Introduction to Mineral Processing
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Lecture – 29
Industrial Screening (Contd.)

Hello welcome. So, we are discussing about the industrial screens. We have discussed so far about what is the difference between an industrial screen and the sieving operation. We have also discussed about the various types of screens used for various purposes.

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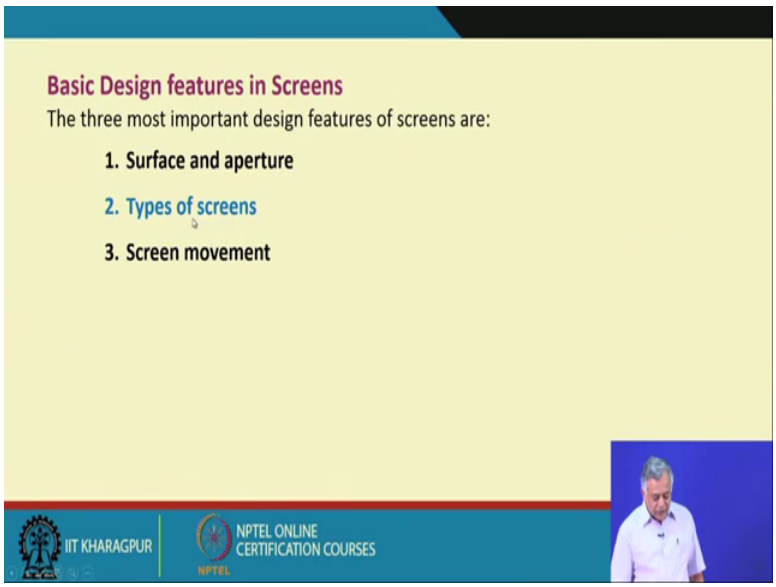

Now, in this lecture we try to discuss about what are the basic design features in the screen. So, if you look at the basic design features in screens, there are three most important aspects or features of the screens are, one is surface and aperture. What type of surface it should be? You may not getting into the topic that what do I mean by surface, but when you discuss it very soon you will be able to understand it.

And the aperture sizes you must be thinking that why the aperture is important because when I want a separation at say suppose at a size of 100 micron or say suppose a 300 micrometer now 300 micrometer is fine if the screen is horizontal to the surface. But if the screen is at an angle or screen is inclined they k now what should be the actual aperture size to have a separation at 300 micrometers and then how do I have that apertures to be built or to be fabricated or to be engineered.

Then the types of screens or the various types of screens not based on the say your different purposes for its use, but also is how the screens effectiveness you try to increase by using various means that is called the types of screens.

Then there is called the screen movement. How the material is being transported through the screen surfaces that is being controlled by various means even by the screen movements also.

So, these are the three most important design features of the industrial screens. I repeat them surface and aperture, types of screens and screen movement we try to discuss these three features a little bit much more at depth.

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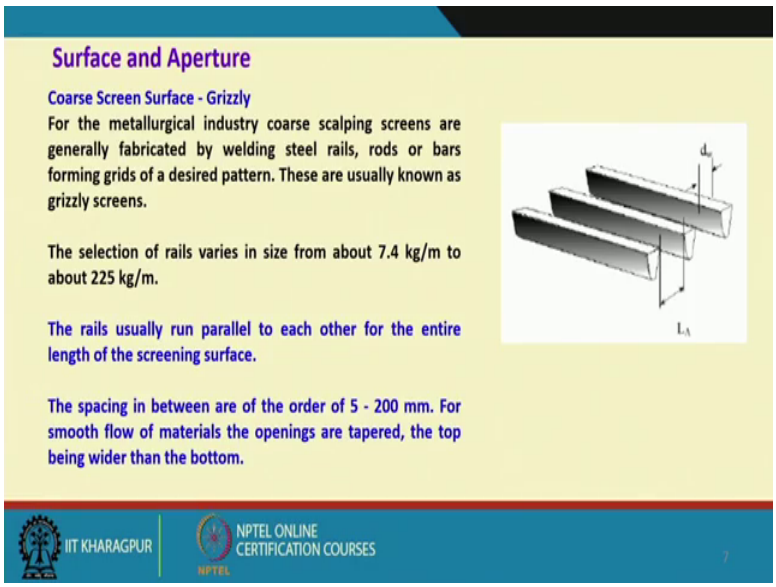

When you look at the surface and aperture now we have to look at that what purpose the screen is to be designed, is it for very coarse material, is it for very five material separation or is it intermediate sizes. How do I know them? That is why we have used a different know your terminologies there is scalping screen like your grading screens and all this.

Now, this is called is coarse screen surface we call it a various. This is a typical screen which is being used in most of the mineral processing operations when the feed material to be processed is directly coming from the mine site. So, that is called the grizzly, the popular name is called grizzly. They look apparently very simple in design, but there are

certain aspects also you have to take into consideration to improve their effectiveness. Now these are nothing, but the scalping screens which we have discussed in detail in the previous lecture. So, for the metallurgical industry course scalping screens are generally fabricated by welding steel rails, rods or bars forming grids of a desired pattern these are usually known as grizzly screens.

Like you see that they are like your rail steel rails and they are basically placed in parallel so that when the material is coming is falling on top of this. So, that is the aperture size. So, this is what is the your dimension of the aperture that is your length of aperture, there is the d w is the how what is the width of my your screen surface. And you see that it is robustly built because they are very heavy duty screens; that means, the material whichever is being say actually being fallen on top of this they are of very large particle sizes. So, they it has to instant that much of impact and while doing the screening job.

The selection of rails varies in size from about 7.4 kg per meter to about 225 kg per meter what it means. Suppose this is the 1 meter length, so when it is 7.4 kg if this weighs 7.4 kg naturally the thickness and the width of this material of this rail will be much less in comparison to while using 225 kg per meter. So, when we are handling your very large height on edges of material per unit time. So, and then we have got a very big particles to be separated or to be handled through the screen surface then we go for very your say much thicker and much deeper say dimensions for this your rail your steel rails.

So, and if it is relatively small at sizes and then if they are not very high density material. So, and if they are soft material we can go for much thinner and much lesser wider your surfaces. So, depending on the application, depending on the nature of your ore characteristic the even this your say dimensions of the rails you have to select because if you go for this 225 kg per meter; that means, the your capital investment will be huge and then your foundation requirement also will be huge and all other engineering say your say features also will cost you more money.

The rails usually run parallel to each other for the entire length of the screening surface run parallel to each other. The spacing in between are of the order of 5 to 200 millimetre that their spacing; that means, whatever is coming out through this they can vary from 5 to 200 millimetre. For smooth flow of materials the openings are tapered you see that

there is a tapering because otherwise what will happen the particle may not fall or may not pass through this opening freely because you are doing the sizing operation here on top of this and once it has passed it should be free flowing in nature otherwise the it may be jammed somewhere in between.

So, they are generally top tapered the top being wider than the bottom. So, you need some kind of your machining or some other your say method you have to have this tapered. So, how much of tapering angle you require? That is again depend say actually depending on the flow ability characteristic of your material which you try to screen.

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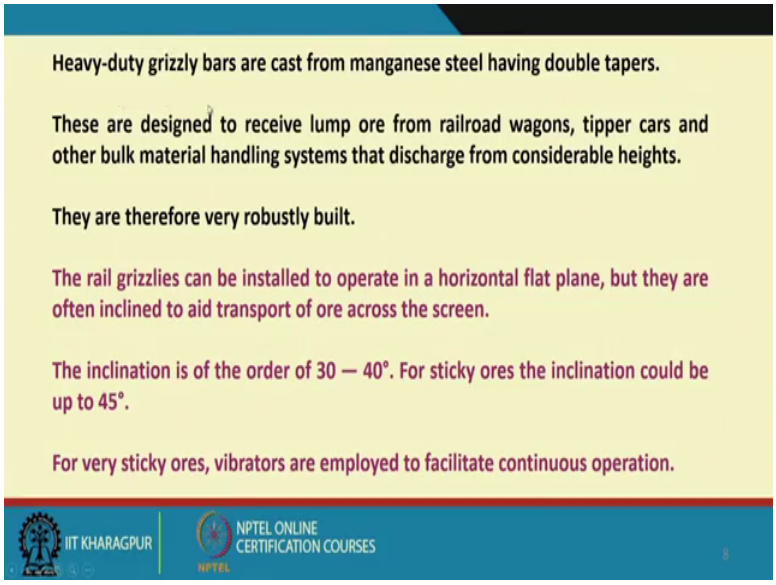

Heavy duty grizzly bars are cast from manganese steel having double tappers that you can have your double tapper also that is you have a taper and then you can have further taper and they are mostly basically made of your cast manganese steel. These are designed to receive lump ore from the railroad wagons tipper cars and other bulk material handling systems that discharge from considerable heights.

Mostly what happens the mind materials they are being transported even to the mineral processing operation, many times by through your some kind of your bulk material handling systems, even they are transported to long distances by different types of bulk material handling systems. One example is through railway railroad wagons that is you are carrying the mined material through your railroad wagons and then what happens

then when it is getting your discharge at the site where the processing operations will be will be happening.

So, there the wagon entirely there is system mechanical system is there that the entire wagon will be tilted and the material will be falling on top of the screen surface from a certain height. So, that as you increase the height of the material from where it is being your support into the surface of the grizzlies, so that will have a huge impact on the screen surfaces. So, if the screen surfaces if the screens are not robustly built, this cannot with stand that impact and they may damage the entire screen. So, that is why it is written that these are designed to receive lump ore from railroad wagons tipper cards and other bulk material handling systems that discharge from considerable height. So, you have to take it into consideration that how the material will be discharged on the screen surface and that will help you in deciding that what should be the dimensions of my grizzly bars.

They are therefore, very robustly built. The rail grizzles can be installed to operate in a horizontal flat plane that they can be horizontal flat plane, but they are often inclined many times they are inclined to a transport of ore across the screen then what happens many a times this is my grizzly many a times the material is poured from this side. So, how do I to relies this portion of the screen surface.

So, because if there is a your inclination if there is a gradient, so then the material on top of that will say actually have a free flow nature because of the gravitational forces and then it will be utilizing the entire your surface of the screen. So, they are many times they are inclined to a transport of ore across the screen surfaces. So, it is again designed that if the screen surface is horizontal then the entire wagons would download or entire bulk material handling system should be able to unload their material on across the width of the and the length of the across the width and the length of the screen surface, otherwise there will be the some unused portion of the screen surfaces will be there, so the screen efficiency will drastically reduced.

But if the material handling system they try to download the material from one end of the screen then it has to be inclined otherwise the free flowing of the material will be hindered and in the part of the screen surface only will be utilized for your screening operations.

The inclination is of the order of 30 to 40 degree. So, it is not only the material handling system what you are using and the point of we are unloading, it is also the material free flowing characteristic. So, you should have the material characteristic the flow ability characteristics of the material to be known beforehand.

For very sticky ores, for sticky ore the inclination could be up to 45 degree because the more inclination means more momentum you can generate for the probability of the materials. So, in the material becomes sticky; that means, you have more of clay content in the ore you should you can go up to gradient up to 45 degree. For very sticky ores even the vibrators are employed to facilitate continuous operation because if these materials for the sticky ores; what will happen? They will try to get your say clogged inside the screen surfaces and then the effective aperture area will be reduced and then the relatively coarser particle they may not pass through your screen surfaces which were supposed to pass through the screen and they may jam the screen. So, in that case you try to even vibrate the screen surface by using some vibrators so that these clay particles, these sticky particles they are loosened from the screen surfaces and they are dislodged from the surface.

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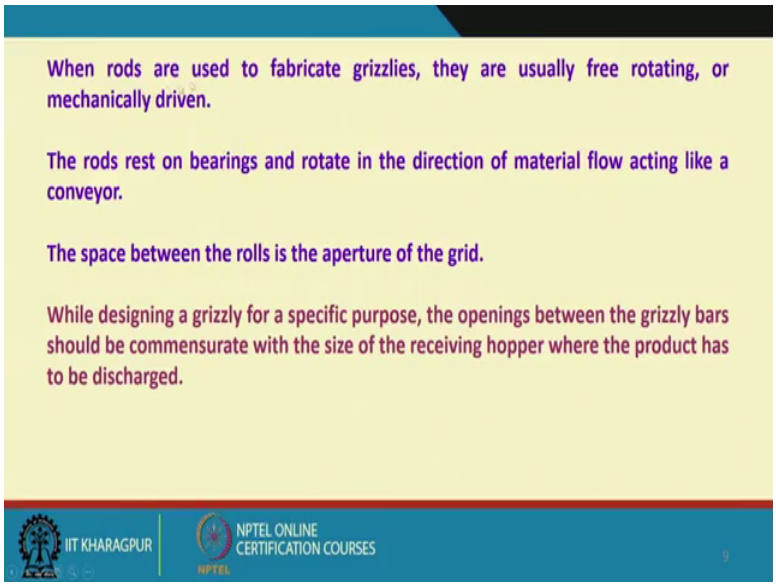

When rods are used that means, it is not always required that you have to use a rail, your steel rails for you are making the grizzlies even you can use the rods, are used to fabricate grizzlies they are usually free rotating type. That means, the rods will

automatically be free rotating type; that means, they are hinged on two ends in such a manner that when there is some kind of your some material starts flowing and then the rods will start rotating and that will enhance the your flow ability of my particles.

And the rods may also be mechanically driven; that means, the rods may be you know your rotation can be generated by some mechanical means also. The rods raced on bearings and rotate in the direction of material flow acting like a conveyor; that means, if I have a grizzly made of rods and the material is being said say downloaded on this side and that is in a gradient. So, the material we try to say travel across that because of its gravitational force and because you have the bearings and you are making the rods of free rotating type of thing. So, when he rotates, it basically helps in the transporting the material as you do in a conveyor built or in a conveyor.

The space between the rolls is the aperture of the grid; that means, you have got two rods like this that is you have a pain here and you have got another pain here. So, the spacing in between that is called up, that is basically the aperture of the grid. While designing grizzly for a specific purpose the operate the openings between the grizzly bars should be commensurate with the size of the receiving hopper where the product has to be discharged. That means, the many times the grizzlies are fed through a hopper. What is a hopper? It is basically a, it is like a your contain a big container where you have the material being poured into that and then the container is like your cylinder conical part and that conical part is basically controlling the flow ability of that material whatever is coming through that.

So, what happens? You are basically trying to control at what rate the material will be basically poured into the surface of my say screens or the grizzlies. So, the openings between the grizzly bars should be commensurate with the size of the receiving hopper; that means, the openings will be such that at what rate the material should pass through that screen aperture it should be synchronized with at what rate the material will be coming through my hopper, discharge it.

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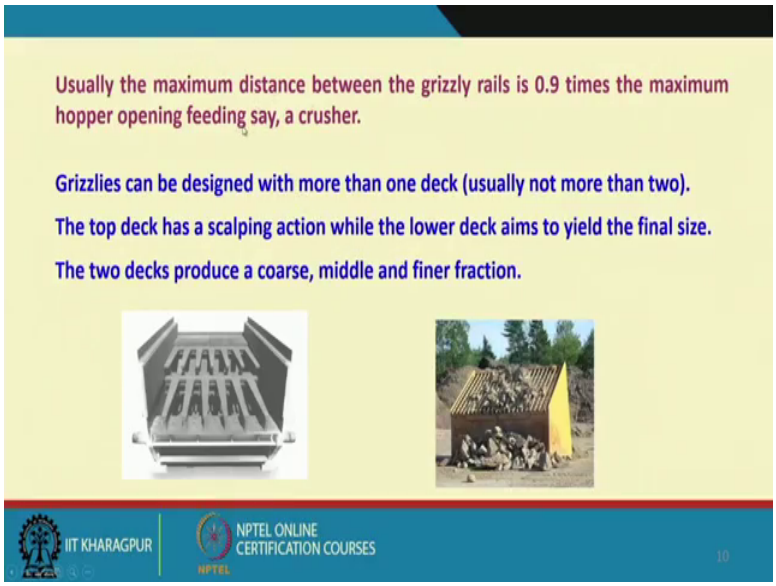

Usually the maximum distance between the grizzly rails is 0.9 times the maximum hopper opening feeding say a crusher. That is let me repeat this the maximum distance between the grizzly rails is 0.9 times, the maximum hopper opening feeding. Say a crusher suppose you have a crusher product and that is being fed to a screen through a hopper and that your grizzly bars that is the maximum distance between the grizzly bars should be minimum say the 0.9 times the maximum hopper opening to prevent your grizzly from getting choked. Grizzlies can be designed with more than 1 deck usually not more than 2; that means, do I need only one surface no many times when we are dealing with relatively finer particles not the large boulders.

So, then you can have even 2 decks. So, what is the 2 decks? The one deck the top deck has a scalping action that is it removes the bigger particles while the lower deck aims to yield the final size. That means, the first part is trying to remove the much coarser particles than the openings of the grizzly and the lower part is basically controlling your the final size of your material the two decks produce a coarse middle and finer fraction. So, what will happen? If this aperture is bigger than this aperture. So, what will happen? So, that you will have a very coarse material which you will decide that whether we should further cross it or not or whether with these materials and we do not require at all. So, you can remove this from the entire circuit. So, you will have a coarse fraction and the material which has passed through this, but retained on that that is the middle size that is because if the aperture sizes are lesser than this sizes. So, you can have in between

sizes and then whatever material is passing through that that is called the finer fraction. So, you can have 3 size fractions when you are using 2 decks, that is one is coarse one is intermediate another one is your finer fraction.

This is also another type of your say your grizzly screen that is material is poured from somewhere from the top by some other means and then you can have the oversized material is taking out like this. So, they are free falling a free flowing material, but you see that some material are getting say actually getting stable on the surface of the screen. So, if you have some kind of your vibration that is that will help this material to flow and then while flowing they will have the interaction between the aperture and then based on their aperture sizes and the particle sizes they will decide that whether I will pass or whether I will retain on top of that and that is how you can have a separation based on the sizes.

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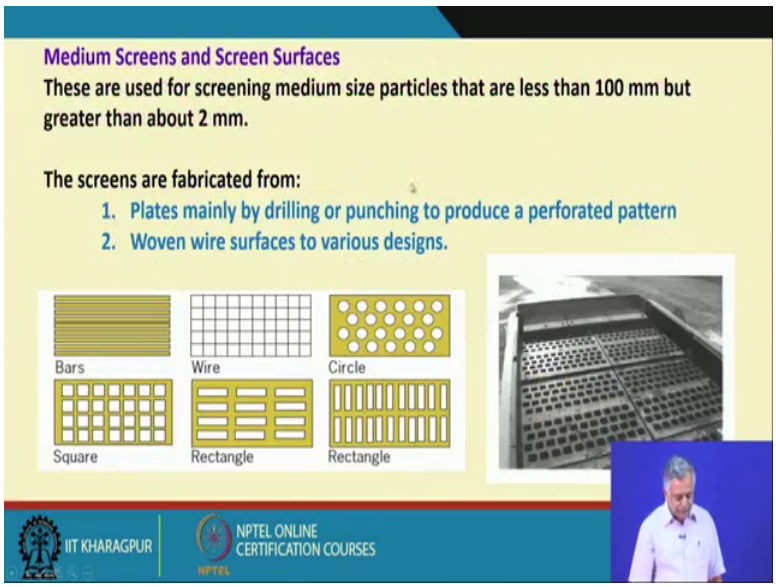

Now, that is about the coarse screens. That is the surfaces and we have structures we have discussed. Now it is called the medium screens; that means, when we are dealing with the medium size fraction; that means, they are not the boulders, they are not directly coming from the mine sites they have already been crossed, they are normally the crossed products.

So, the medium screens and screen surfaces they are used to be these are used for screening medium sized particles that are less than 100 millimetre, but greater than about

t2wo millimetre. So, when the particles are within this range that is within 100 millimetre to 2 millimetre; that means, it does not require that much of your robustness that because I know that individual particle mass is cannot be more than a certain amount. So, and then the bulk material handling system can also be monitored because these are already having some kind of control through my grizzly through my cross product and all this. So, the surfaces are different than what we have used for coarser material that is for scalping purposes. These screens are fabricated from like plates it may be fabricated from plates mainly by drilling that is I can have plates and I can drill it like this or punching or by punching also. So, you can make the holes like this by through drilling or by punching, to produce a perforated pattern like this.

The surfaces also can be made like your woven wire surfaces to various designs like we can have wires on a your surface and it is like your clothes you know if we look at it closely that you will see that there are fibbers which are woven in a particular pattern and that is what is giving you the clothes and these are also perforated your screen. So, these are having very fine screen mediums if we look at your clothes quite closely.

So, like that we can have this your we can have bars even for relatively coarser sizes, we can have wires like this can be woven like this and we can have the different shapes of my aperture like this square aperture you can have a rectangular aperture and you can have a rectangular aperture of different orientation. You can have even square apertures by even by made by some kind of your say your woven wires. So, the wires are being woven wires surfaces or various designs you can make it even you can use the some kind of bars for you are making the surfaces, but here you do not have any control or you have only control on the width of the your aperture, but not on the length of the apertures. These are some of the pictures of images of some industrial screens which are which looks like that they are made of your punch. So, these are basically your perforated pattern that is through punching we have got.

Now, the question comes that is what where we use what type of pattern of these open surfaces. So, that is being decided that for what purpose the screen is being used that is what we have explained it that whether it is for dewatering purposes, whether it is for your grading purposes, whether it is for desliming purposes. So, we can have our apertures properly controlled by this woven wires surfaces mechanism or even by punching holes we can do that.

So, in our next lecture I will try to show you, I will try to explain you that what are the different considerations we should have while even making this your perforated patterns and how do we control that there say different perforations, and then what are the pros and cons of these woven wires surfaces over other surfaces, and then where we use what kind of your patterns. Like whether I will use a rectangular pattern or of aperture, whether I will use a square aperture, whether I will use your circular aperture. So, that is being decided based on the purpose for which the screens are being made for.

Till then, thank you very much.