# Metal Casting
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## Module - 02
## Sand Casting Process
## Lecture – 06
## Cores And Core Sand

Good morning friends, in the previous classes we have been learning about different moulding sands. These are the green sand, core sand, dry sand, loam sand, facing sand, backing sand and finally, the parting sand.

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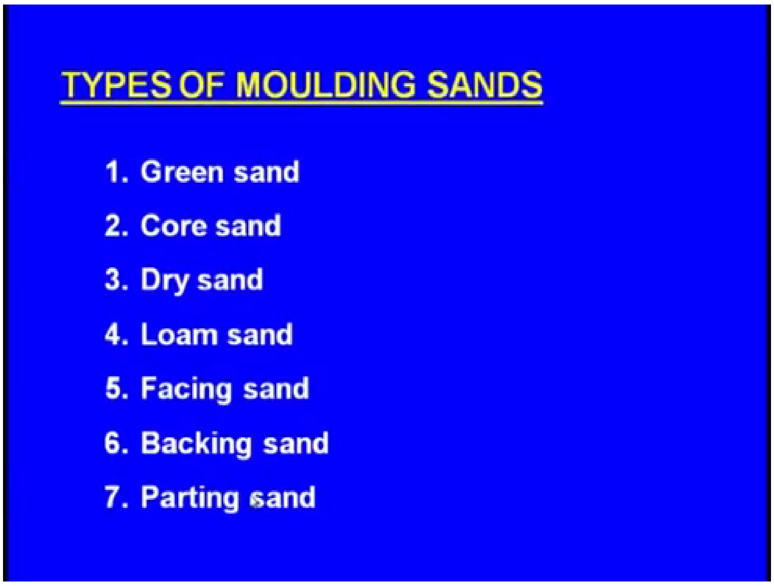


So, these are the different molding sands that are used in the metal casting and regarding the green sand, we have widely learnt about the green sand. What are its ingredients, what are its what say components and what are its properties and how to test the properties we have learnt in detail. And the second important sand in the metal casting is the core sand. So, today let us learn about the cores and the core materials.

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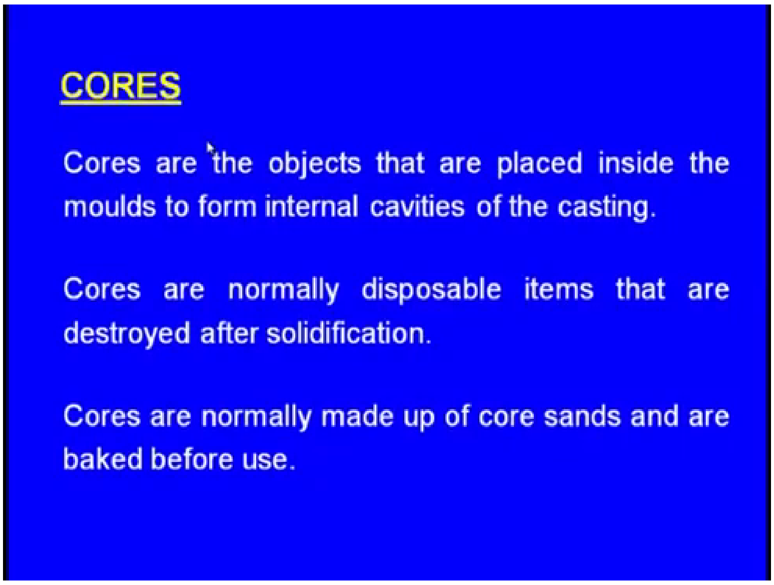


What are these cores and what are the materials for the cores. What are the cores first of all; cores are the objects that are placed inside the moulds to form internal cavities of the casting. Suppose inside a casting if we want a hollow cavity are a recess right we have to prevent the molten metal to occupy that particular region. So, we place a object which is made up of generally made up of what say some special core sand in that particular region, then the molten metal will flow around that what say core and afterwards we can break that core and we will get a hollow cavity are the hollow recess the. So, that is the purpose and concept of the core.

Now, these cores are the normally disposable items that are destroyed after solidification naturally these are most of the times these are made up of the core sands and after solidification we have to break them and they will be disposed right. So, cores are normally made up of core sands and are baked before use. So, we are going to learn about this core sands. So, using these core sands we will be making this cores in different shapes as per our requirement and remember they must be baked means they must be what say kept in wovens for long time for gaining better strength then only we should paste them place them inside the mould.

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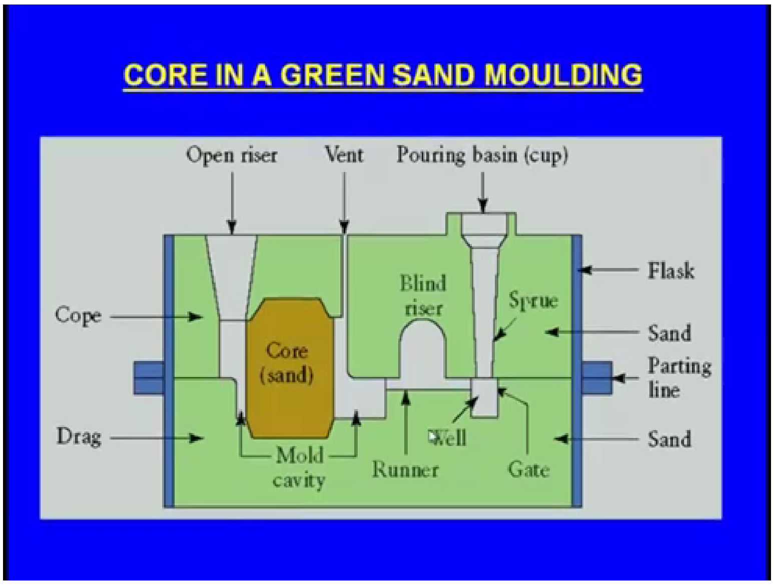


So, here we can see say this is the what say section of the mould and the right. So, this is the drag box and this is the cope box and the molten metal enters this way, enters this way yes this is this sprue the vertical process is known as this sprue and yes it reaches this sprue well then it passes through the horizontal process. The horizontal process is known as the runner, then it enters into the mould cavity. So, this is the mould cavity, now inside the mould cavity it is a cylindrical one, we wanted hollow cavity at the center. So, we have kept it sand core here, now the molten metal flows around the sand core and finally, it rises through the riser. Once it rises through the riser we stop pouring the molten metal. So, that is the what say concept of the core.

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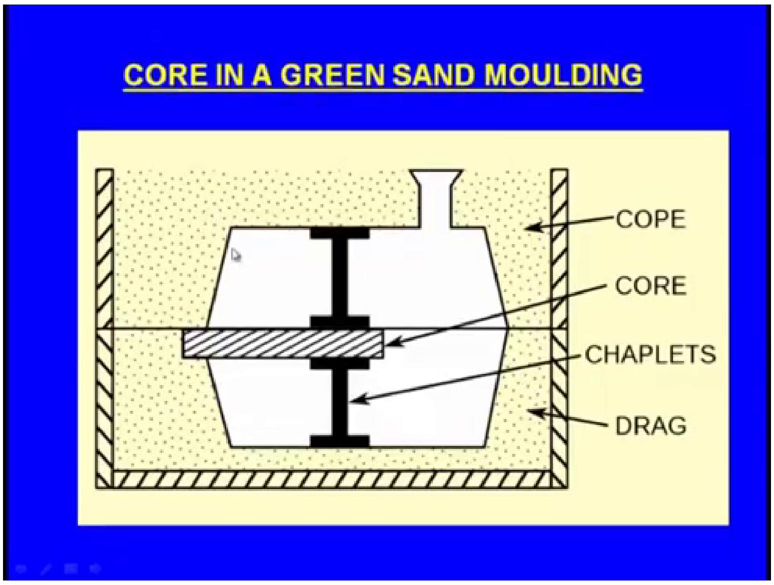


Now, let us see another what say case and here you can see. So, this is the moulding system and this is the drag box and this is the cope right and this is the core, and here we wanted a hollow cavity. So, this we made up of the core sand and we have kept here and say once ahead it is supported in the mould other side there is no support, that is why we have kept chaplets here. So, in the previous class we have learnt about the chaplets chaplets means these are the metallic components. So, to support the cores and what happens during the pouring. So, the molten metal flows around these chaplets and the chaplets partly they will fuse and what say join which the molten metal and be they become the part of the casting.

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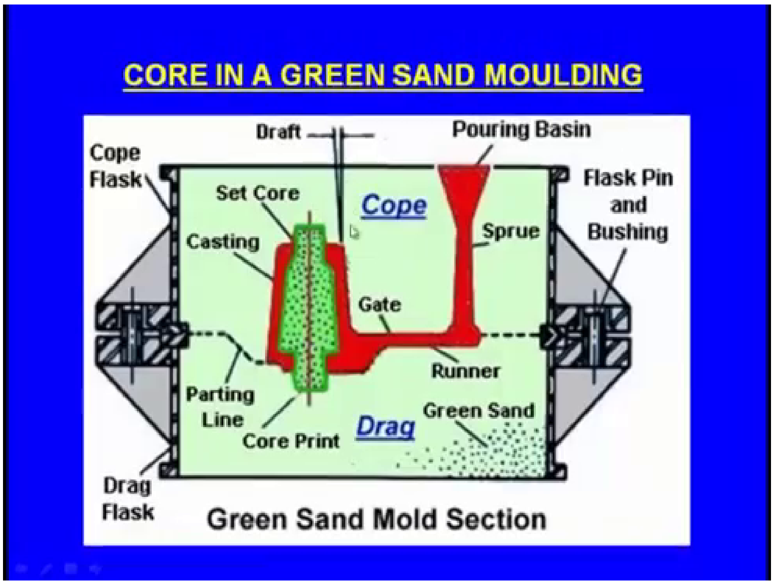


So, this is another case and here we can see this is another case, and this is the what say pouring what say basin and this is the sprue the vertical passes and next the molten metal passes through the runner, the horizontal passes and this is the mould cavity and inside the mould cavity we wanted a what say we want we do not want a solid casting, but we want a casting with hollow cavity. So, here we have kept a core and here it says steel what say it is a core right and here we have kept the what say set the core. So, this is the a concept of the core.

Now let us see some examples of what say some castings were cores are used.

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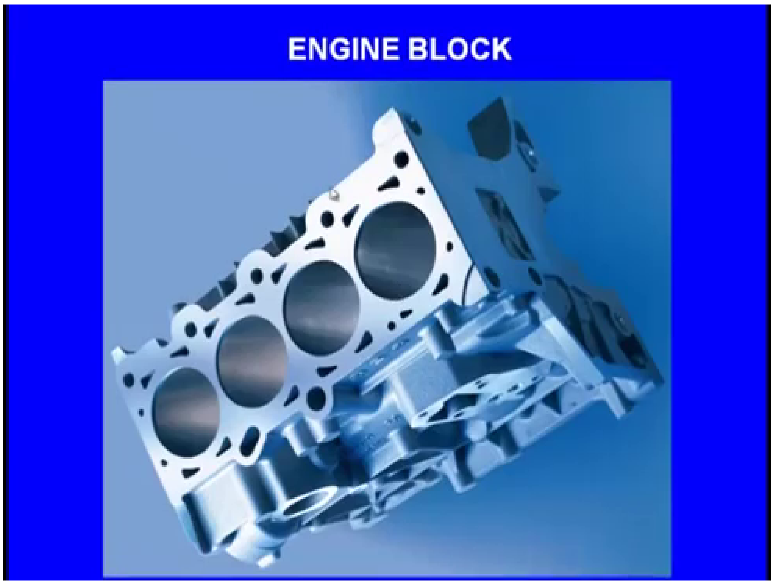


And here you can see this is an automobile engine, the 4 cylinder engine right. So, maybe in our Honda city right or the Maruthi, Swift in all this cars there will be 4 cylinder engines now this engine block is manufactured by casting. Now what happens now this a we create a cavity similar to this shape, now this is the what say here we can see there is a what say a hole is there right in all this we can see 4 holes are there in all these 4 holes there will be 4 pistons will be reciprocating.

Now, how to get these holes are the inter these 4 cavities we place the cores there the molten metal does not occupy where we have placed the core and it flows around the core that is how after solidification we break the cores and we get the internal cavities. So, these are important application of the metal casting where core is used.

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Now, here you can see this one this is a this is a what say electric motor housing and inside there will be armature and coils will be there, inside it is a what say big hole will be there cavity now see how this is made initially we make a cavity of this shape, and inside we place the core that is how we get the electric motor housing and here we can see this is a pump housing.

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And again this is a casting and inside there will be a hollow space will be there how to get that hollow space? We make a core and place inside the mould cavity then we get the pump housing of this shape.

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So, these are all the practical examples of the cores and here we can see one more case this is the centrifugal pump housing and here we can see a hollow recess is there and here we can see there is a cavity and hole and again this is obtained by placing the core in that particular place.

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Now we can see here this this is another example. So, this is the spur gear manufactured by casting now for to manufacture this spur gear. So, this is the pattern used, now when we take this pattern and put it inside the molding box and when we make them what say cavity using this pattern and after the formation, completion of the compaction of the molding sand we withdraw the pattern then what happens? There will be a mould cavity and there is no provision to get this kind of hole, again to get to the hole here what we have to do? We have to place a core here. So, this is the concept of the core.

Next one let us see the types of the cores based on the sand there are different types of the cores and based on the different what say considerations. Firstly, when we consider the sand that is used we can broadly divide them into green sand cores and dry sand cores, this classification is based on the sand that is used.

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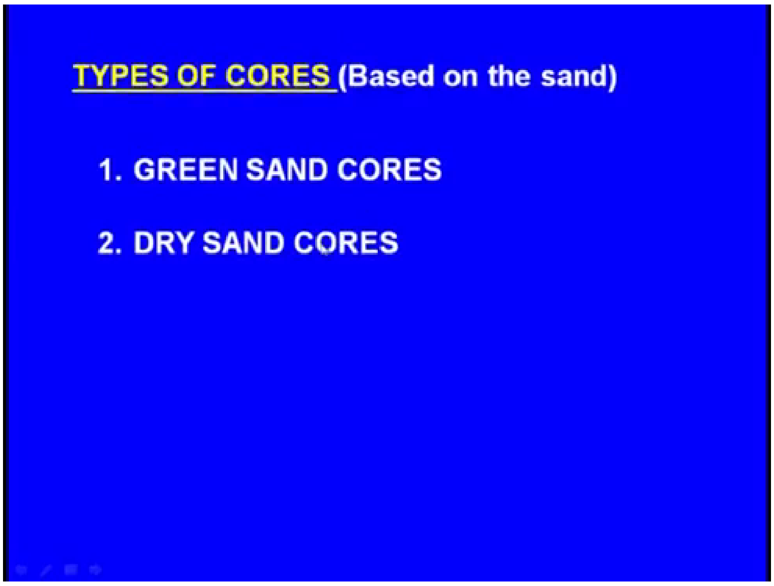


First let us see the green sand cores; green sand cores are not typical type of the cores they are part of the cope and drag, but still form and internal feature means these cores are not manufactured are they are not made separately, while we are making the what say green mould that time itself this core is formed. But still it is forming a what say an internal feature that is why it is known as the green sand core, here we can see this is the typical green sand core and this is the drag and this is the cope.

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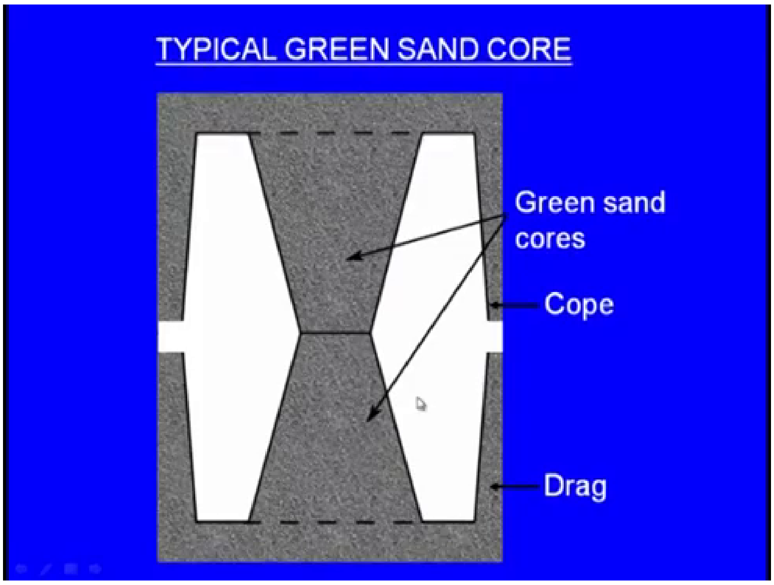


Now, you can see here the what say cope is extended like this, similarly the moulding sand in the drag is extended up to here. Now here in this place the molten metal does not flow and ultimately we get a what say recess are internal cavity there of this shape, but the thing is we have not a made a core separately, we have net not kept a core what say separately in that particular location, but while what say doing the mould itself, while making the mould itself this what say feature is created means pattern is like this. So, this is the green sand core means this core is made up of the green sand itself automatically while the we make the mould. What are the disadvantages of the green sand core? The major disadvantage is the lack of strength, because they are made up of the green sand.

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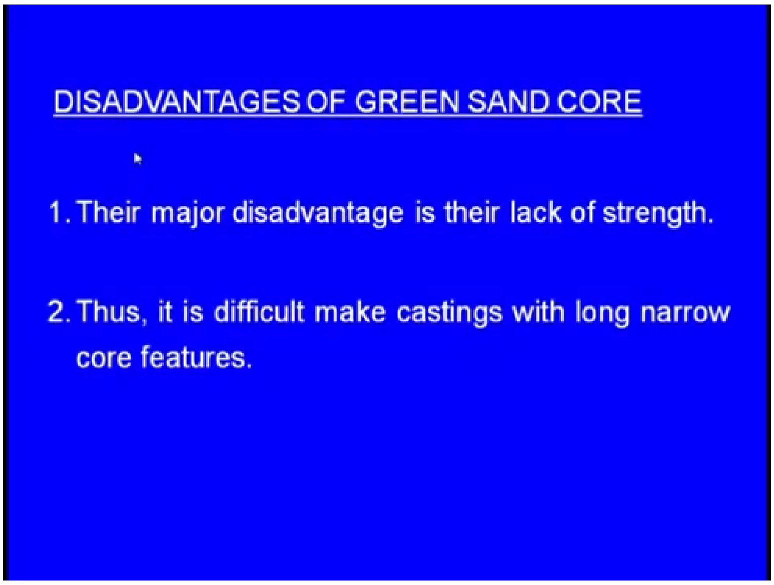


Next one it is difficult to make castings with long narrow core features using the green sand cores.

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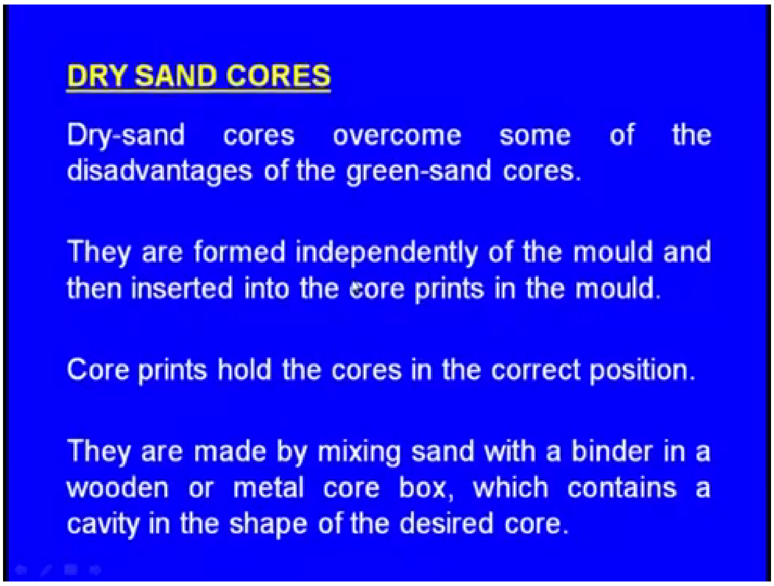


Next let us see the dry sand cores; dry sand cores overcome some of the disadvantages of the green sand cores. First of all green sand cores are not man what say made separately they are form while we are making the mould itself, but the thing is they have poor strength. So, when we make the cores with the dry sand dry sand cores have additional strength, that is how they overcome some of the disadvantages of the green sand cores.

Next one they are formed independently of the mould and then inserted into the core prints in the mould. We make the mould separately and we also make the cores separately, after making the mould we take those cores which we are we have made with the dry sand then we insert into the mould cavity. So, that is the another feature of the dry sand cores. Next one a were these are supported these dry sand cores? They are supported in the core prints these core prints hold the cores in the correct position right.

Next one they are made by mixing sand with a binder in a what say wooden or metal core box, which contains a cavity in the shape of the desired core and here we can see this is the typical dry sand core.

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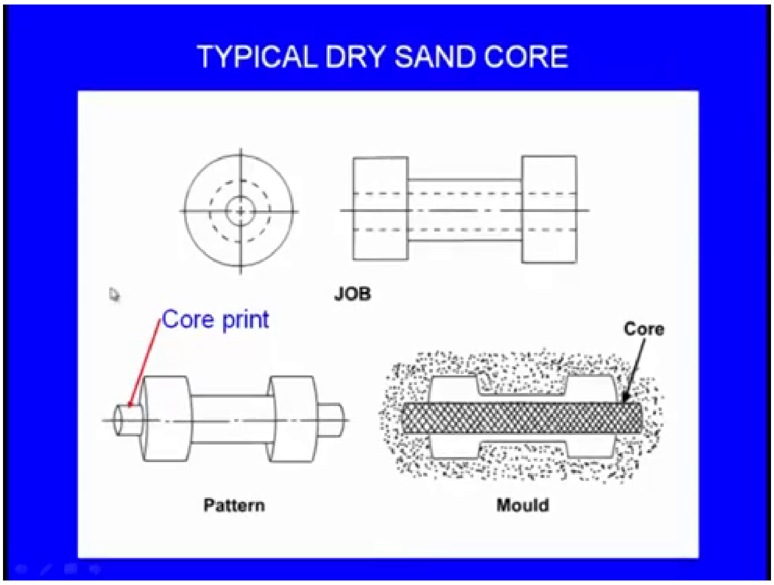


Now this is the casting we want right. So, this casting what say internal it has got a hole here in axial hole is there right the diameter is this much in axial hole is there. So, this is the casting we want. Naturally one can think that the even the pattern will be of the similar geometry, but here it is not so, let us see this is the pattern used. So, somehow the geometry seems to be different from the geometry of the casting. Why were because here we can see these projections here we see one projection and here we see another projection. If we remove these two projections the geometry of the pattern is exactly similar to the geometry of the casting that we want.

Now, the thing is why there are projections here, because there are projections here in the moulding what say sand are in the mould additional hole is created, you can see here because of the presence of this projection a hole is created in ad extra hole this side and extra hole this side. These two what say what say cavities are used to support the core are in those cavitys the core is supported, that is why to the pattern we have made some modifications. So, this extra projection is known as core print, core print means extra projection to the pattern. Not only it is pattern here we can see what is the core here. So, this is the what say cavity of the casting. So, the core means here from this point to this point we want a hollow cavity. So, core should be of this much size only from here to here why it is extended up to here big to support the core in the that extended hole. So, even this extended portion of the core is known as the core print. So, this is also the this extended portion is the core print.

Now let us see the ingredients of the dry sand cores. So, these are the typical ingredients of the dry sand cores.

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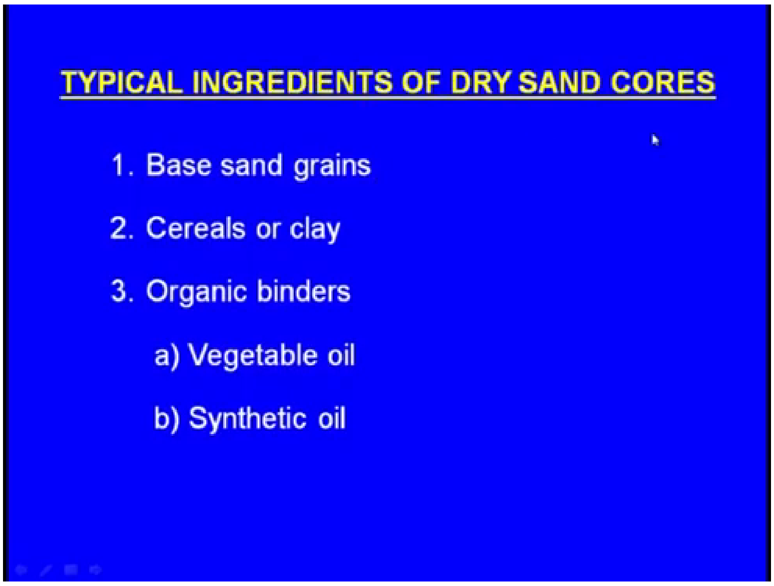


One is the base sand grains, second one cereals or clay, third one organic binders. These organic binders can be vegetable oils or synthetic oils first one let us see the base sands of the cores.

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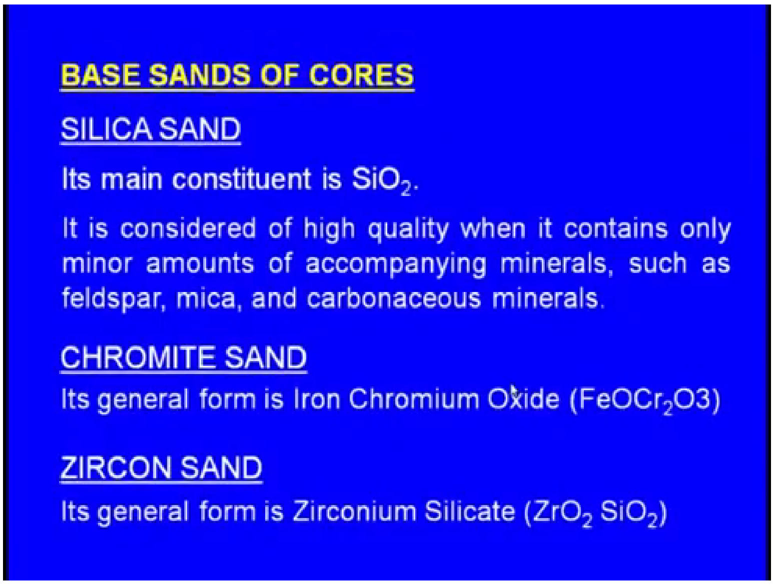


So, generally the base sands of the cores are either they can be silica sands or chromite sands or the zircon sands, even these sands are used in the green sands also of course, we were using a more sands like olivine sand. So, here it is not used. So, these are the base sands used in the what say dry sand cores. So, its main constituent the main constituent of silica sand is silicon dioxide SiO 2, it is constituent of high quality when it contains only minor amounts of accompanying minerals such as feldspar mica and carbonaceous minerals. So, these materials present or present in the extremely what say small quantities then it offers the better properties.

Next one the chromate sand its general form is iron chromium oxide FeOCr 2 O 3 next one the zircon sand its general form is zirconium silicate ZrO2 SiO 2.

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COMPARISON OF BASE SANDS OF CORES

| | Silica sand | Chromite sand | Zircon Sand |
|---|---|---|---|
| Chemical composition | $SiO_2$ | $FeO\ Cr_2O_3$ | $ZrO_2\ SiO_2$ |
| Density , $g/cm^3$ | 2.65 | 4.4- 4.6 | 4.6- 4.7 |
| Bulk density (vibrated), $g/cm^3$ | 1.52- 2.00 | 2.9- 3.1 | 3.01 |
| Melting point, °C | 1723 | 2180 | 1900- 1995 |

So, this is the comparison of the base sands of the dry sand cores right. So, this is the silica sand this is the chromate sand and zircon sand and is. So, chemical composition we have seen for silica sand it is the SiO 2 for chromate sand the it is FeO Cr 2 O3 and for zircon sand it is ZrO2 SiO 2.

Next one coming to the density grams per what say cubic what say centimeter, the silica sands density is 2.65 grams per cc, next one chromite sand it is from 4.4 to 4.6 and for zircon sand it is from 4.6 to 4.7, and this is the bulk density 1.52 to two 2.9 to 3.1 and for zircon sand it is 3.01.

Next one the melting point, it is a melting point is for silica sand it is 1723 degree centigrade and for chromite sand it is 2180 degrees centigrade and for the zircon sand it varies between 1900 to 1995 degrees centigrade. So, this is the comparison of the base sands of the dry sand cores.

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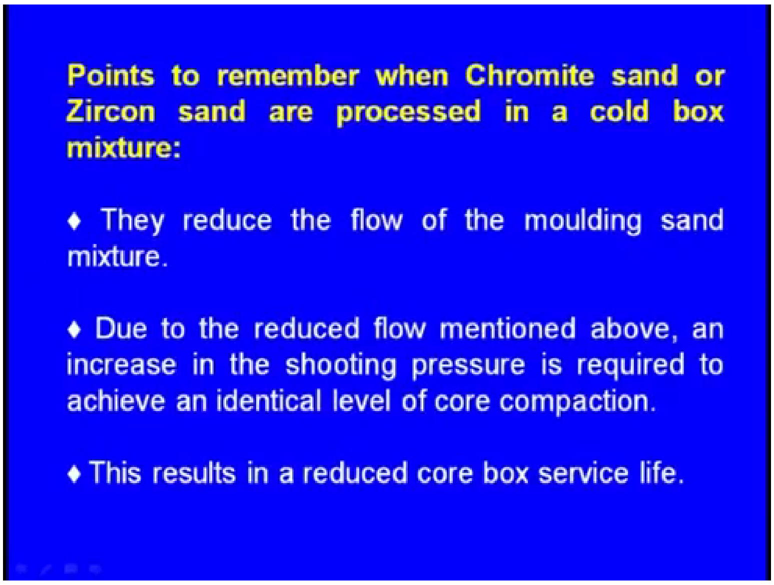


Points to remember when chromite sand or zircon sand are processed in a cold box mixture, what happens when we use the chromite sand or the zircon sand. They reduce the flow of the moulding sand mixture because we make a mixture generally we used to shoot inside the what say core box. So, these sands reduce the flow of the moulding sand.

Next one due to the reduced flow of the what say these sands an increase in the shooting pressure is required, naturally and see to achieve the identical what say level of the core compaction.

Next one finally, because we are using what say high pressure, the life of the what say these core boxes will be coming down. They also reduce the bench life of the moulding sand mixture.

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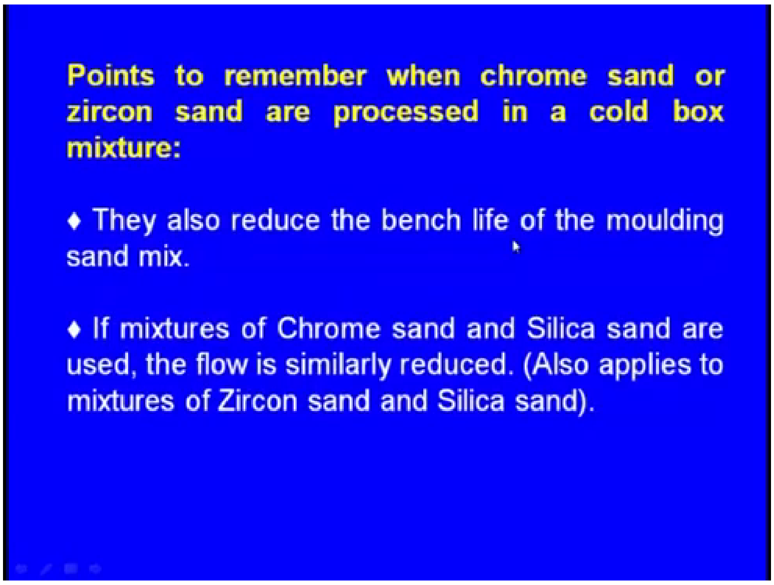


Next one if mixtures of what say chrome sand and silica sand are used the flow is similarly reduced. So, this also applies to mixtures of zircon sand and silica sand. Next one sequence of making cores how to make the dry sand cores first one first appears the mixing of the ingredients second one packing of the cores sand in the core box.

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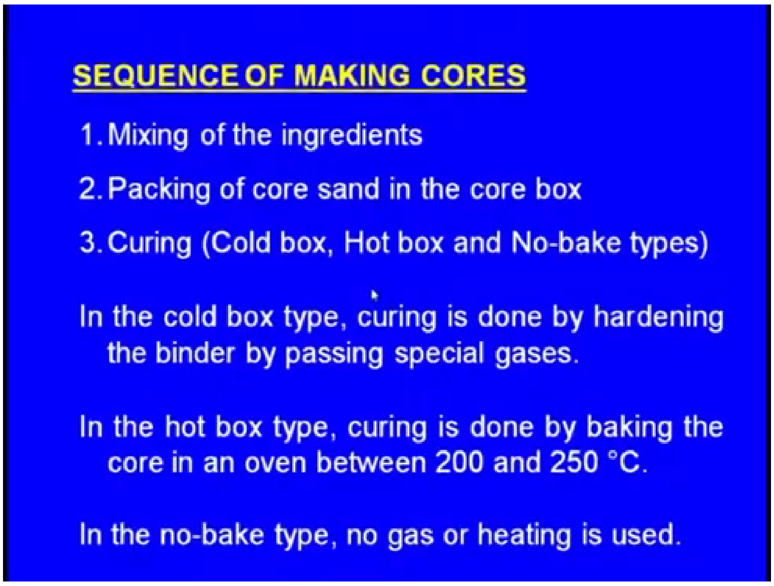


Next one curing right it can be by cold box hot box or no bake type no bake type and in the cold box type curing is done by hardening the binder by passing special gases through it like carbon dioxide; and in the hot box type curing is done by baking the core in a novel between 200 to 250 degrees centigrade, and in the no bake type no gas no gas or heating is used we mix some binder right and the moment where what say we place the mix what say cores sand in the core box immediately within few minutes, it will be hardened. These are the types of the dry sand cores based on the curing previously we have seen based on the sand right.

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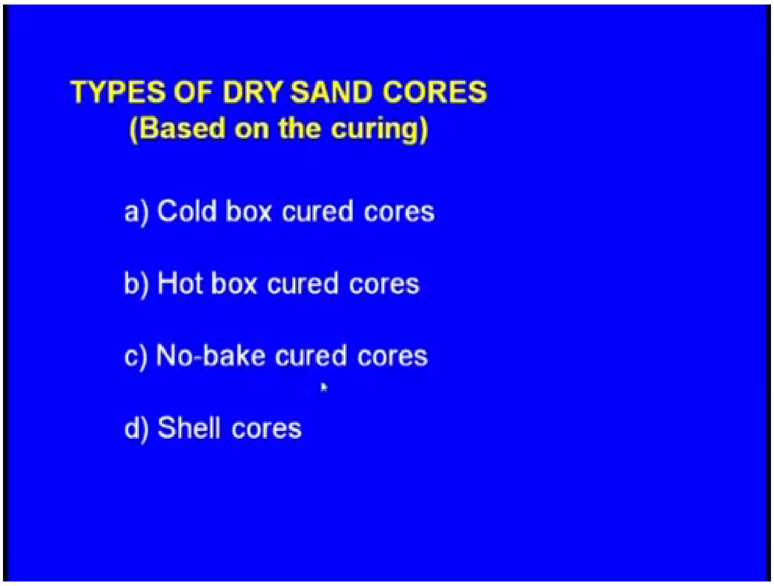


Now, these are the types of the dry sand cores based on the curing one is the cold box cured cores.

Next one hot box cured cores next one no bake cured cores and finally, the shell cores first let us see the cold box the cured cores.

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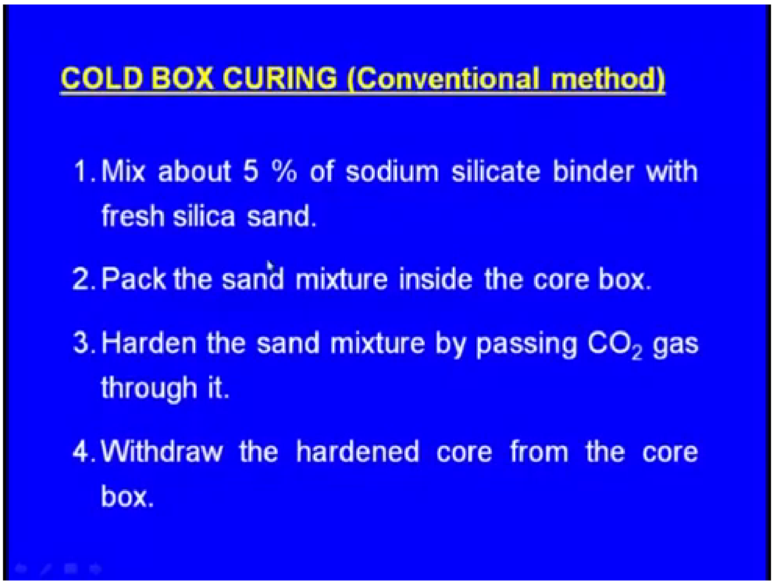


This is the procedure mix about 5 percent of sodium silicate binder with fresh silica sand, it should be fresh silica sand pack this sand mixture inside the core box. The core box will have the required cavity right. So, the cavity will be similar to our requirement are similar to the core. Now hardened the sand mixture bypassing carbon dioxide gas through it, and the carbon dioxide will be passed around the moulding sand that is packed in the core box, and it will be hardened and after that withdraw the hardened cores from the core box and then we have to place it inside the mould. So, this is the procedure for making what say core using the cold box curing.

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So, these are the cores made by the what say cold box curing. So, that is also known as the sodium silicate process.

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So, these are the cores made by the sodium silicates process, when we harden it by what say cold box process and also by what say passing carbon dioxide. So, these are the cores

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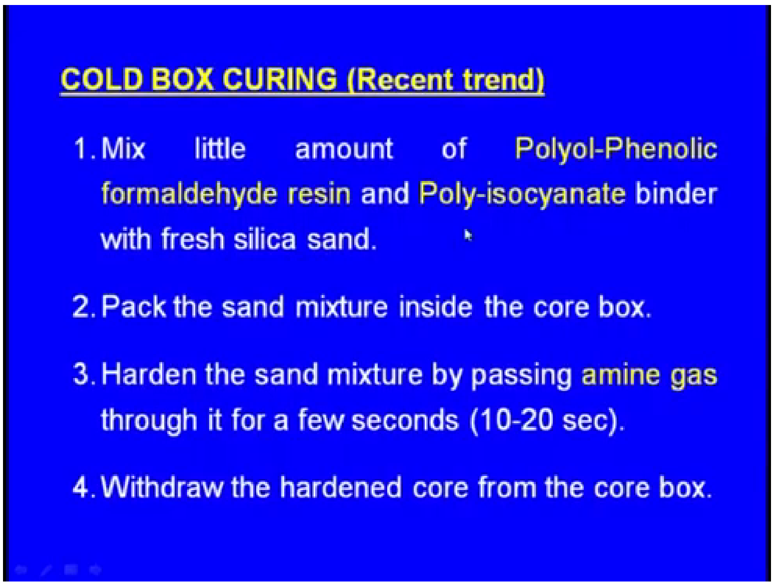


Next one. So, there is what we have learnt just now is a what say traditional method now recently another method has come. Mix little amount of Polyol-Phenolic formaldehyde resin and Poly-isocyanate binder with fresh silica sand pack the sand mixture inside the core box. Yes naturally the core box will have a cavity of the required shape into that we have to pack this mixture, you we need not apply excessive pressure. Next one harden the sand mixture by passing amine gas through it for a few seconds maybe 10 to 20 seconds then it will be hardened, withdraw the hardened core from the core box then the core will be kept inside the moulding box.

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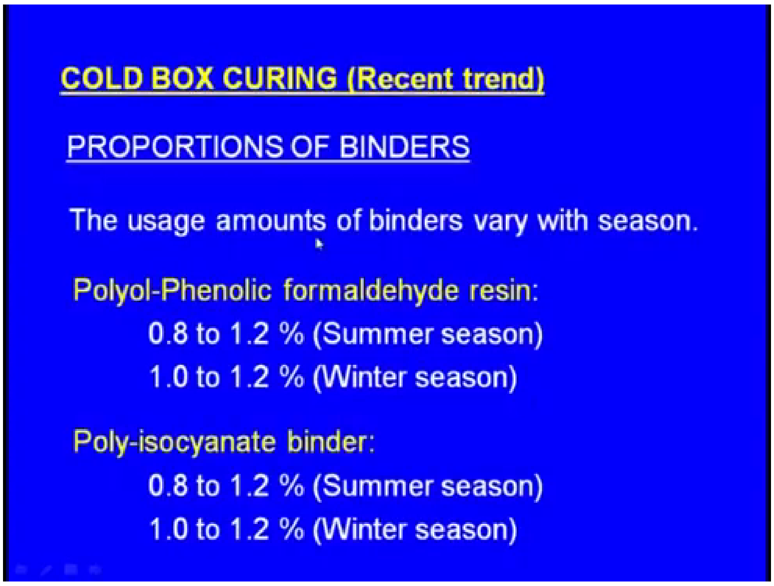


So, these are the what say proportions of the binders in the cold box curing which has been developed very recently right. So, the uses of the binders vary with the season right. So, the Polyol Phenolic formaldehyde resin it varies 0.8 to 1.2 percent during summer season. It varies 1 percent to 1.2 percent during winter season. Similarly poly isocyanate binder it varies from 0.8 to 1.2 percent during summer season and it varies from 1 percent to 1.2 percent during winter season.

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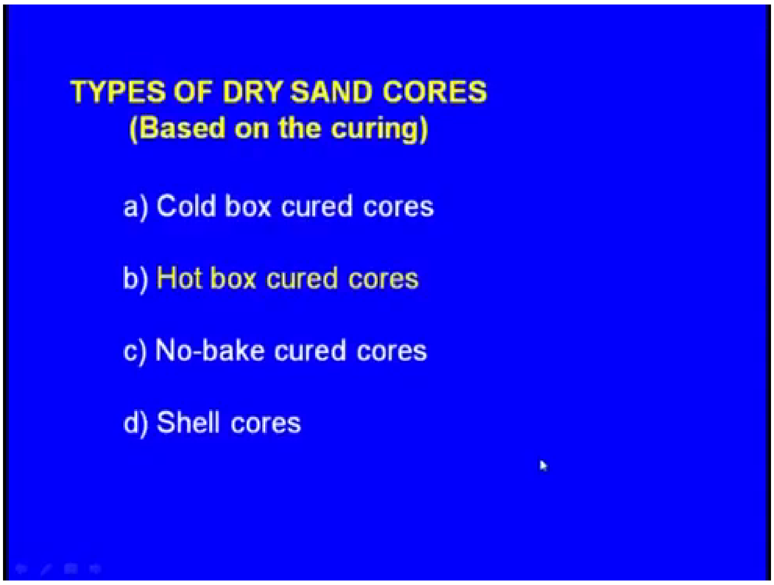


Next one so far we have seen the cold box cured cores means in this cores right we use the cold box next one hot box cured cores let us see.

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So, this is the typical woven used in hot box curing means we mix the what say ingredients of the cores and we place it inside the core box, and this will be kept inside the woven then what happens the it will be hardened. So, this is the simple principle of the hot box curing. So, these are the cores made by using hot box curing.

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Next one let us see the no bake cured cores.

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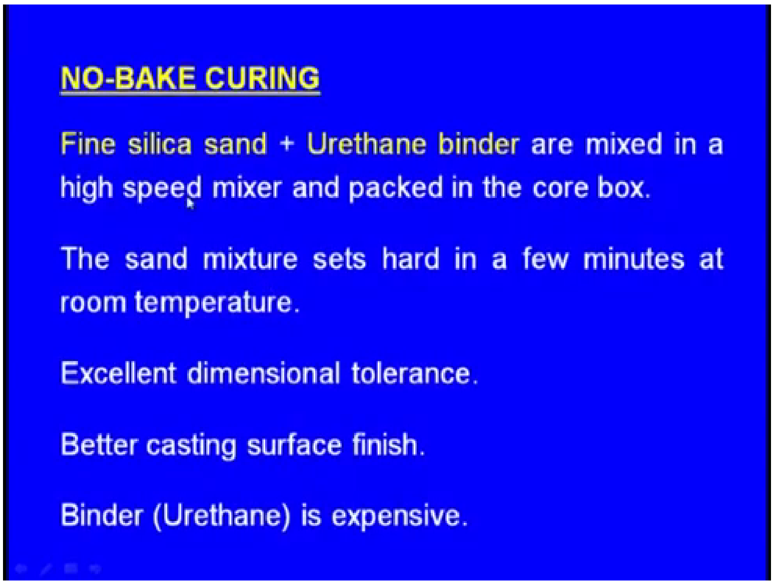


What is the procedure for making no bake cured cores fine silica sand and urethane binder are mixed in a high speed mixture and packed in the core box. So, this should be these ingredients fine silica sand and urethane binder should be mixed in a high speed mixture, and the they should not be exposed to the what say atmosphere, because once they are exposed to the atmosphere they will be hardened very rapidly.

Next one the sand mixture sets hard in a few minutes at room temperature. So, that is why once we mix this sand inside the high speed mixture, we have to keep the core box close to the high speed mixer and we have to drop the sand or we have to shoot the sand inside the cavity of the core box and within few minutes that sand will be hardened even at the room temperature.

Next what are the benefits of this process? We get excellent dimensional tolerance and we get better what say casting surface finish, but one thing is this binder urethane is expensive.

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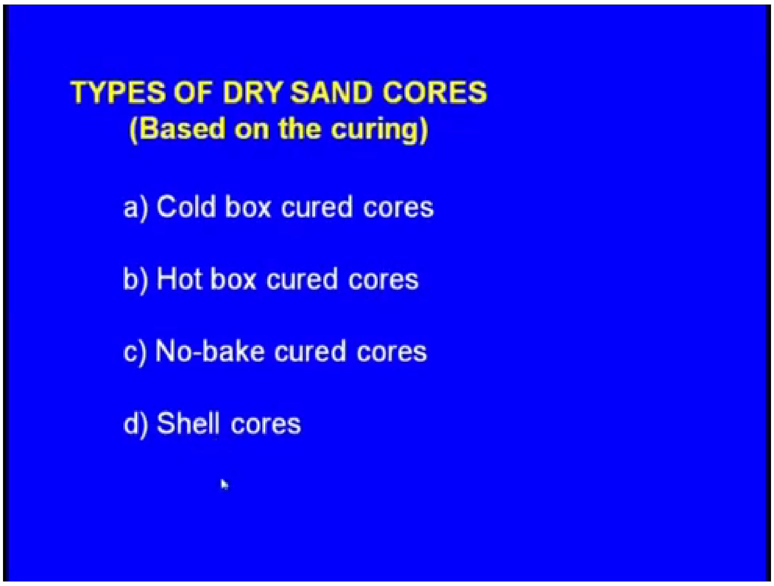


Next one so, far we have seen these three once we have seen cold box cured cores hot box cured cores and the no bake cured cores now let us see the shell cores.

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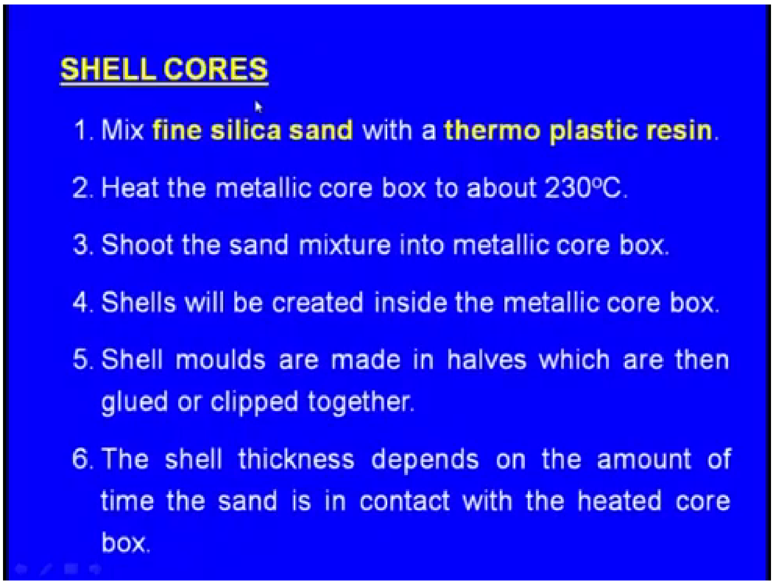


So, this is again a what say recently developed process. Now what is the procedure in the shell cores mix fine silica sand with thermoplastic resin heat the metallic core box to about 230 degrees centigrade, now shoot the sand mixture into the metallic core box here a metallic core box is to be used.

Now, what happens when we shoot the sand mixture into the metallic core box, which are heated about 230 degree centigrade, shells will be created inside the metallic core box because say they will be hardened because the metallic core is heated about 230 degree centigrade. So, shells will be created on the what say cavity surface close to the cavity surface right. So, shells are made in house which are then glued and clipped together means, if we want a cylindrical core two half will be made means two self will be made these two halfs will be what say clip together and they will be glued together. The shell decrease depends upon the amount of time the sand is in contact with the heated core box, longer at a time we play what say keep inside the metallic core boxes larger will be the thickness.

So, it all depends upon how long we keep inside the metallic core boxes. So, these are the typical shell cores.

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You can see here yes this is one half this is another half. So, this a what say shell core and again these are all the shell cores.

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We can see inside they are hollow, but externally they are offering us the required shape required geometry, and the important of benefit is they are light and weight and they can be handled very easily and they do not to consume excessive of sand.

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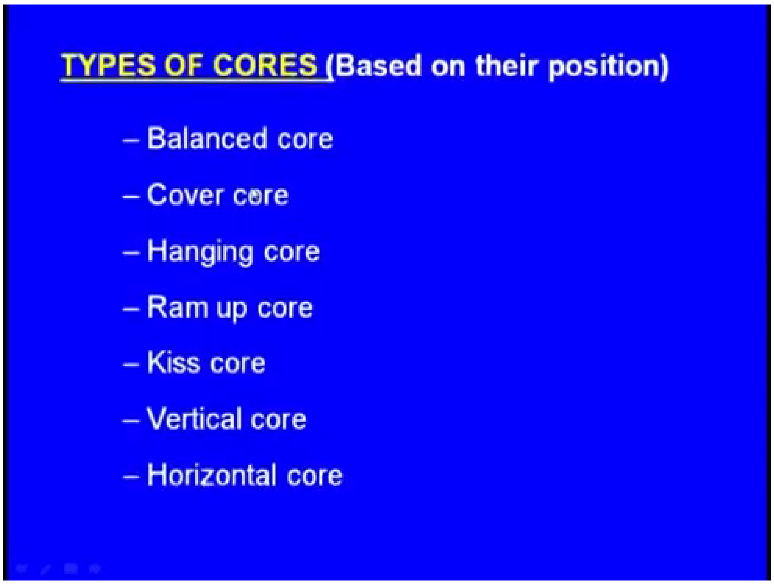


Now, these are the types of the cores based on the position, one is the balanced core next one cover core hanging core, ram up core, kiss core, vertical core and finally, horizontal core. So, these are the what say different types of the cores based on their position now let us see all these one by one. So, this is a balanced core.

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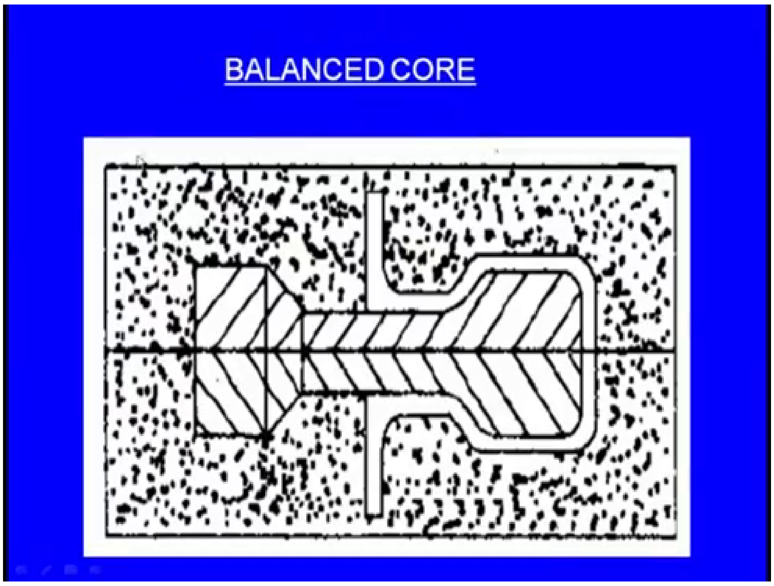


Now, this is the mould right. So, this is the drag and this is the cope, you can see here this is the mould cavity and the molten metal flows around here the molten metal goes like this, but how it is supported and here it is supported like this. So, it is balanced core.

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Next one cover core. So, again we can see this is the mould and this is the drag and this is the cope and this is the core this is the core and the molten metal flows like this in this region the molten metal flows like this, but the thing is the cores it look appears that the core is covering the cavity mould cavity is it not that is why it is non has the cover core next one the hanging core.

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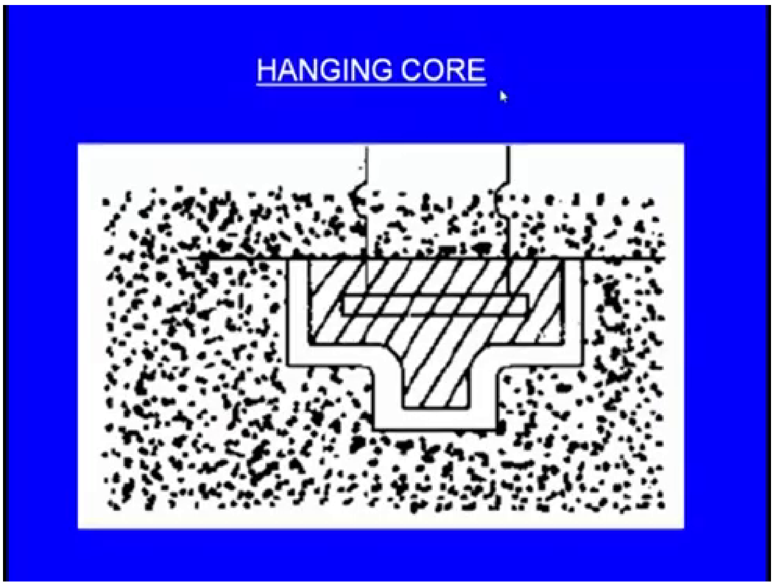


We can see here yes this is the mould cavity and this is the drag and this is the cope the molten metal goes like this, but there is a little difference between the previous one and this one in the cover core and at the bottom there is what say no gap between the mould and the core it is closed here whereas, in the hanging core there is a gap that is the difference and it looks it is hanging from the top. So, that is why it is known as the hanging core. So, this is all this is the hanging core right.

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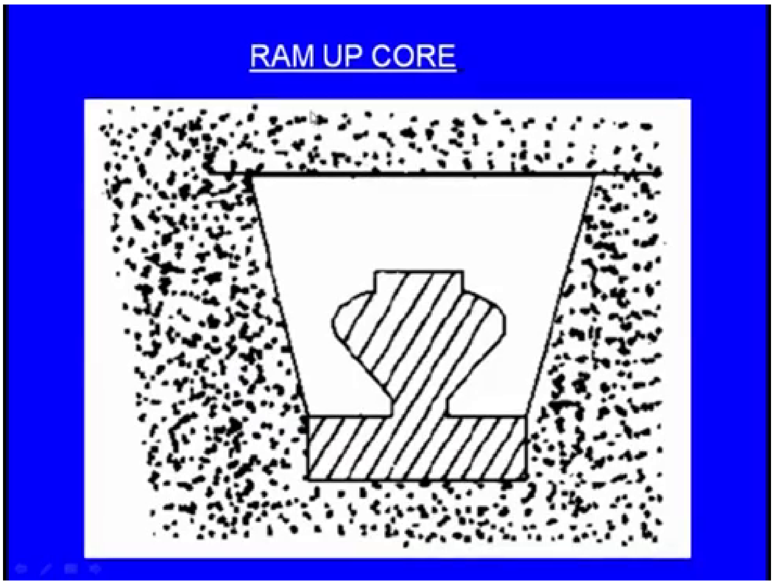


Next one this is the ram up core this is you can see this is the mouldings right this is the mould and this is the core, this is the core, this is the core and the molten metal fills this area this part is the core. So, this is known as the ram up core.

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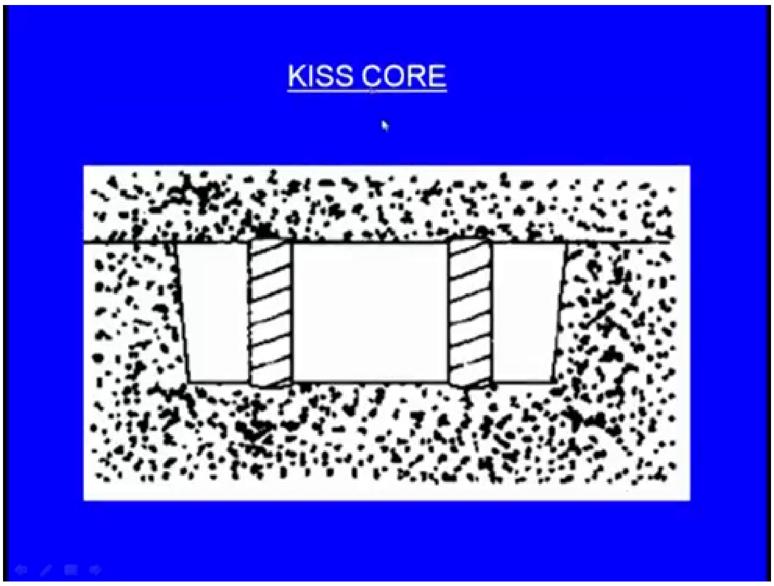

Next one the kiss core and you can see here this is the moulding sand right. So, this is the drag and this is the cope and this is the core and this is the core. Now what is happening it is stretching from what say it is starting from the cope box and it is touching the drag are it appears it is kissing the drag box. So, that is why it is known as the kiss core.

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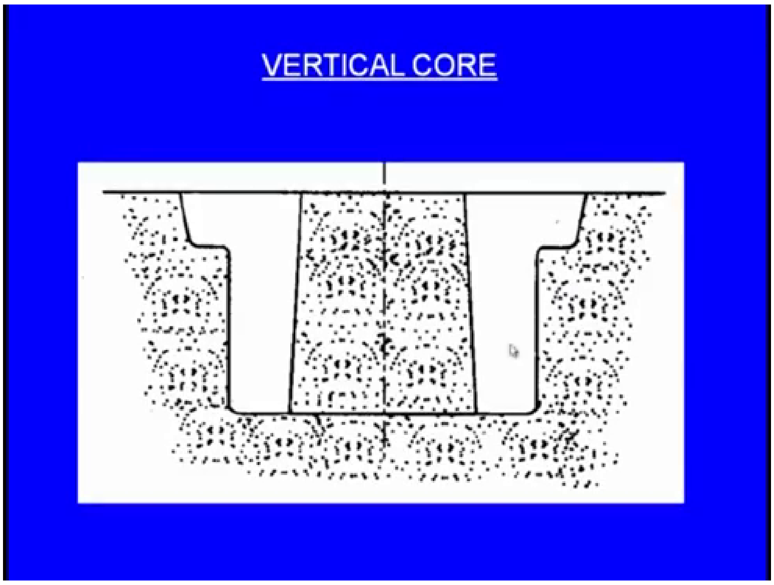


Next one the vertical core again you see here this is the drag and this is the mould cavity and this is the vertical core.

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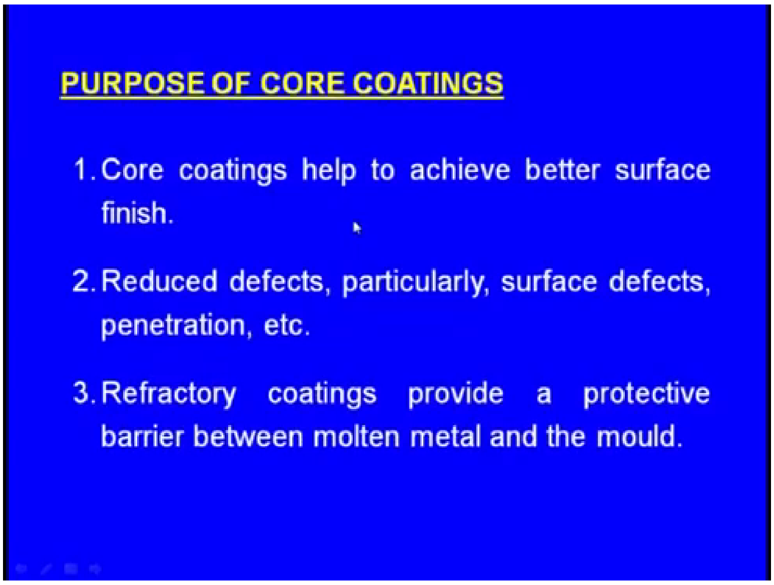

Next one core coatings. So, we will see what are these core coatings; purpose of core coatings first of all why we should give the core coatings. Core coatings help to achieve better surface finish right and they also help us to get the reduced defects particularly surface defects penetration etcetera and if the what say size of the sand grains are somewhat larger and there will be some clearance between the neighboring sand grains and the hot metal can penetrate into the clearance between the two neighboring grains and that results in the penetration defect. So, when we give this what say this core coating, the possibility of the penetration defect comes down.

Next one refractory coatings provide a protective barrier between molten metal and the mould. So, they make a protective barrier otherwise what happens because of the very high temperature of the molten metal, the mould sand or the surface of the cavity may be damaged, this is the classification of the core coatings right.

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So, these are the what say minerals of the core coatings one is the aluminum silicate, second one zircon silicate third one graphite. Here we can see carrier liquid means we will mix any of these minerals with this carrier liquid we can mix these minerals with water are also with the Iso propanol and finally, what is the delivery form when we mix the minerals with the carrier, it can be in the powder form or it can be in the paste are finally, it will be in the slurry means slurry means once we make the slurry? Immediately it should be used whereas, once we make the powder and paste they can be packed and they can be stored for some time.

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**APPLICATIONS OF DIFFERENT CORE COATINGS**

| Refractory materials | Carrier | Main Use |
|---|---|---|
| Zircon | Alcohol | Steel castings |
| Zircon | Water | Steel castings |
| Al- Silicates | Alcohol | Heavy grey iron castings |
| Lamellar Al- Silicate | Alcohol/ Water | Grey iron Aluminium and non ferrous automobile castings |
| Various refractory materials | Water | Gas permeable coatings for the full mould and lost foam processes |

Now these are the applications of the different core coatings, what are we have seen different what say these one materials are there. So, these are the different core minerals are there and what are their applications. Next one first one is if it is a zircon mixed with a what say alcohol when the carrier is alcohol it is used for the steel castings, zircon when the carrier is water it is also used for the steel castings.

Next one aluminum mineral when mixed with the alcohol is used for heavy grey iron castings. Next one there is another mineral lamellar aluminum silicate when mixed with alcohol or water can be used for grey iron aluminum and nonferrous automobile castings. Next one various refractory materials are there and they can be mixed with water and they can be used for gas permeable coatings for the full mould and last foam process. So, these are the applications of different core coatings.

Next one design considerations of the cores, how to design the cores and what are the factors to be considered while we are designing the cores, and what are the precautions to be taken while we are designing the cores.

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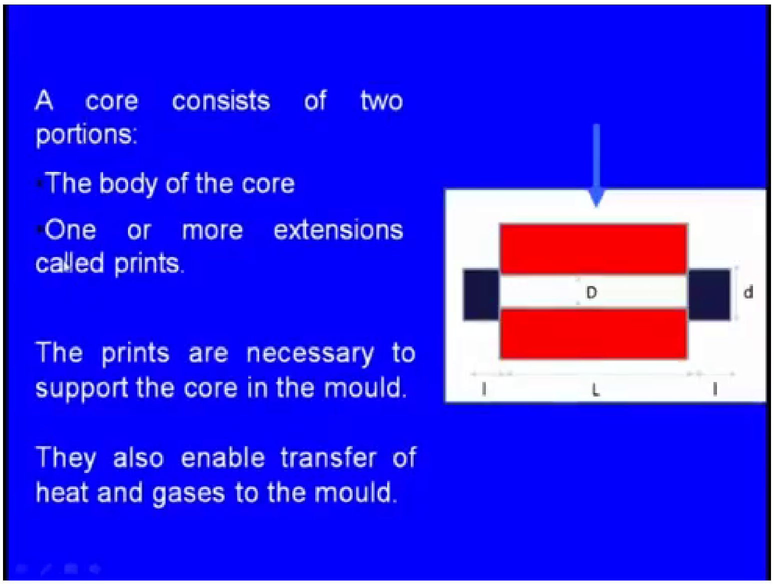


Now, let us see a core consists of two portions remember, the body of the core right one or more extensions called the prints. Suppose this red coloured one is the casting now internally we want a hole. So, to get the hole we place a core there. So, this portion in this portion we are placing the core, but see here there is an extension and here there is an extension there we do not want any what say cavity nothing, but why the core is extended up to that, because it will be supported here and here if these supports are not there it will be falling down. So, these extensions are known as core prints. The prints are necessary to support the core in the mould, they also enable transfer of heat and gases to the mould and. So, the these core prints what say transfer the heat to the mould.

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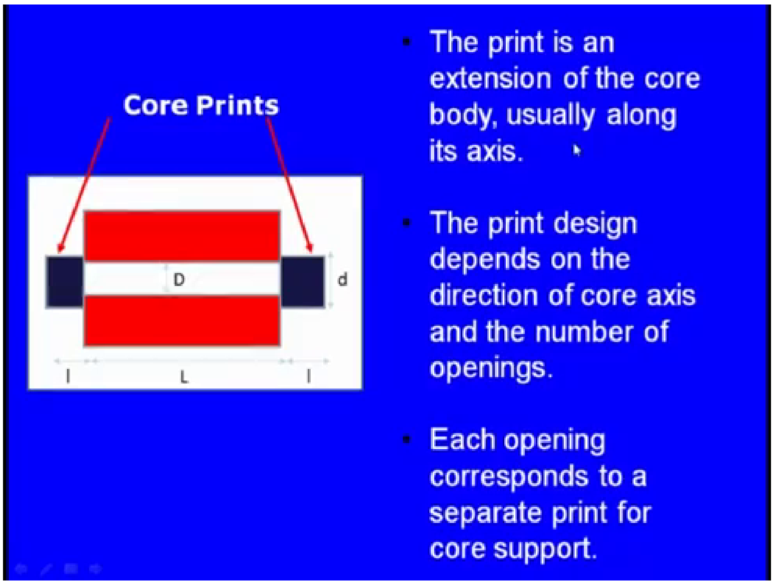


The print is an extension of the core body usually along its axis right, we have seen that the core has an extension that is along the generally it is along the axis. So, this is the core print and this is also the core sprint. The printed design depends on the direction of the core axis and the number of the openings.

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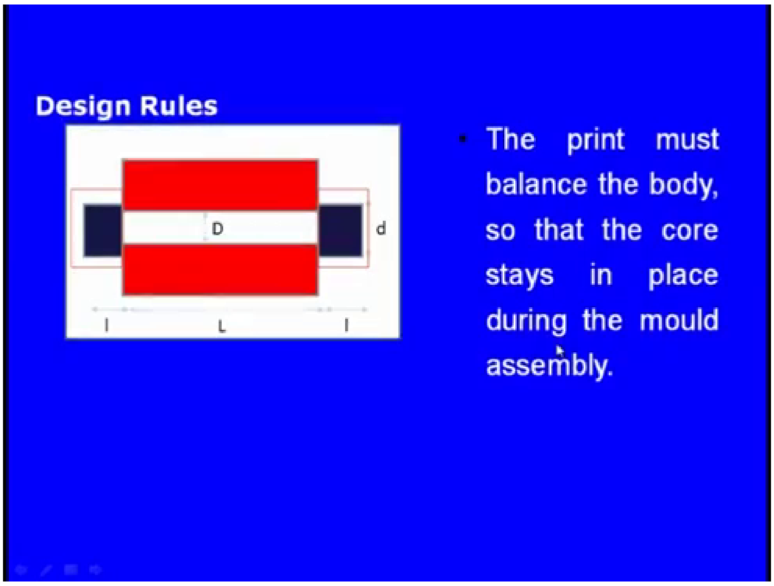


Next one each opening corresponds to a separate print for core support next one the print must balance the body. So, that the core stays in the place during the mould assembly right. So, it must balance the a body of the core next one the prince should minimize the deflection of the core.

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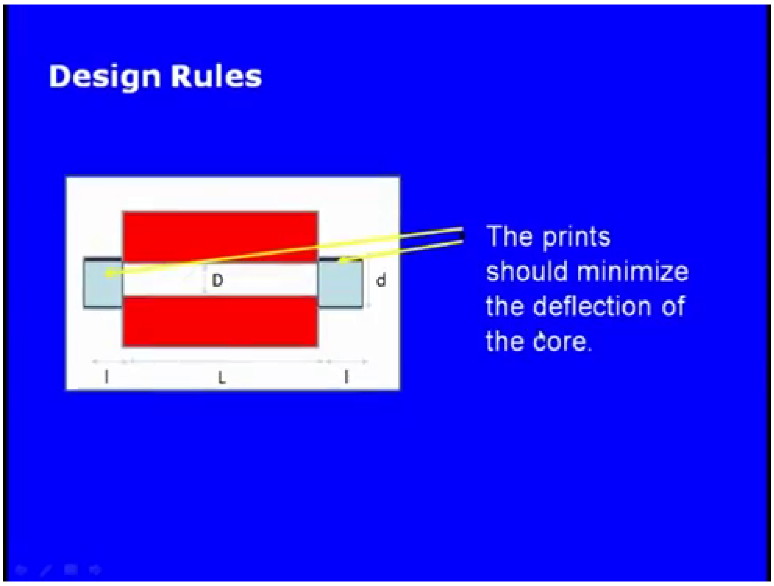


So, this is the print and this is the print and in between this is the core. The prints should be designed in such a way that the core should not deflect at the center of the cavity.

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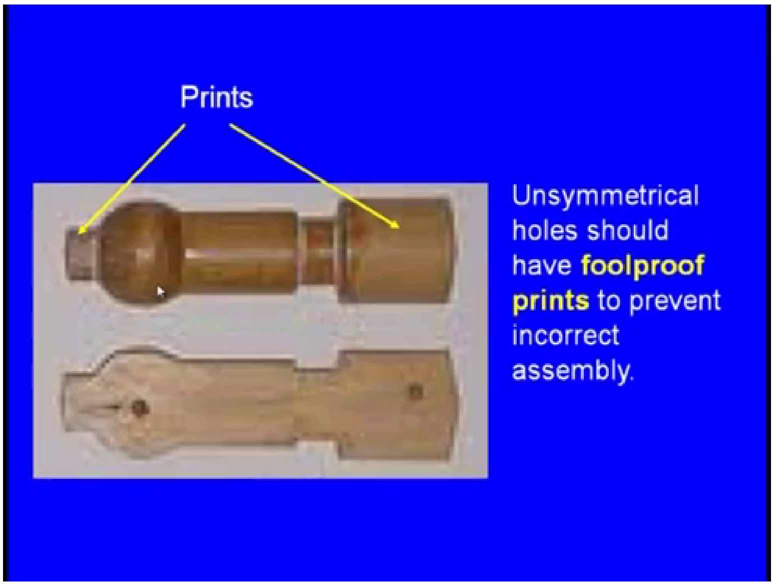


Next one unsymmetrical holes should have foolproof prints to prevent incorrect assembly. Now let us see a case, this is the core see the core cavity is actually from here this portion to this portion and it ends here like this like this only this much is the core portion, this much is the core portion and certainly it needs core prints both the sides for supporting the cores. Now what is the this rule is that it should have the foolproof prints means the previously in the case we have seen say simple cores a cylindrical core. So, that in the for the cylindrical core also there were prints these prints were similar in the geometry does not matter you make the core and put it in this direction are reverse it in the put it in the other direction does not matter, but here the direction is very important and what happens if the core prints are of same geometry of what say same size by mistake someone may place it in the other direction.

So, this must be avoided. So, to avoid this chance of mistake right miss placing the core in the wrong direction the core should have the foolproof prints means this here you can see this is the print and here this is the print. Now here the print is smaller and here the print is bigger by mistake can someone change the direction and put it in the wrong direction no even if we wants to do it these foolproof prints do not permit him to place in the wrong direction why say here in this case we require foolproof prints, because the design of the core is not same along it is axis it is different it is continuously changing. If it is a simple geometry yes no need to have the foolproof prints.

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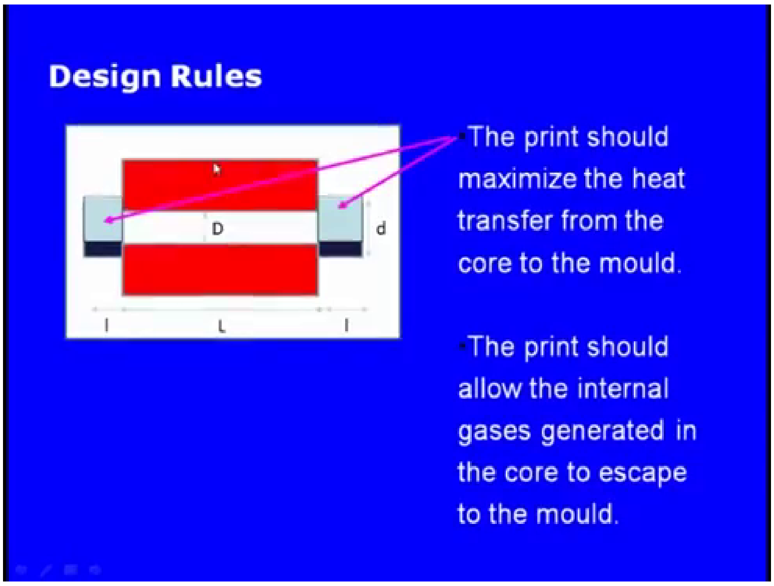


Next one the print should maximize the heat transfer from the core to the mould; that is another rule. Next one the print should arrow the internal gases generated in the core to escape the mould right. So, here some gases will be evolved inside the core and the core must enable these hot gases to escape to the mould and ultimately to the atmosphere. So, generally we try to make holes at the center of the core.

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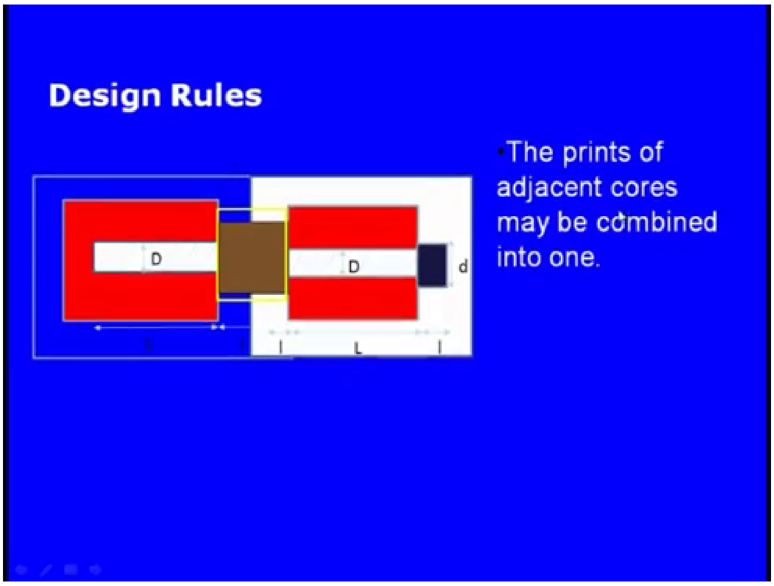


Next one the prints of adjacent cores may be combined into one and here we can see this is what say one core and this is one core and this can be what say combined into one and here we you can see they are combined, and here we can see what is happening here right.

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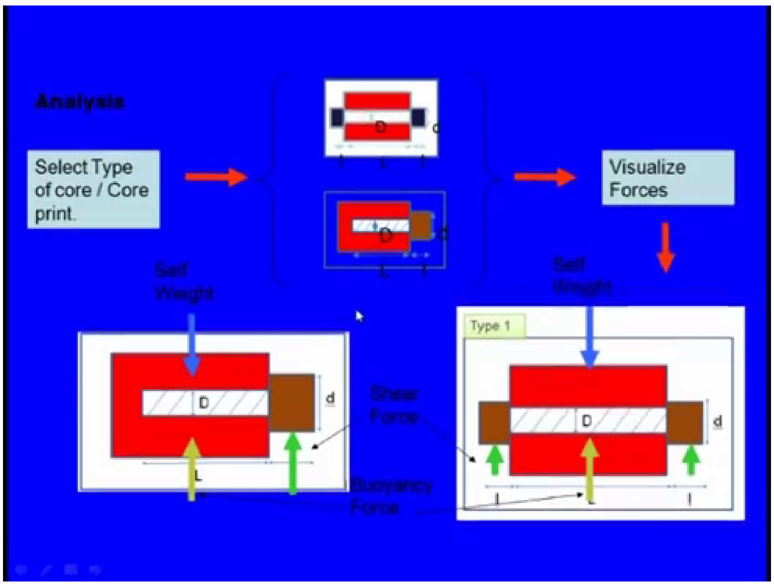

So, this is the selected type of the core and here and the core print and we have to select whether what say it should have two prints or one print or what say foolproof prints and we have to decide. So, that is the first part of the core design.

Next one we have to visualize the forces falling on the core, and here we can see and here the molten metal is causing the what say creating a force on the core like this, and there is another force that is the buoyancy force here.

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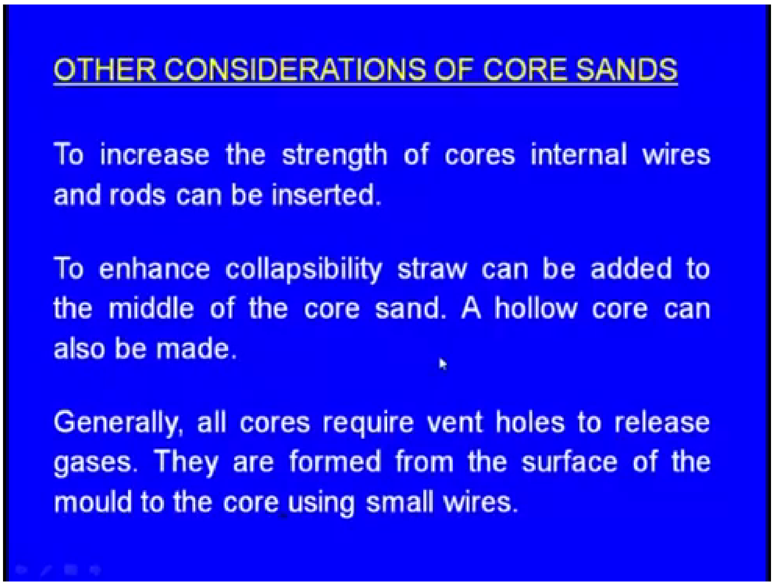


So, all these we have to consider, other considerations of the core sands. To increase the strength of the cores internal waves under rods can be inserted internally at along the axis we can what say insert the wires are the rods. To enhance the collapsibility straw can be added to the middle of the core sand straw can be added. So, it will enhance the collapsibility and a hollow core can also be made. Generally all cores require vent holes to release the gases, they are formed from the surface of the mould to the core using small wires.

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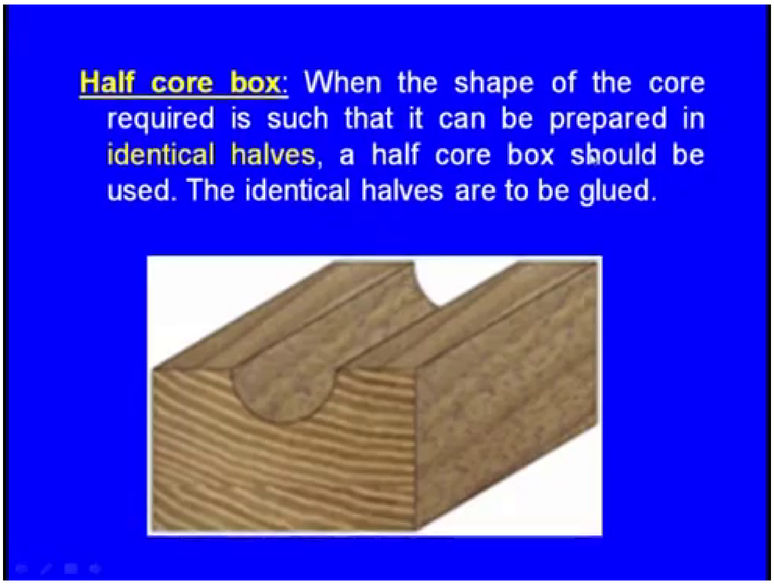


Finally we will see the type of the core boxes; half core box right when the shape of the core required is such that it can be prepared in identical of a half core box should be used, the identical halves are glued together means here we can see a simple core right. So, we can make two halves using the same core box, and these two halves can be glued together. So, this is the half core box.

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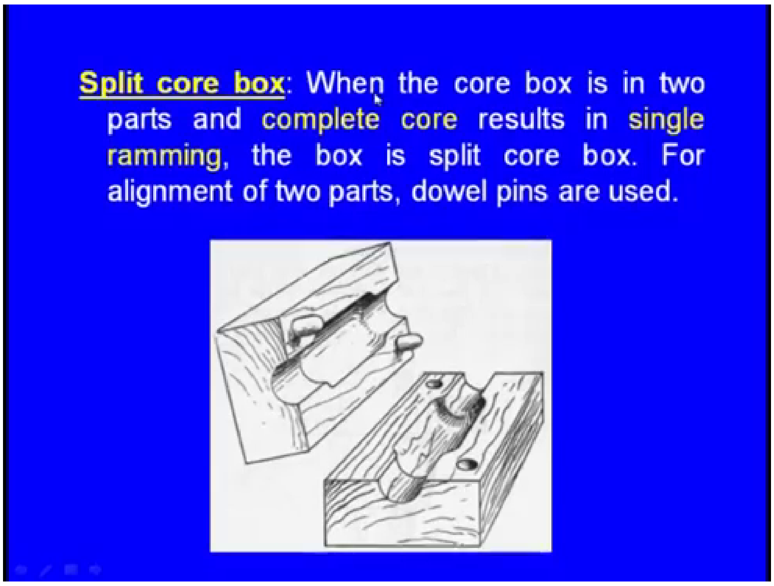


Next one this split core box and here we can see when the core box is in two parts and the complete core results in single ramming. So, there will be two boxes will be there yes please the what say core sand in this gap and what say close the moulding boxes, the axis sand will be coming out and we get the required core of course, we have to cure it before we take the core outside and the it has got the dowel pins.

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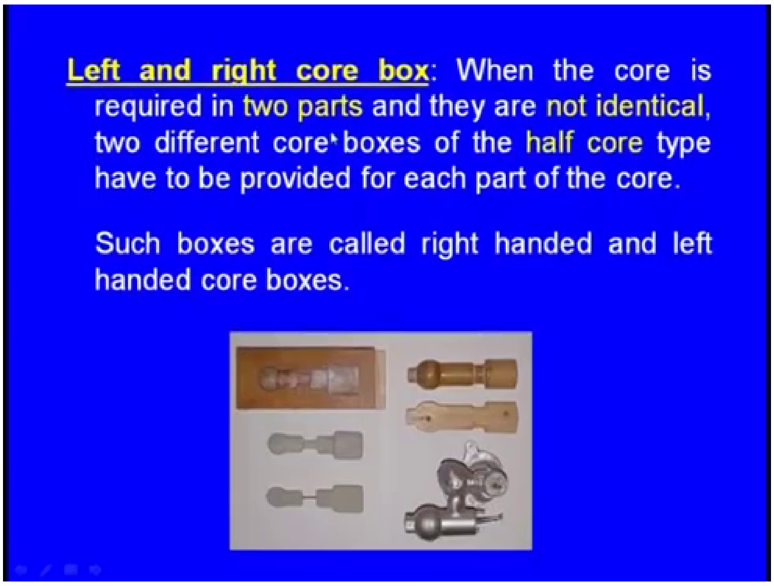


Next one this split box right split core box looks like this, next one left and right core box when the core is required in two parts and they are not identical though different core boxes of half core type have to be provided for each part of the core such box are called right handed and left handed core boxes.

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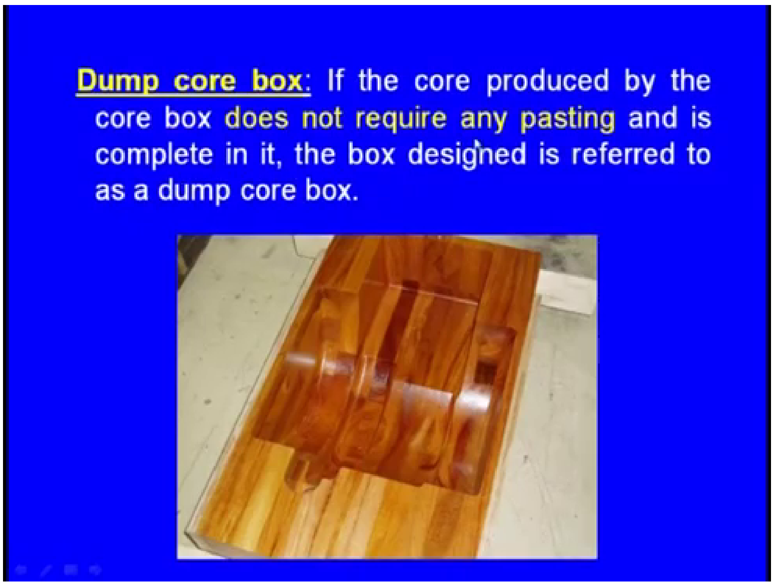

Next one the dump core box; if the core produced by the core box does not require any pasting and is complete in it the box design is referred to as a dump core box and here we can see a dump core box next one strickle core box.

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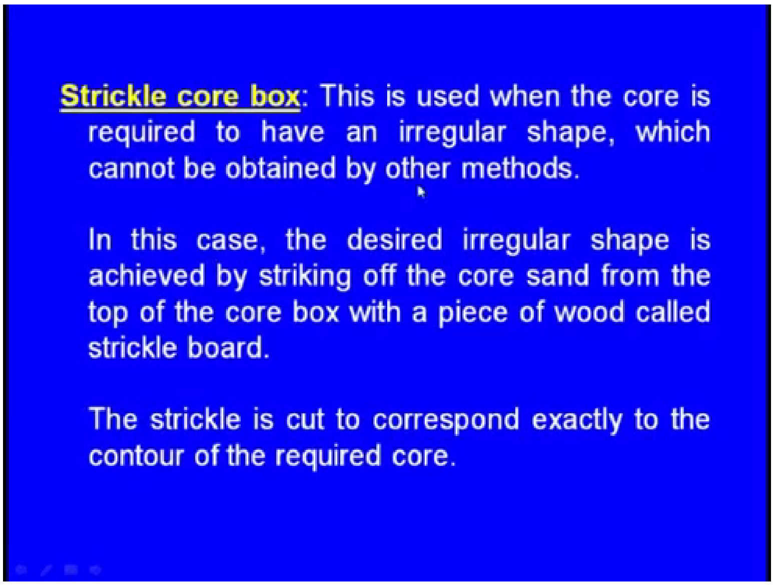


So, this is used when the core is required to have an irregular shape, which cannot be obtained by any other methods. In this case the desired irregular shape is achieved by striking of the core sand from the top of the core box, with a piece of wood called strickle board. This strickle is cut to correspond exactly to the contour of the required core.

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And here we can see this is the strickle core box, and this is the core box are here we place the moulding sand the axis sand will be strickle by a rod striking bar.

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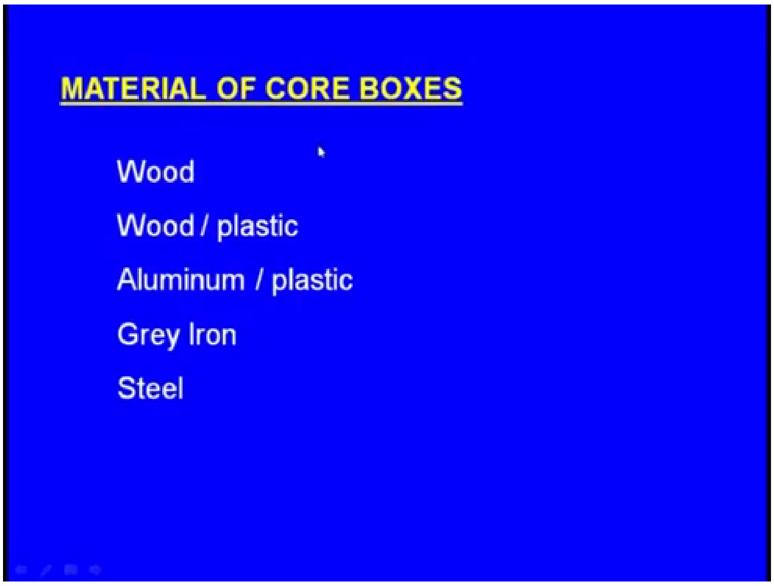


And these are the materials of the core boxes; core boxes can be wood made up of wood, they can be made up of wood along with plastic, they can be made up of aluminum and plastic or they can be made up of gray iron finally, they can also be made up of steel.

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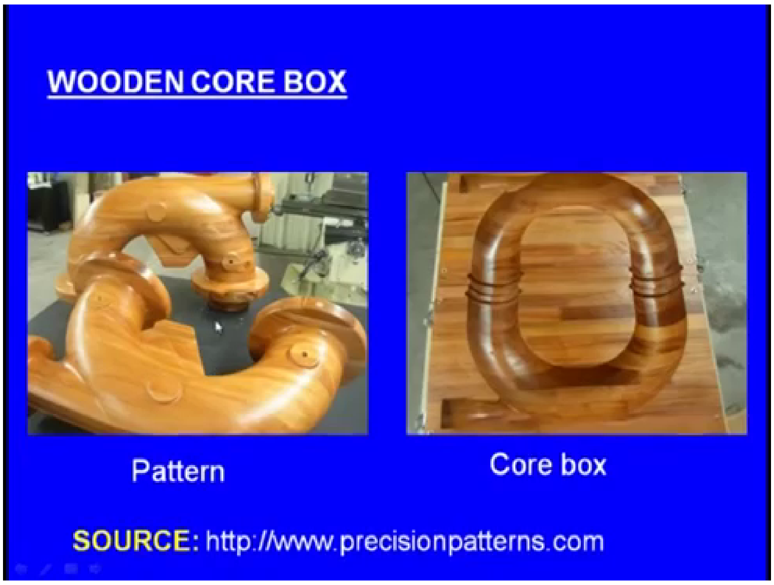


And here we can see these are the wooden core boxes. So, this is the pattern this is the pattern you can see right and this is the core box and here we make the core and this core will be kept inside the mould cavity that is made by using this pattern.

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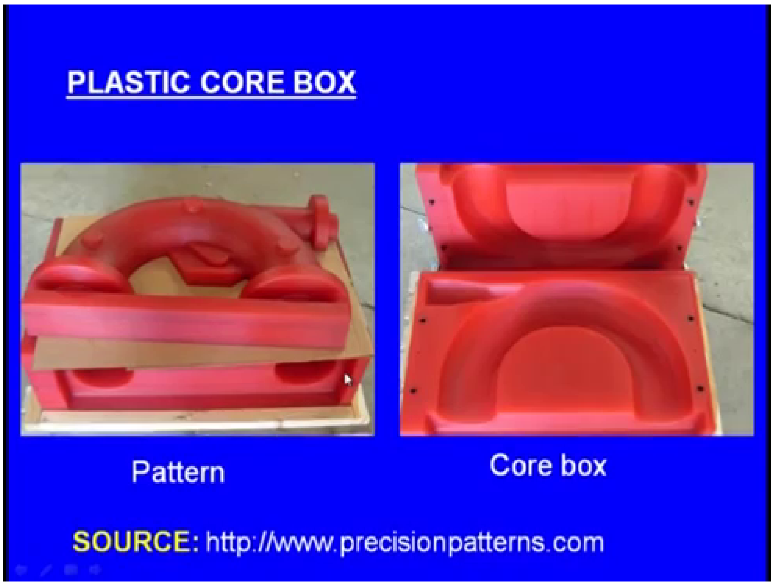


Next one plastic core box and this is the plastic pattern, and the cavity will be created and this is the core box and here we make the core and this core will be kept inside the hollow cavity that is made using this plastic pattern.

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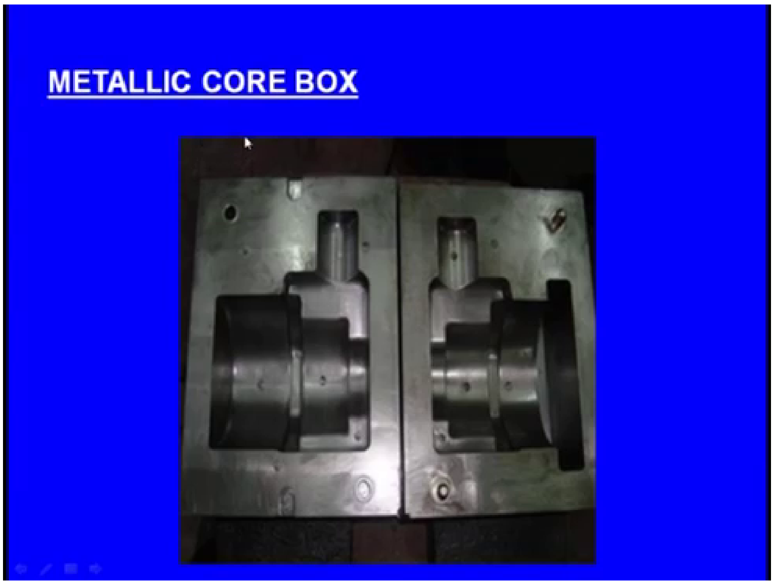


And these are the metallic core boxes you can see here these are the metallic core boxes. Friends in this lecture we have seen the importance and the concept of the cores, we have seen different types of the cores we have seen that the what say cores are mainly divided into green sand cores and the dry sand cores. The green sand cores are made while making the green sand mould itself we do not make that cores separately whereas, the dry sand cores are made independently and later they are kept inside the green mould and we have also seen the classification of the cores based on the what say classification of the dry cores based on the sands that are used, and we have also seen the classification based on the position and we have seen in this class the coatings made to the coating what say cores and the purpose and their applications and finally, we have seen the different types of the what say core boxes and the core material what say material of the core boxes we have seen.

So, with this we are completing the cores and the core materials.

Thank you.