling ability improves the tool life. The thermal deformation of the work piece and it also helps the tool sharpness to maintain the tool sharpness. So, that the better surface can be achieved and many more applications of cutting fluids are there.

If you see, the second part or one of the major parts of this course also deals with cutting fluids in manufacturing. So, whenever you are say, you may understand or you may get the question that the why cutting fluids are getting that much importance in this course.

So, we are studying machining as well as the machining fluids that is cutting fluids. So, that at the end of this course, what will be the best feasible solution for the sustainable machining processes. So, we study the machining as well as machining fluids, then we find the common solutions for the better ment of the humans, or the operators or the engineers who are working on the shop floors so that we can give the environmental friendly or sustainable manufacturing process. So, if you see the cutting fluids the basic functions of the cutting fluids is cooling and lubrication ok.

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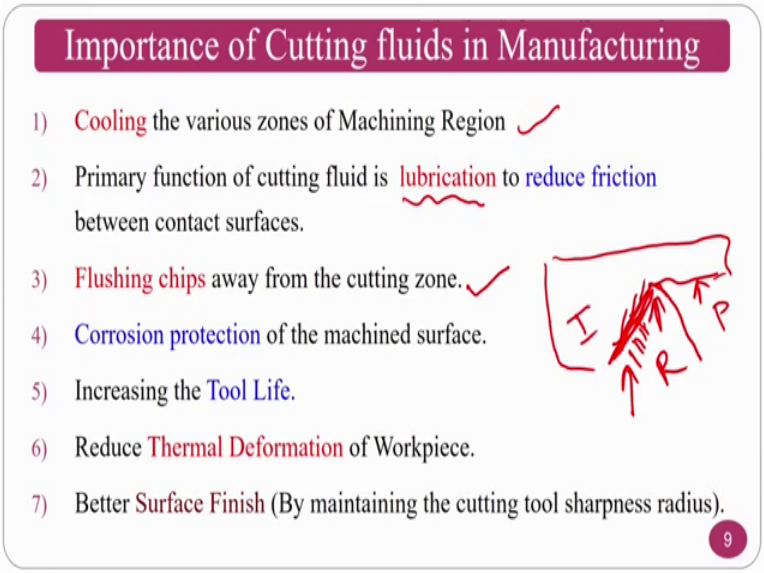

So, if you see the main function of the cutting fluids is cooling as well as lubrication.

So, normally cooling is important, whenever the temperature generation in the machine is very high, that is called one of the examples is high speed machining. So, normally the lubrication is most important in terms of hard machining applications where friction is dominating compared to the temperature.

Apart from it the other functions are flushing away chips. This is referring to basically the drilling process or reaming process which we study in the upcoming slides about their introduction. So, whenever you do the drilling operation normally. So, the the chips will be there along with the drill beads.

So, you have to flush it out. So, the cutting fluids also helps in flushing away chips. It will have lot of additives like a corrosion inhibitors or corrosion preventers; which will help the work piece to not corrode after becoming a product. At the same time the cutting fluid reduces the temperature the machining zone. So, that the tool life will goes up by maintaining it is hardness.

So, it also reduces the thermal deformation of the work piece if there is a temperature is very high what will happen. There is or there may be a chance of, work piece enlarge in micro or nano size so that the, tolerances may go beyond what the operator expects.

The better surface finish. So, the better surface finish is when you will achieve if the my sharpness radius is maintained properly. There is a slight difference between nose radius as well as sharpness radius. The nose radius as so, if you see a cutting tool normally it will be like this. So, this is called nose radius ok. So, it will.

So, the sharpness radius is nothing but if you think this is one of the primary cutting zone. The it will have one rake surface this is the rake surface, another one is flank surface. This will have a flank surface. The angle made by this cutting edge with respect to the rake, as well as a flank surface is nothing but the sharpness radius of that particular cutting edge.

So, if the cutting fluid continuously fall on this one, what will happen? The hardness will remain maintain, at the same time the proper cutting will takes place. So, that the surface finish that you achieve on the final product will be better this is the final product, and this is initial work piece ok.

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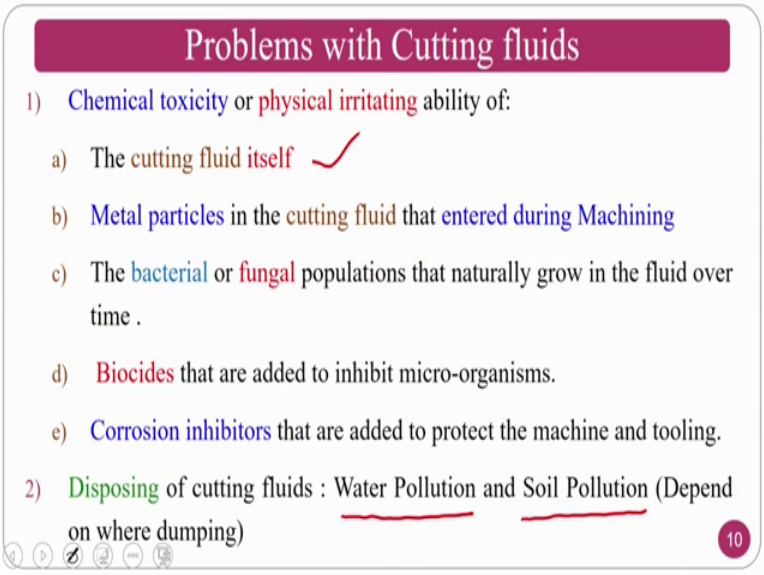

But there is big problem with the use of cutting fluids. Basically, the cutting fluids are made with the petroleum fluids. Commonly these petroleum fluids are carbon based. So, it will emit lot of emissions. At the same time metal particles whenever you are machining predominantly brittle materials, where the particles are entered in the cutting fluids. So, this also causes lot of problem. And if you if you see many of the workshops.

Basically, this cutting fluids is recirculated again and again. Whenever you make the cutting fluids, basically it will be a mineral oil to impart the cooling nature, what will happen they add water; water is a better cooling property fluid. And the mineral oil is a good lubricant. So, in order to have the better cooling and lubrication property you will mix it. Whenever you mix it basically if you see in the workshop it will be like a milky colour.

So, if you recycle it and again and again. The basic problem is the chemical cracking takes place at the same time the metal particles also embed, and what are the other foreign elements also embed and it will drastically changes from milky white colour to light brownish brownies, and then slightly blackish. So, it will have it is own emissions as well as many problems.

So, this is the one of the problems with the cutting fluids itself ok. So, bacterial see if you are using for a long period of time recycling again and again what will happen? If you do not use proper biocides then what will happen? The bacterial and fungal population increases in the cutting fluid.

So, this biocides are properly used, but if you use the biocides so, basically if you do not use the biocides, the bacterial and fungal formation many other living organisms will grow on the top of it. If you use the biocide, the biocides also have it is own chemical impact, it will also emits lot of a harmful gases, whenever the cutting fluid falls in the machining region where the temperature is very high.

So, corrosion inhibitors normally we are using the corrosion inhibitors for protecting the work piece from the corrosion. But it also have it is negative impacts from the points of emissions. This is about while using the cutting fluid. If you are recycling again and again, what at last whenever you want to discard this cutting fluid.

So, disposing is also a major problem. If you see there are 2 ways, or many ways are there, but that predominantly there are 2 ways how the workshop will workshop people will discard one is discarding into the water bodies nearby or just they dig the holes or wells in the premises of the companies and they just dispose it inside.

So, if you are discarding into the rivers or the water bodies, it leads to the water pollution. If you are digging a holes or if you digging a well on the corner of the

companies some wasteland whatever the land that they have, if you do what will happen this leads to soil pollution water pollution.

So, it may contaminate the water, it also leads to lot of dangerous things of the living organisms that there in the water bodies.

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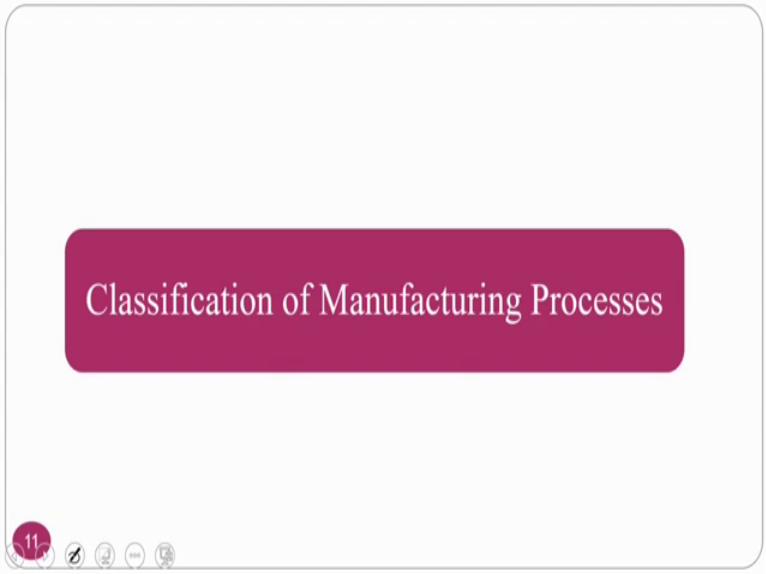

So, this is about the machining as well as the machining fluids coming to the classification of manufacturing processes.

So, we are studying about the machining; however, there are some other processes also that we have to look at.

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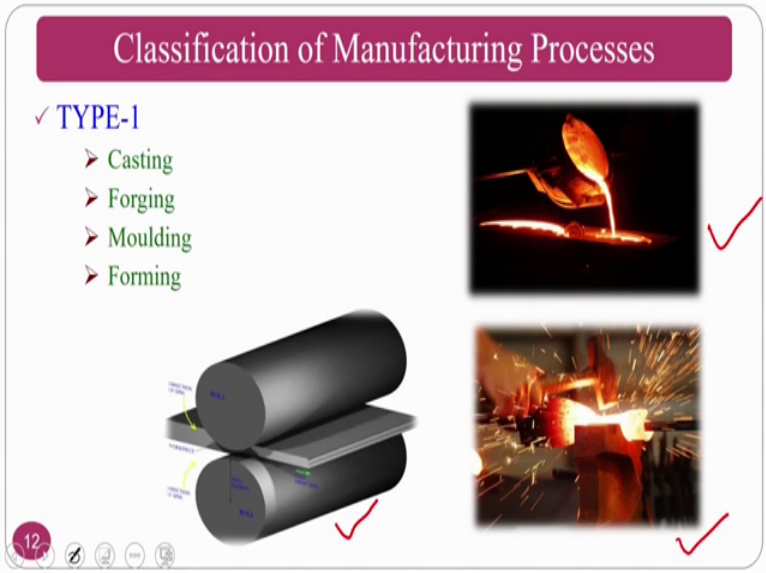

There are different types. If you see, type one or primarily you can say this are casting forging moulding and forming. This are the one category of manufacturing processes. You can see this is the metal forming process, this is the casting process, and this is also the metal forming process.

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So, type 2, which we normally deal in this course is machining and finishing. So, we deal introduction to machining as well as introduction to conventional finishing processes also. So, you can see the machining operation here at the same time you can see the

grinding operation here. So, grinding comes under the conventional finishing process. So, this is what we study in elaborative way in from the point of the introduction to these processes in this course.

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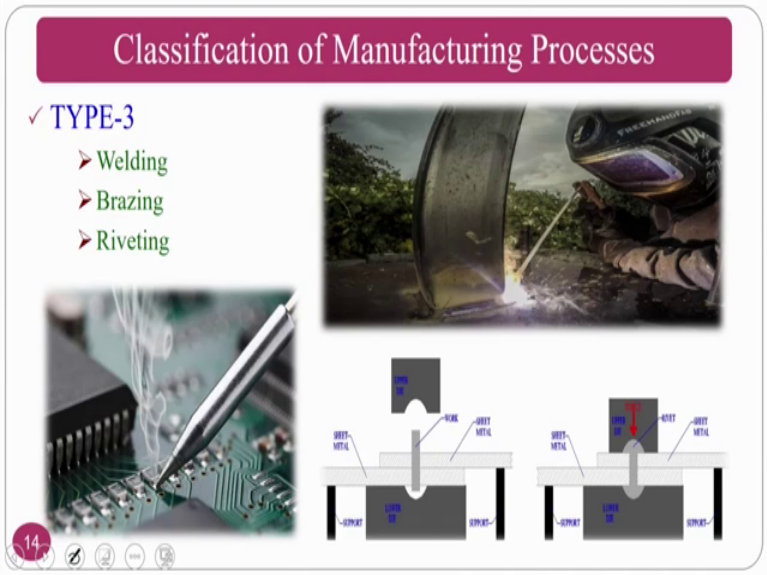

Apart from this you have, we also have the type 3 that is welding, brazing and riveting processes. These are the some of the joining types of the manufacturing processes.

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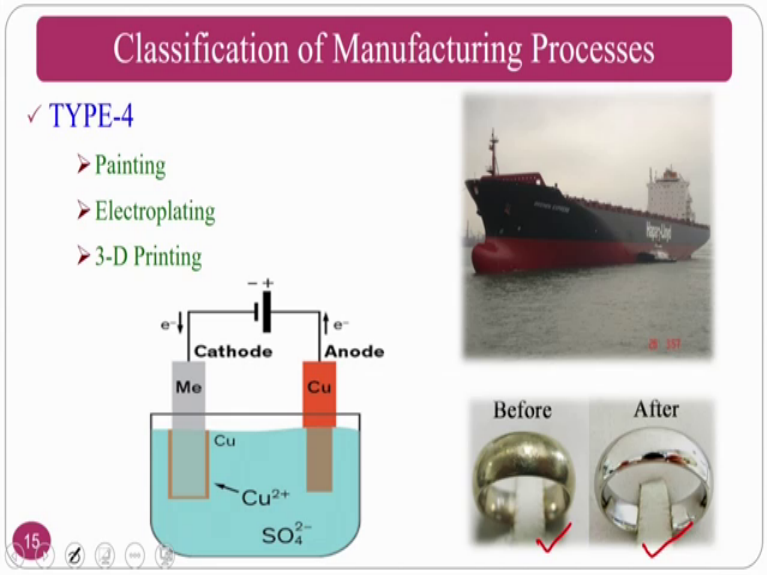

So, type 4, we have another one that is called the painting, electroplating or additive manufacturing like a 3-D printing, now a days these are picking up ok. If you see the

ships normally anti fall coatings are done on the ship surfaces. At the other same, the other thing that you can see is electroplating normally electroplating can be done in mini products. So, for example, if you see this application before and after the some of the coating processes.

3-D printing as I already said, 3-D printing is coming up in a great way where it is a bottom up approach where u assemble or deposit, atom by atom or molecule by molecule or material, you just do the layer by layer materials ok.

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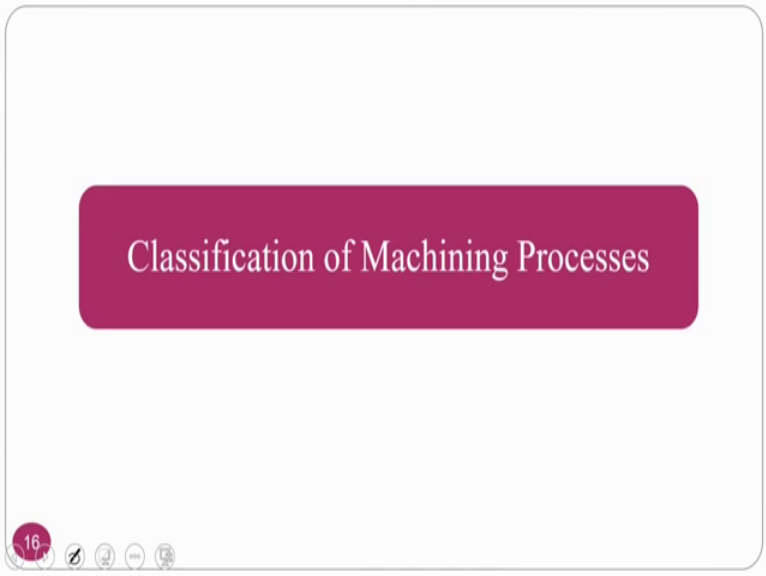

So, this is about the manufacturing; however, we deal with machining. Particularly machining and finishing processes. In this one we are going to see what are the classification of machining, how do we do.

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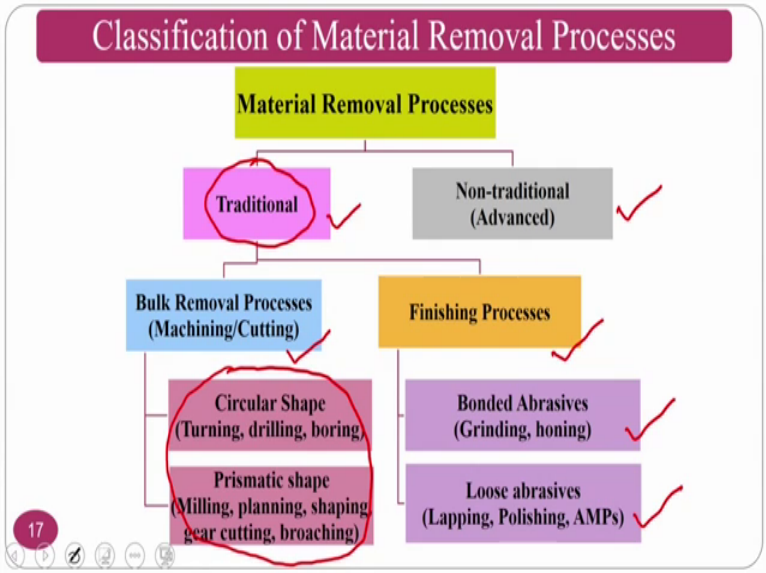

Machining is a material removal process basically.

So, there are 2 major varieties. One is a traditional as well as non-traditional that is called advanced machining processes. This particular course we deal with only traditional. So, we deal with only traditional machining process in the traditional machining processes, we have bulk removal processes, and finishing processes.

That means in the bulk or the machining processes or the cutting process your main aim is material removal. So, how much material I am removing is what is the concern here in a finishing process normally, you are main aim is what is the surface finish that I have achieved.

Here your material removal may not be a criteria, but the final product of required quality specified by the customer is majorly important in the finishing processes. the turning, drilling, boring or milling planning, gear cutting broaching, these are all the processes are mainly comes in the bulk removal. Grinding is also now a days considered to be the bulk removal only because after coming the advanced machining processes. This also considered to be the bulk; however, as per the conventional machining is concerned still we take it as a finishing process.

Lapping polishing or that is nothing but, super polishing, and some of the advanced machining processes or advanced finishing process like abrasive flow finishing, magneto

rheological finishing, these are all comes under the loose abrasive particles based finishing process.

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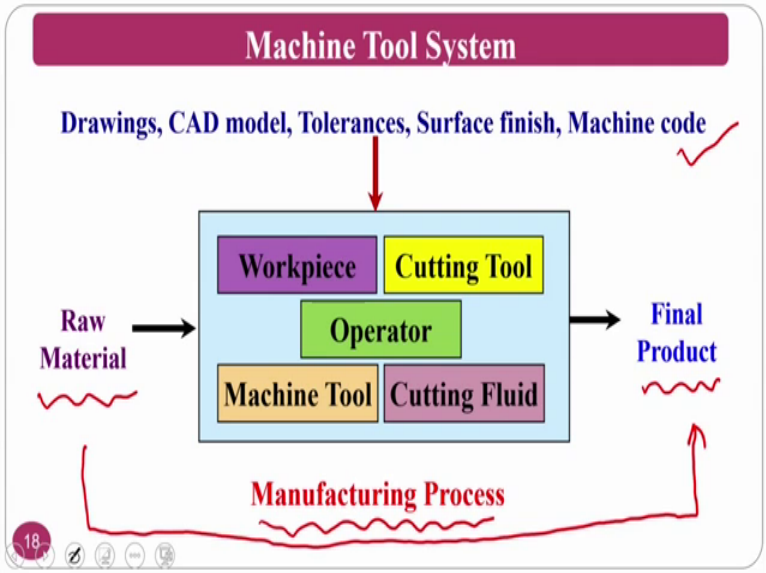

So, the machine tool system, what is a machine tool system? That you can see is how the machining tool normally a customer specifying the product.

So, they may give the drawings cad model, and they also specify the tolerances, surface finish that required and all those things.

Even some people they may also give the machine codes ok. So, these are all or the one of the inputs, and based on their requirements the manufacturing engineer make contact the materials person or if it is in the purview of him, he may choose the raw material suitable raw material and you will process.

So, work piece cutting tool material operator machine tool and cutting fluids, these are all comes under a system, which is called as a manufacturing process to give the final product. So, raw material is fed from here. And this will go through a manufacturing process, and we get the final product as per the requirement given by the customer ok.

This is about the system. This completely starts from raw material to the manufacturing process to the final product this is a called as a one system.

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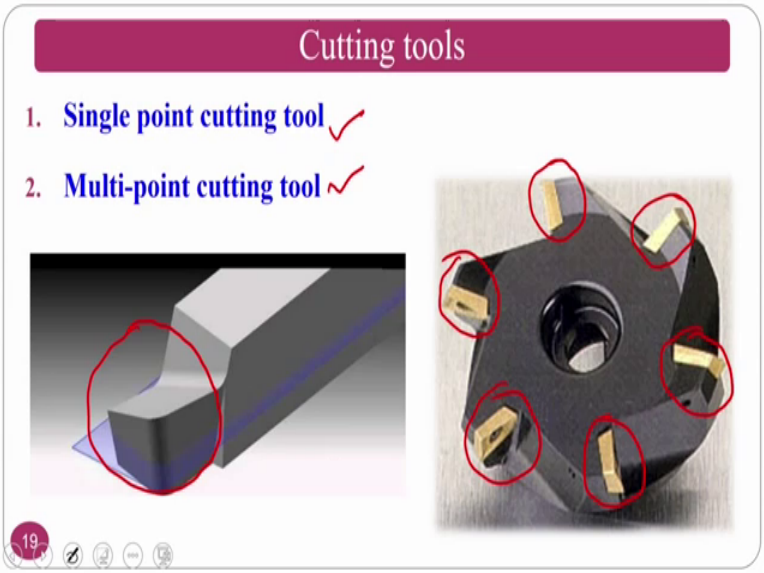

So, in the cutting tools basically we study about 2 varieties of cutting tools. One is single point cutting tool, and multipoint cutting tool. This is simply you can see. This is a single point cutting tool. Normally lathe machine turning operation and all those things operates on single point cutting tool.

Where only one point is there in a multipoint cutting tool, you can see there are more than one cutting tool points are there. So, this is a multi-point cutting tool, where we have more cutting tool ok.

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Coming to single point cutting tool-based machining processes, there are variety of the processes; however, limit we limit to ourselves to some of the basic processes. Many people when I am teaching the course to some of the B-tech people it is one of the basic courses. So, people whenever I asked commonly before starting of the course itself, what is the difference between a machine tool and a cutting tool, people with a mechanical basic mechanical knowledge or without the mechanical knowledge, they thinks are they thing that both maybe similar, or they say machine tool is nothing but a cutting tool. There is some conceptual errors are there among the students.

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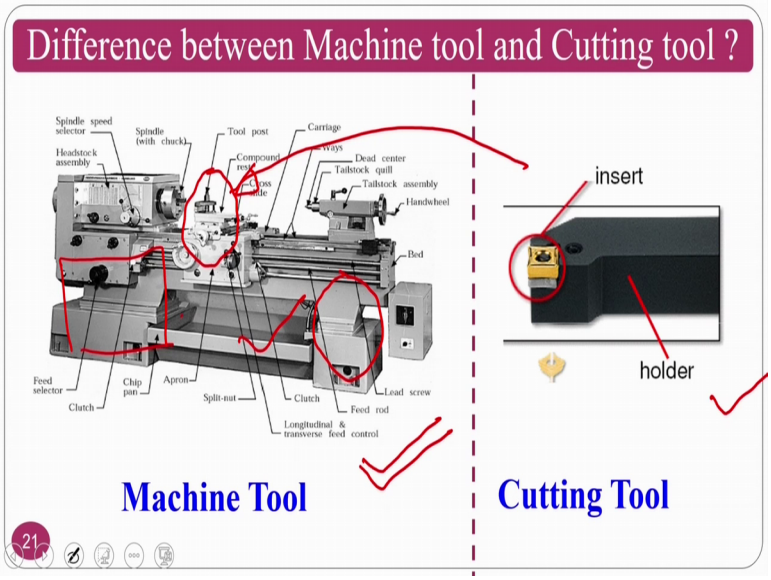

So, I want to clarify what is the difference between a machine tool and cutting tool? The cutting tool is a subset of a machine tool. Machine tool is nothing but complete machine. This is the overview of a lathe, if you see. This is overview of the lathe machine where this complete machine is called as a machine tool. And on the tool post, you mount a cutting tool; this is nothing but cutting tool.

That is why cutting tool is subset of the machine tool. This is a part of machine tool ok. So, that is the difference. Normally machine tool is made up of cast iron because vibration damping effects and all those things this is where the carbon percentage is high in the cast iron. So, the carbon also in the form of graphite it will use the damping effect. That is why basically complete lathe, if you see this particular portion, or this particular portion lathe bed and other things, completely made up of the cast iron.

However, if you see the tool normally made up of much harder material compare to work piece material. That is why these all are made up of h s s carbon diamond so on.

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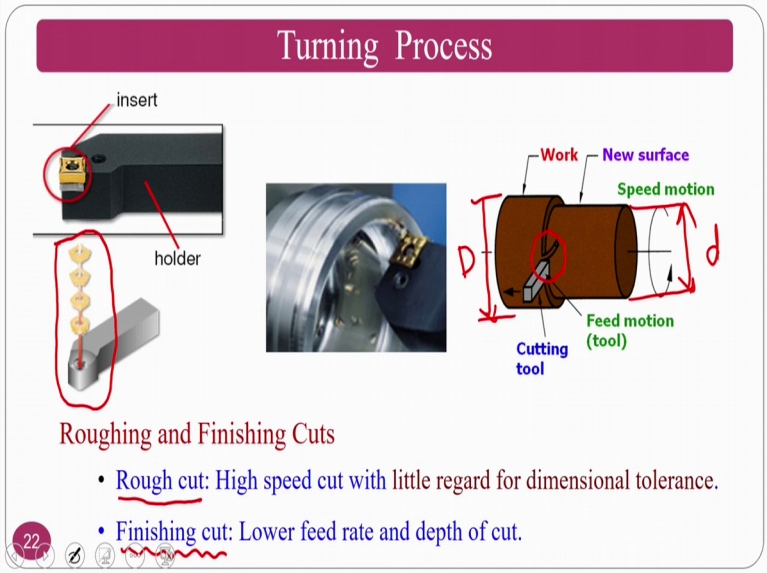

The basically the common physics whenever we see a single point cutting tool, the first process that we come across is turning process. This is how you fix the insert. There are many other ways also to fix the cutting tool. So, this the one of the way, and you do the machining operation.

The normally in the turning operation, it is a subtractive machining process, where you remove the material. This is what the initial diameter is of your work piece, and this is your final diameter. So, machining from capital D to small d that; that means, is mine turning process ok, you are removing the material, you can see the chip of the work piece is removed by the cutting tool.

So, this is a subtractive process where the chips are remaining as a waste. So, there are 2 cuts, if at all I want to remove the material in a bulk that is called rough cut process. And if I want the surface finish, better surface finish on the work piece, normally you can go for finish cut. So, in the finish cut basically you will give low feed low depth of cut so that the material removal will be very less or less, and the surface finish that is achieved during the process is better.

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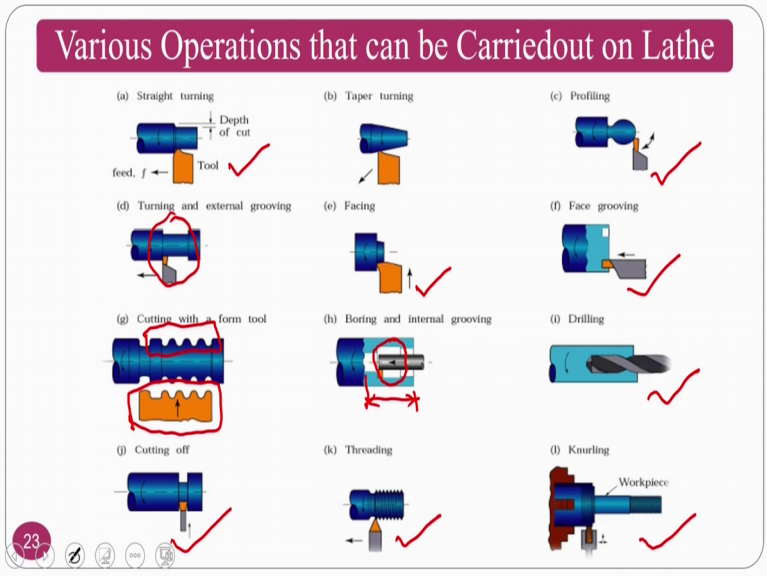

Various other operations also can be performed on the lathe process. One is straight turning, as you have seen in the previous slide that is called straight turning where from capital D to small d, that you have achieved that is called turning process. Taper turning, taper turning is nothing but you will instead of straight turning, we can also use the taper turning operation. So, that for some of the applications where your straight turning is not required. You can you use the taper turning process. Depend on your application.

Profiling, you can generate the profile with the single point cutting tool; the required profiles. The 4th one is external grooving. If at all I want a certain groove at certain location of the rod, you can generate the particular groove. So, that is called turning and external grooving.

The facing is one of the common processes that you perform as soon as you start the lathe operation. That is called the facing. You just remove the waste material or uneven material on the surface. Like a facing you can also do the face grooving, similarly you can generate the groove. So farm cutting with a farm tool, you can generate the converse of the surface. You can see this is the one of the tool, which generates the converse shape ok. So, this is called cutting tool with a forming boring and internal grooving.

So, boring is nothing but enlarging of the existing hole. At the same time you can do the internally grooving also. This is up to if at all I want to generate the boring normally this is done up to boring process previously, and here they are generating the groove.

So, internal groove also generating. So, the other process that you can also perform the drilling operation on the lathe where we can hold the work piece, and you can hold the a work piece in the head stock and tail stock you can hold the drill. Then you can give the rotary motion to the work piece, and you feed with the tail stock so, that you can do the drilling operation.

Cutting off after the performing the machining process, if I want to cut off the product and separate. You can do the cut off operation. Threading; threading is another important process where you generate the different types of threading. The commonly v, v type of threads that is generated here in this picture, knurling; knurling is the process that is embossing of diamond cone pattern. Not only diamond cone pattern many other patterns you can generate on the work piece so that proper gripping and all those things will be here ok.

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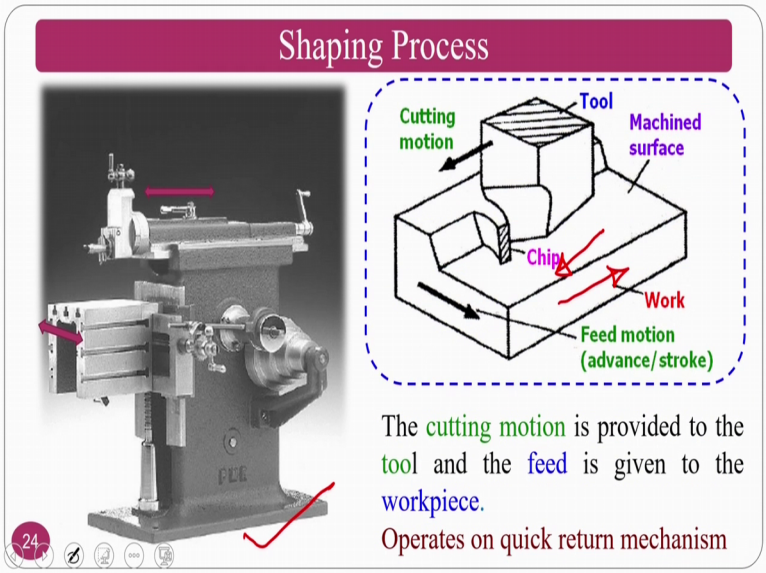

Other single point cutting tool process is shaping process. Where the cutting motion is given to the cutting tool and the feed motion is given to the work piece. This is the shaping process; where it will run on the quick return mechanism, because when during the forward stroke the machining takes place and during the return stroke there is no machining. So, that is why it will come quickly to it is original home position, that is why it is called quick return mechanism.

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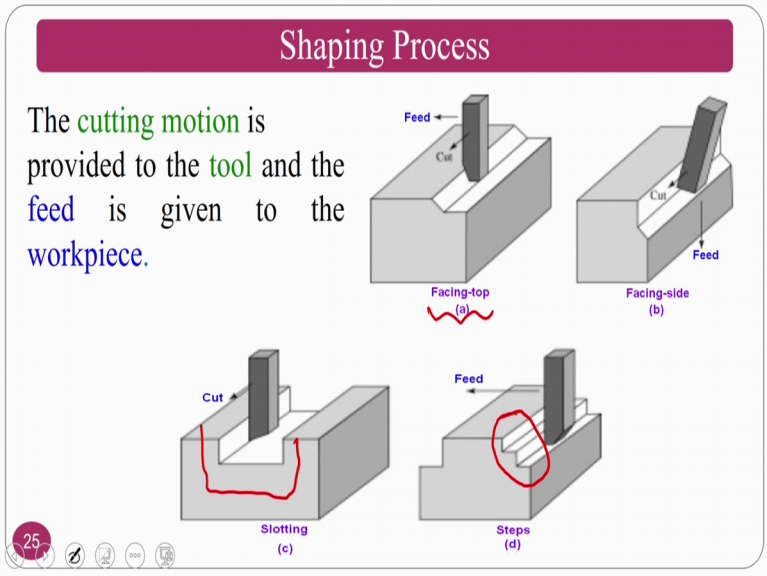

Different types of cutting, that you can perform on the shaping is facing on the top. You can see you can do the facing on the top facing on the side at the same time, you can cut a slot normally this slotting, you can use for the fixtures manufacturing, you can cut a slot like this. And you can do the steps. Some for some of the guide ways and all those applications, you can do the steps also.

So, this are the some of the application that the shaping process can do.

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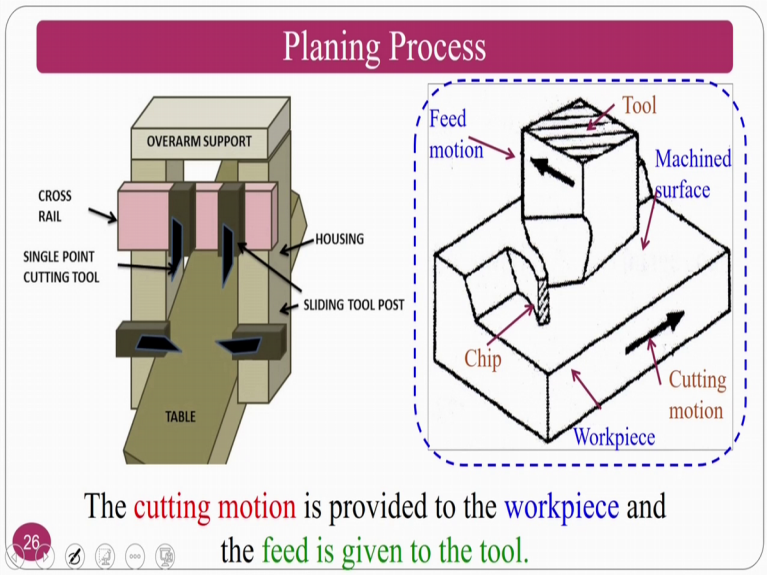

Other single point cutting tool process similar to shaping is planning; however, here the difference between shaping and planning is here, the feed motion is given to the cutting tool and the work piece is given the cutting motion. That is the only difference. But shaping normally applicable or it is applied for the small type of work pieces.

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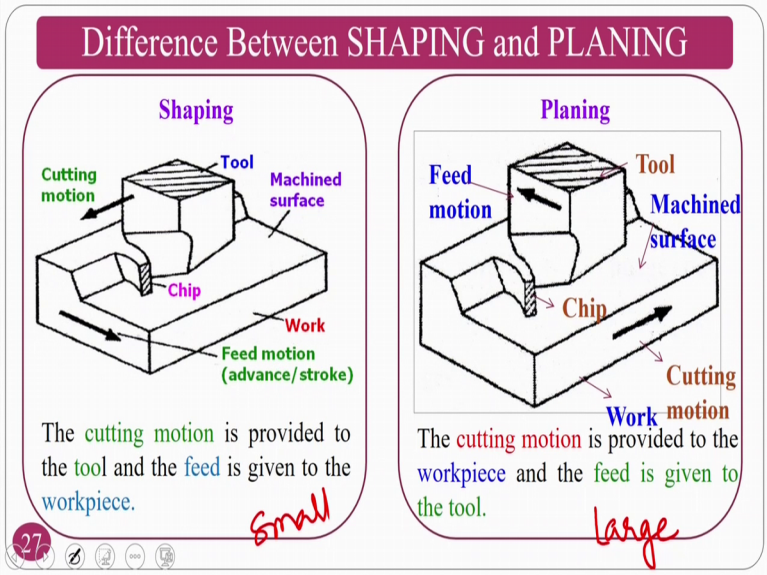

However, the planning is for the large work pieces; that is, the difference here is is clearly shown that is the shaping and planning.

Shaping cutting motion is given to the tool and feed motion is given to the work piece. Here the cutting motion is given to the work piece and feed motion is given to the tool. At the same time here, large work pieces are machine. Here the small work pieces are done. So, that is another application of this 2 processes.

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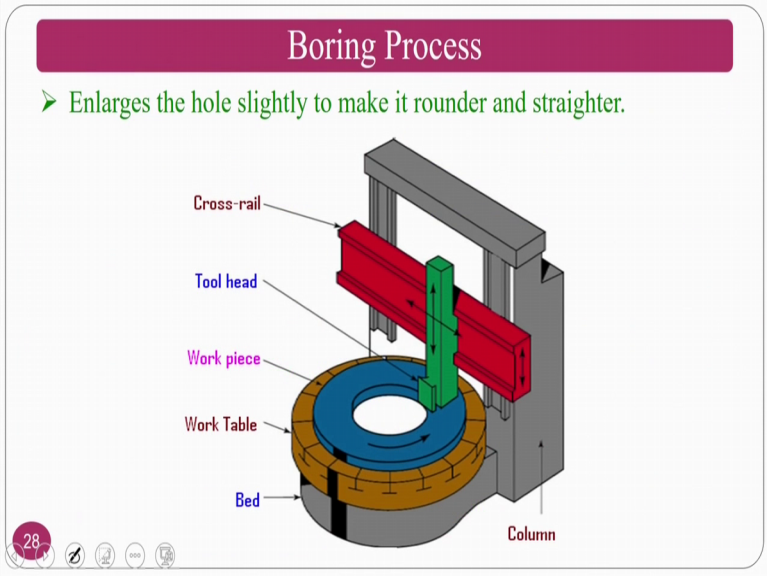

Another process which we have already seen in the overview of lathe processes; that is, called boring process, normally boring process is nothing but the enlarging of the holes. If there is a existing hole, we can enlarge the existing hole that is called the boring process. You can see the overview of the boring process is here; where it is enlarging the existing hole as per the requirement of the given drawing or the customer.

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We will now go to the introduction to the overview to the multi point cutting process. The first multi-point cutting tool is process is drilling process.

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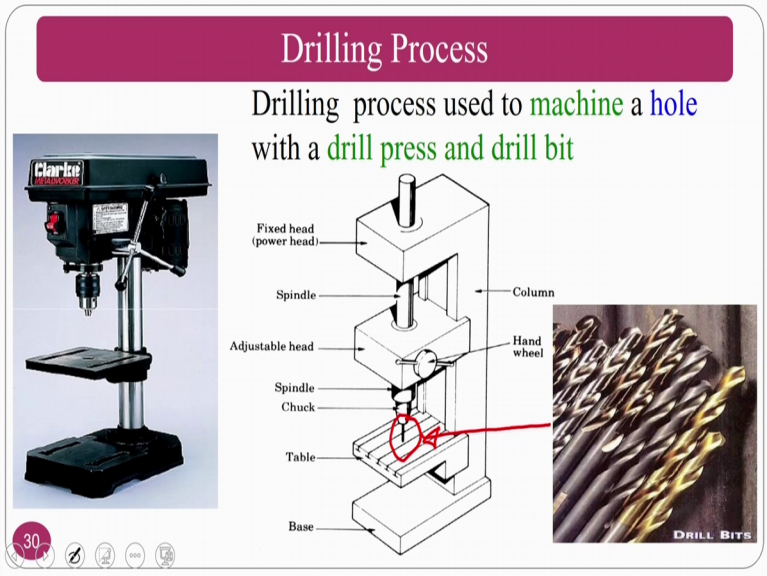

Drilling process is used to machine a hole with a drill press and drill bit. So, drill press is nothing but complete system of the machine is nothing but the drill press, and the drill bit is particularly this portion you can see. This is the drill bit where you are using the use as a cutting tool.

Normally drill bits will have even number of flutes. If it is not customaries or something if it normally these are even flutes when you if you see the commonly you will have 2 flutes. So, that there is no vibration on the other side and all those things. So, so that the chips evacuate uniformly from the both flutes; flutes are nothing but the grooves that are generate that are there on that drill bit.

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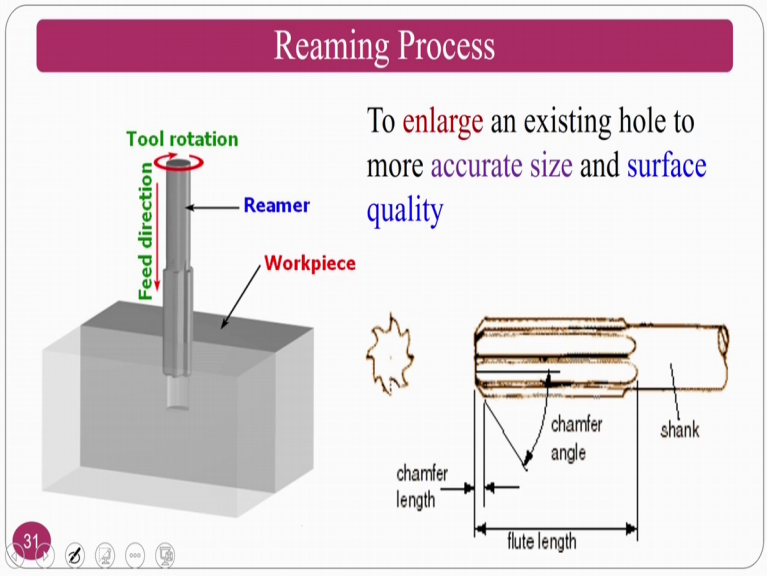

So, reaming process, reaming process is to enlarge the existing hold more accurate size and surface quality. Assume that I want to generate a 10 mm hole, in that circumstances, normally we first drill a hole, and then you do the reaming process as per the requirement. That is called that is how the complete hole is done.

If you do not use the reaming process, the small small buds will be there in the machining or the in the drill holes. That is why you need to go for the reaming process.

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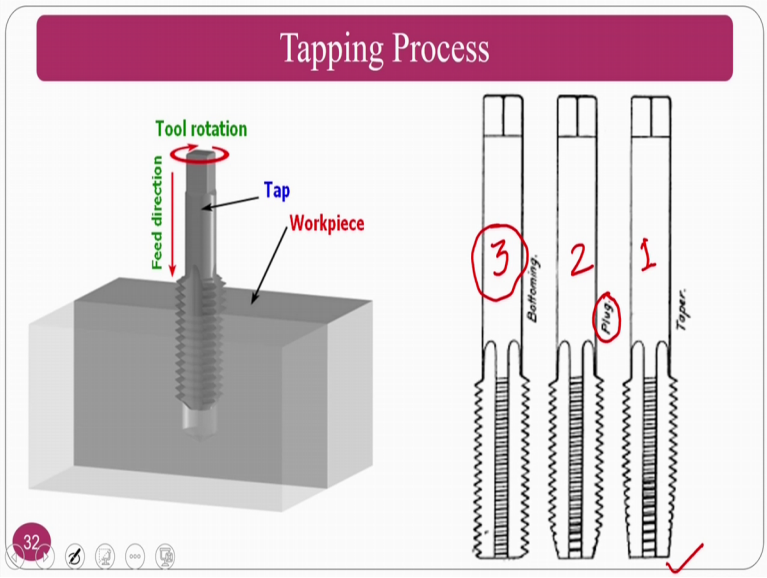

The other process is tapping process. The tapping is normally used for generating the external as well as a internal threads, this is nothing but the tap. So, if you see on the small small workshops or sometimes in the construction sites. The people will be using rotating by putting on a rod or something on a block if they want to do generate the internal threads, just they put the tap and they just rotates on it if at, all I want to generate or somebody want to generate the threads on a pipe. They will do the external threads. So, just they will put it and they will rotate with the hands.

So, this might be commonly you can see on the construction site or the workshops ok. So, tapping process as such you cannot go directly and do direct tap. So, that is nothing but first if I want to generate m 10 thread or something first you have to go for that taper type of tap. You have to fit this one and you have to rotate by keeping this is 1, this is 2 and this is number 3 ok.

So, first you will go and put number 1 and you just rotate by giving the feed motion to this tap. So, it will partially generate the threading. Then you go with the plug one. So, that it will slightly improves, then you go for bottoming up.

So, that you can perfectly get the threads ok. So, this is sequentially you have to do. So, normally if at all I want and I cannot go directly and do it. You can do it, but the thing is that you may face some difficulties like it may break because of many many things. So, this is a preferential order; where you can go for one first second, then third so that, you can get a better internal threads.

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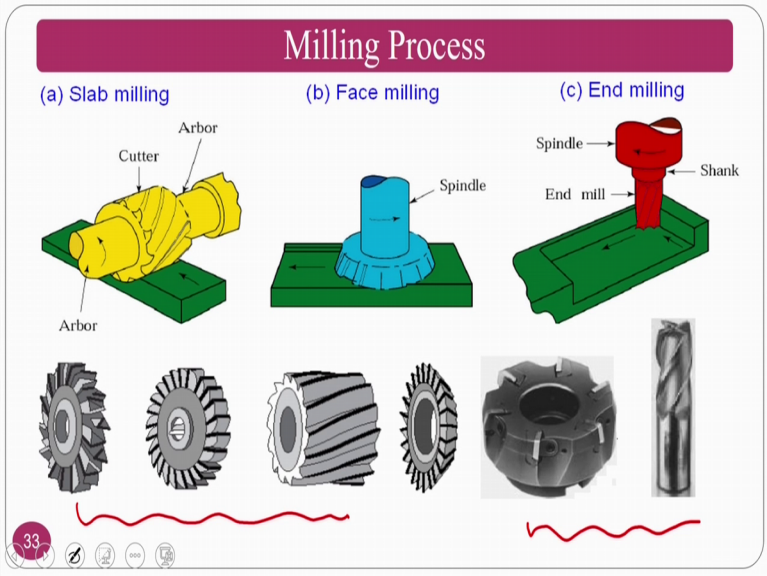

The other process of multi point cutting tool is one of the famous processes or highly used in the workshop is milling process. There are varieties of milling where you can see the slab milling face milling and end milling. So, the other way classification is this are the various cutters, for the horizontal and there are various cutters for the vertical milling cutter.

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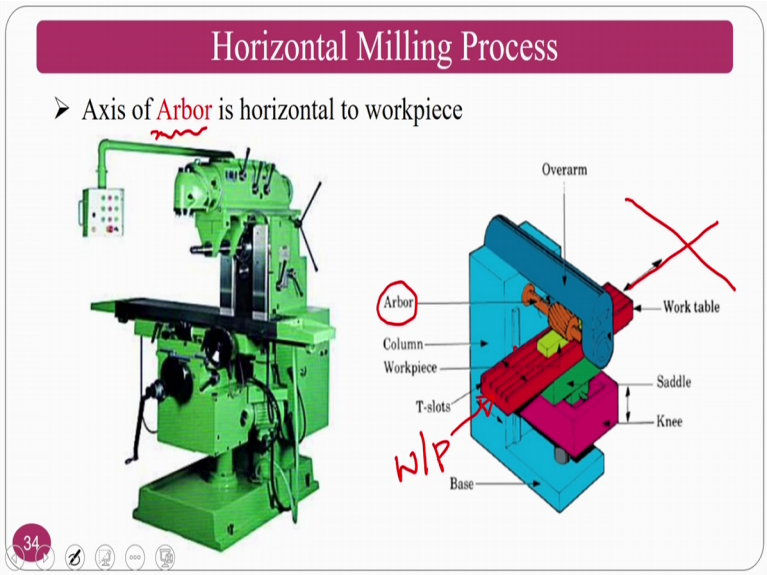

You can see the horizontal milling process; where the arbour, arbour is you can see here the arbour axis is horizontal to the work piece; that means, if this is my work piece. And

this is my arbour this is my arbour, you can see here. This is the axis and this is also axis ok.

So, both are parallel to each other. Whenever the arbour axis. Arbour is nothing but where the tool is mounted. So, if this both are parallel. So, that means, that it is horizontal.

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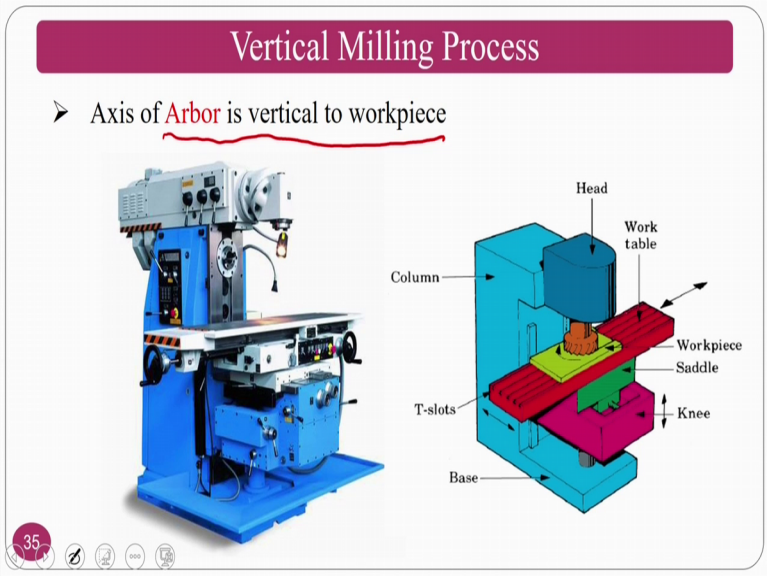

If it is perpendicular what see as arbour is vertical to the work piece; that means, that it is vertical. So, that is a difference slight difference between horizontal milling and vertical milling.

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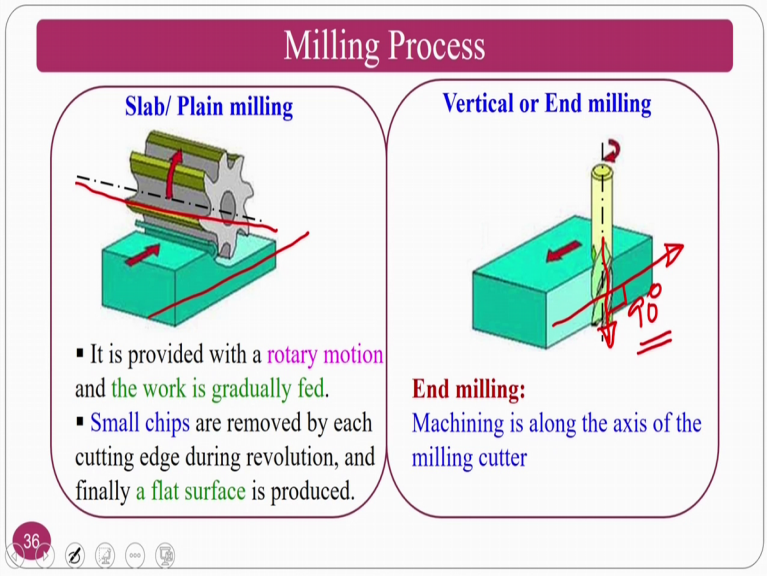

You can see here arbour axis this is arbour axis, and the work piece both are parallel. Here both are perpendicular, this is one axis and another one is this axis ok.

So, this are at 90 degrees ok; that means, that this are this is called vertical, this is called plane or horizontal milling process.

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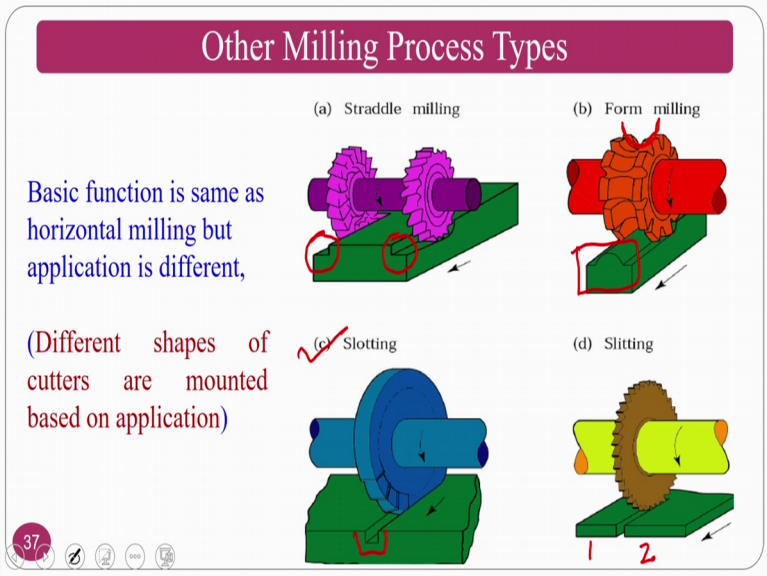

The other milling operations goes straddle milling; where you can generate the steps in one go multiple steps a single pass. And another one is form milling. If I have a to generate if I want to generate certain form, I can make a tool converse of it assume that I

want to generate this type of thing. What I want to generate is on the tools I have to generate the converse form so that I can do the milling operation and I can take the I can generate the required from on the work piece. Slotting another variety is slotting. Slotting is nothing but if I want to make a slot or to put the key way. Normally whenever you want to assemble a gear system or something you need to put a key way. For that I have to generate a slot. You can see here a slot is generated.

Another one is slitting; slitting is nothing but the parting up. If I want to make a 2 pieces out of one big thing, you can see this is one and this is 2. So, you can do the slitting operation. Normally the slitting cutters are very thin so, that the wastage will be minimum.

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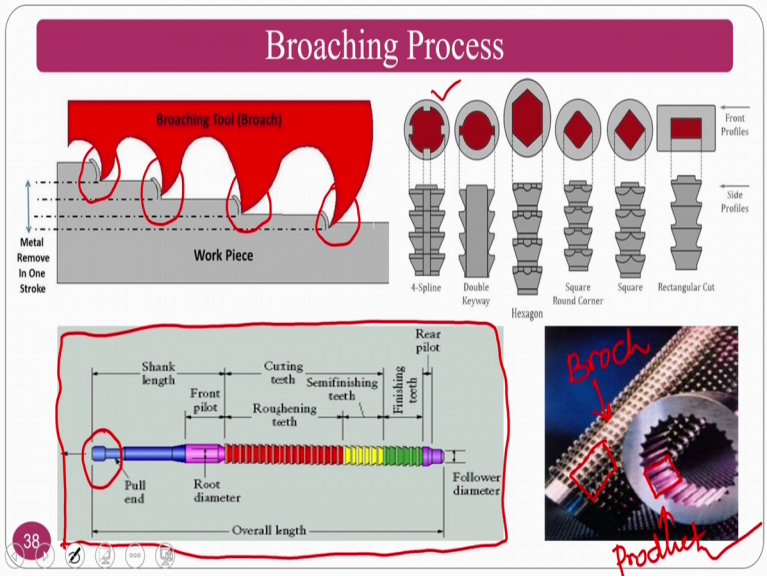

The broaching is another operation. Where, big holes are generated or machine. So, the tool that is used is broach. This is nothing but the, this is nothing but the broach. So, varieties of broach shapes are there you can generate spline, double key way, hexagon, square, round, cotters, square, rectangle cut, many types of varieties of cuts are there.

So, you just for this minimum requirement is you should have existing hole. And so, that you can put this as a input and you just pull it from other sides so that the gradual material removal takes place, and it forms the required shape across the hole. So, you can see one of the examples here. This is the tool. That is called broach. This is the final product.

You can see how these things are generated on the final product.

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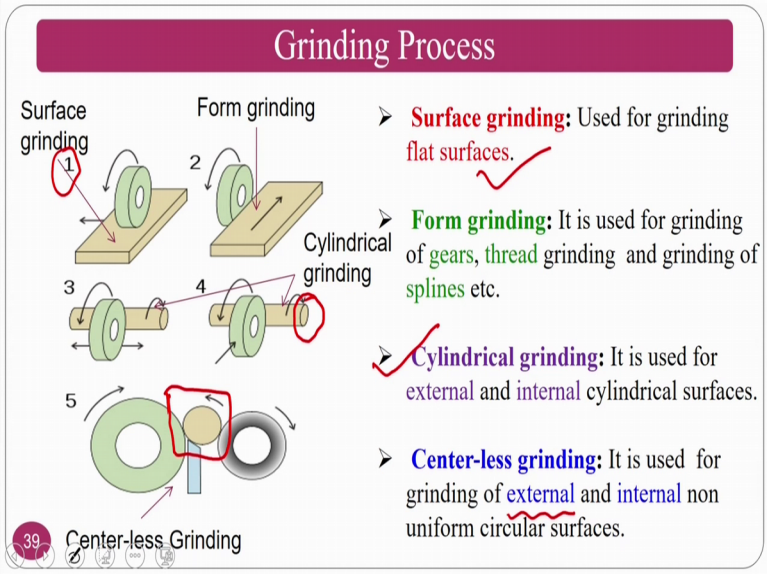

Another important process of multi point cutting tool is grinding process. As such grinding is an abrasive process; however, many tools cutting points are there. So, it also comes in the domain of a multi-point cutting tool, there are varieties of grinding that is called surface grinding, where used for flat surfaces. You can see one stands for surface grinding form grinding again. Form is nothing but if I want to generate certain form or certain shape. So, you can use the form grinding.

Cylindrical grinding, cylindrical grinding is to finish the cylindrical work pieces and the centerless grinding. If my workplace is not perfectly circle, this is circular work piece. In that circumstances I can go for cylindrical grinding. If my work piece is not perfectly cylindrical assume, that this is somewhat elliptical. For the purpose you can go for centreless grinding wheel.

This can be applicable for external as well as internal.

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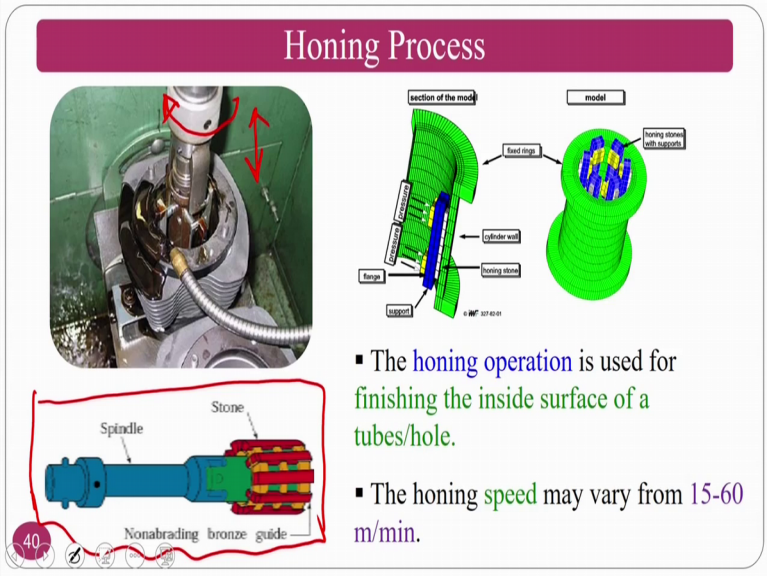

Honing process is one of the conventional finishing processes, where the finishing is done by the hole. This is called the tools that is used is nothing but a hone ok. So, the this machine normally the reciprocation motion as well as rotary motion will be given to the this hone so that it will go like this, and it will come like this ok. So, while going you are giving a reciprocation motion along with rotary motion, it will also rotate so that it will go in a helical path and come in a helical path so that cross hatch patterns will generate on the work piece. The application of this one is in the engine cylinders; where you need cross hatch patterns along with the surface finish.

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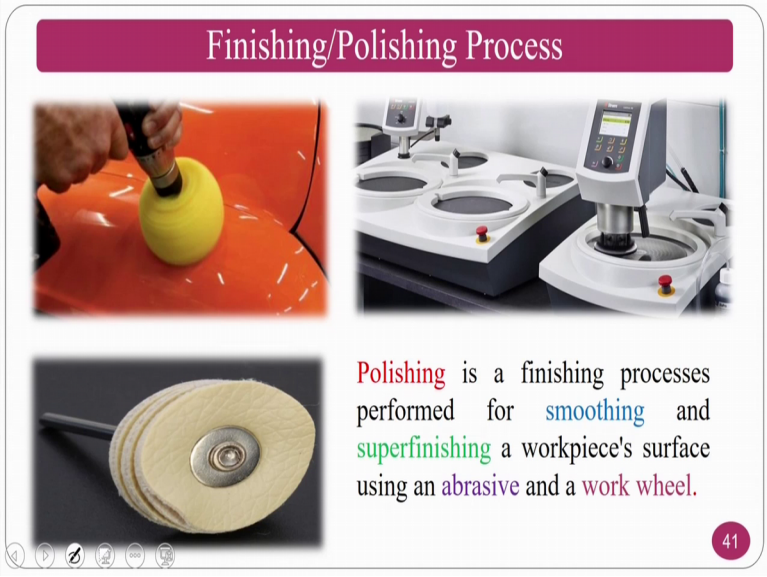

Another and the last application of this subtractive manufacturing or the subtract to process is finishing or polishing. You can see some of the finishing is like buffing process where you need to give some shining or remove small small fragments on the work piece. And you can see other way of buffing whenever you go to the car polishing and all those things.

They will give you shining, this also one way of a removing the existing material on top of it. And most importantly the polishing processes are lapping process. One is the lapping process, super finishing process, or many more process are there.

So, you can see hear the lapping process is going on. This is a automatic lapping process ; however, you can do the hand lapping also. Apart from it drag finishing; you can see the drag finishing operation vibratory bowl feeding processes, and build grinding process many other finishing or the polishing process that are going to be taught in the course. So, this is about the overview of the various processes that I deal during this course ok.

So, thank you.