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Theory and Practice of Non Destructive Testing

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Radiography - 6

So in the previous lecture we talked about image quality and we have seen what are those parameters which control the quality of the image and we have talked about parameters related to the film and the parameters related to the source also okay. But when you actually do radiographic testing and take the image and finally when you develop the image and then inspect it on the image how do you know when you are actually seeing it how do you know whether the image quality is good or not okay.

Because even if you have maintained all the right parameters when the image is actually processed and developed there you do not really know you do not really have any indications which can tell you that the image quality is the right quality that you want okay. So that means you need something on the image which will indicate the quality of the image okay.

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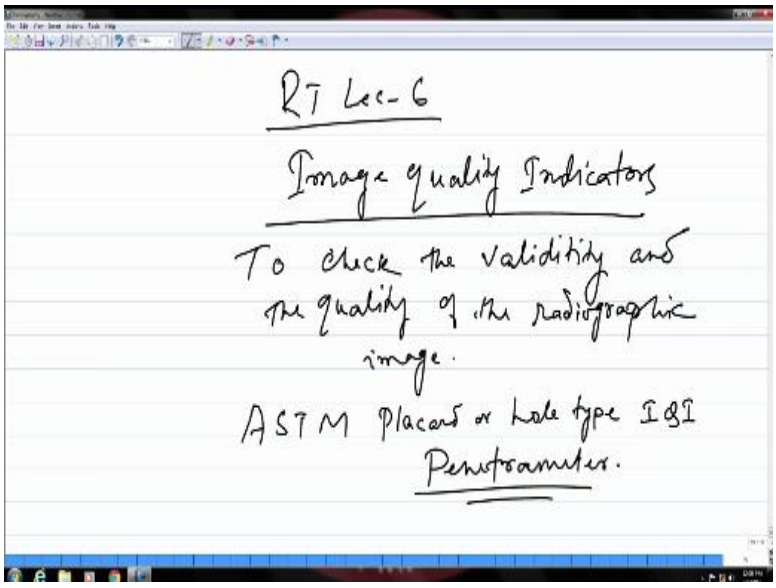

So that is what we are going to talk about right now the image quality indicators okay. So this is to check the validity and the quality of the image, whether the image is acceptable or not and there are different kinds of image quality indicators which are in use. So let us talk about those one by one the first one that you have is ASTM like placard type or hole type.

So this image quality indicators are abbreviated as IQI and the commonly used name for this is penetrameter, people also commonly call them as penetrameter okay. And there are different types which we are going to talk about right now.

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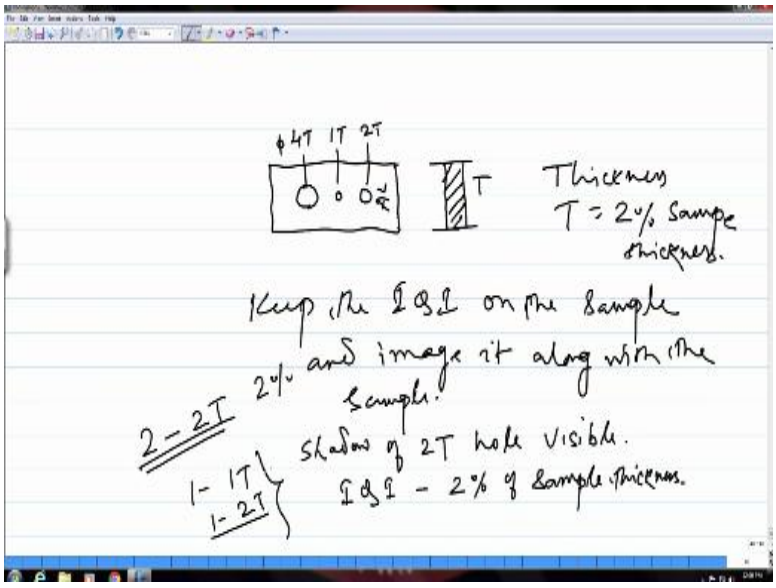

So this STM whole type indicator what you have you have a small thin set of material on which you have number of holes and the size of these holes are according to the thickness of this sheet. Let us say the thickness of this metal set is T, so the diameter of this bigger hole is 4 times T this is one T and this is 2 T okay. So this is how it is made so it is a very thin sheet of a metal on which you have these holes with this kind of size.

And the thickness of this penetrameter T is in terms of the percentage of thickness of the sample okay. For example, this thickness T can be 2% of sample thickness and in this you may also see this kind of lettuce indicated so that will indicate the material of this particular penetrameter okay. So you have to choose the same material as your sample like I would have told this before also then while talking about calibration. So this is also a kind of calibration which does not really calibrate the instrument, but it tells you whether the parameters of the instruments were correct or not when the image was captured okay.

So in this case also this reference which is the penetrameter in this case the material of that should be same as the material of the sample okay. So in this case that is why the material is also indicated on the penetrameter. So here you could see this kind of letters like AL or FE which will

indicate that it is either made of aluminum on our iron okay. So according to your sample material you should select a penetrameter made of the same material.

So this is a small piece which can be kept in a corner of the sample in a region which is not of your interest and image this penetrameter along with the sample okay. So that is what is done keep this IQI on the sample itself in a corner or in some region which is not of interest and image it along with the sample, so this image of the IQI and the image of the sample will be on the same extra film.

And even before you see the image of the sample when you finally develop the image you first see the image of this IQI and in this particular case when you have used a whole type IQI you see which hole is prominently visible on the radiographic image okay. So let us say for the image that you have taken this shadow of the 2 T hole is clearly visible and you have used an IQI whose thickness is at 2% of sample thickness.

So the image quality in this case will be indicated by 2 - 2T in this manner okay. So a 2 – 2T image quality indicates that a 2% material loss can be clearly visible on the radiograph which is imaged by using these parameters okay. Similarly you might see other kind of indications also other kind of image quality also like you can see 11T, 12T and all this, so this is how the quality of the image would indicate in terms of this letters which in turn indicates a sensitivity level like four in this case we saw it was 2% right. Accordingly for the other image quality is also that you see there is a sensitivity level.

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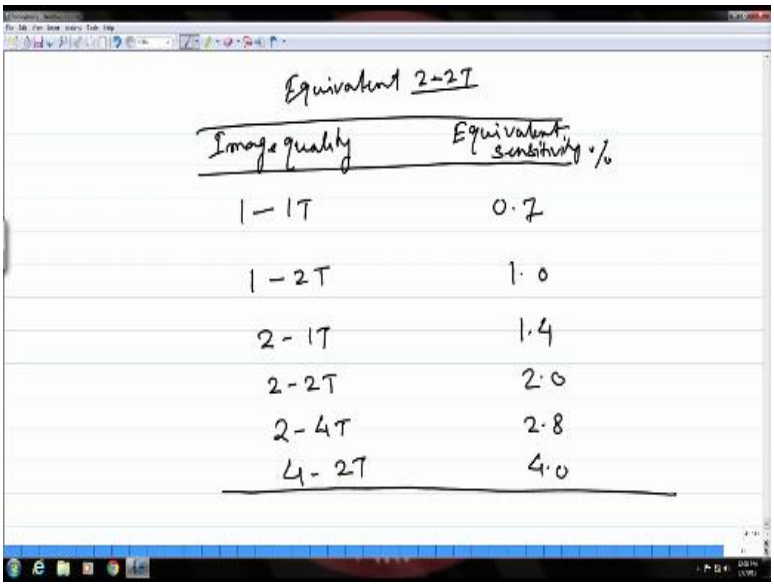

So if you see the image quality for the other kind of hole indications, so the equivalent 2-2T image quality for the other holes will be like this in terms of the sensitivity if it is 11T so the sensitivity is in terms of % so for 11T it is 0.7, for 12tT it is 1% for 21T it is 1.4 %, 2-2T we have seen it is 2%, 2-4T it is 2.8%, 4-2T it is 4%. So like this for different combinations of the thickness of the penetrameter and the hole which is clearly visible on the radiograph these are the sensitivity levels which are specified.

So this is how with the help of this you know you would be able to know the image quality and there will be a requirement for a particular image for example somebody might tell you that I wanted to 2-2T image quality so that means he is asking for a 2% sensitivity, but this may not be the case all the time other kind of image qualities are also you know asked for depending on the requirements like you might want to have 1-2T, 2-4T and other qualities also.

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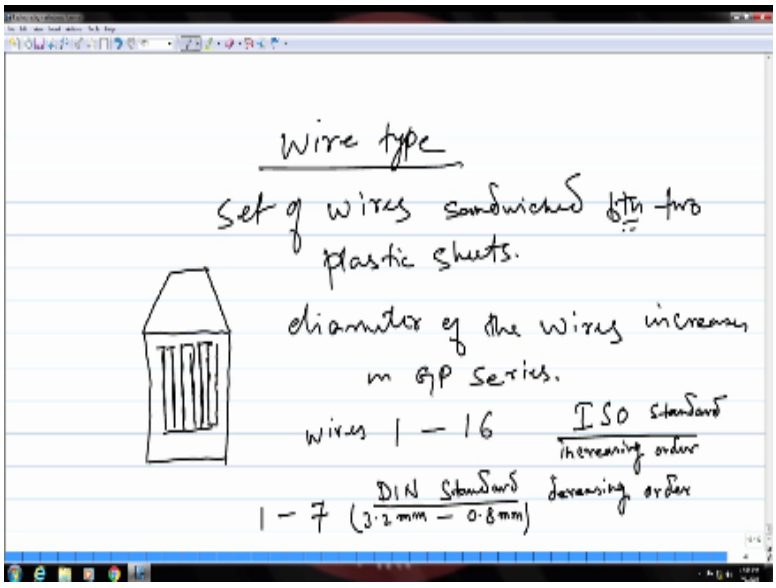

Then you have this kind of wire type penetrameters, so like in the previous case the size of the hole indicates the quality of the image in this case you have a set of wires of particular sizes and the size of the wire will tell you the quality of the image okay. So in this case what you have you have a set of wires sandwiched between two plastic seats and the diameter of the wires increase or decrease in a particular order this generally increases in a GP series.

So what you have basically in this case you will see something like this I have a penetrameter which I am going to show you I have a piece of it so this looks like this something like this so this is the plastic set and inside this you would see a set of wire generally seven wires we will see and from one end the diameter of the wire will increase in a GP series like this, okay so this will gradually increase so you have wires which are given numbers according to their size either increasing size or decreasing size.

So you have wires number from 1 to 16 and according to the standard that you are using this will be either increasing as you increase the number or decreasing. For example, if you are using ISO standard this will increase as you increase the number of the wire, and if you use the DIN standard the construction wise again it will be same we will have a set of wires from small size

to bigger sizes, but in that case the order is decreasing that means as you increase the number of the wire the diameter decreases, okay.

So in one case one standard I also standard it is increasing order and in the DIN standard it is decreasing order. For example, you could have wires from 1 to 7 in this series and this will have for the DIN standard it will have 3.2 mm for the number one wire and as you increase the number it will decrease and finally for the smallest where it is 0.8 mm which is number 7 for the ISO standard it is just the opposite it is increasing so in that case number 1 wire will be 0.8 mm and as you increase the number of the wires it is the diameter will increase and for that case number 7 will be 3.2 mm, okay.

So what you do this is again a small piece like this what I am holding over here so as you could see right there are a number of wires seven wires you can see here 1,2,3,4,5,6,7 and you would also be able to see as you increase the number of the wires in this case the diameter increases, so this tells you this is as per the ISO standard and you could see here that is written ISO is written over here and here there are 7 wires which are numbered from 10 to 16 as you could see that is also written over here, okay.

So this is the penetrameter ISO 10 to 16 having seven wires from number 10 to number 60 and the corresponding DIN standard is written over here okay, and there you also would be able to see the material of this wires which is written at the end over here so in this case it is written Fe that means these wires are made of iron so this has to be used for ferrous materials or the steels iron and steel, right. So this is how the whole thing is made and what you do you have the sample holder like this okay, this is known as a cassette this will talk about some time later.

So inside this you will have the film when you open this you can keep the film inside this okay, here so keep the film here then you can close it which is closed in the dark room itself to protect the film from exposure to light and then your sample will be here somewhere and you keep this in a corner and image the sample like that like what we did for the whole type indicator, okay. In the whole type indicator case we saw which hole was feasible clearly on the radiograph and in this case we will see each wire is clearly visible and the quality will be indicated by the number

of the smallest wire which is clearly indicated on the radiograph, okay. So this is how in this case the film quality will be indicated which is.

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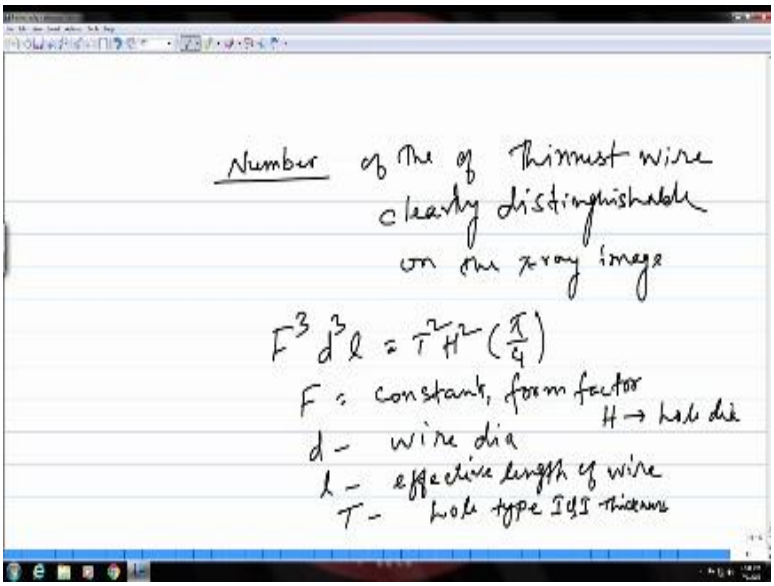

The number of like in this case we have used 10 to 16that number series so you see the number of the thinnest or the smallest wire which is visible, okay. So this is how in this case the number of that particular thinnest wire which is clearly distinguishable on the x-ray image will indicate the quality of the image and there is a relationship by which this quality which is provided by this number can be converted to an equivalent quality for the whole type kind of quality, okay.

So this can be converted into a 2-2t kind of quality through that particular relationship and that relationship is like this, where F is a constant which is known as a form factor, d is the wire diameter, l is the effective length of the wire, t is whole type IQI thickness and this is H is the hole diameter, okay so you could see a relationship between the hole diameter and the thickness of the whole type in 80 meter and the diameter and length of the wire and through this you would be able to convert a wire type quality into a hole type image quality.

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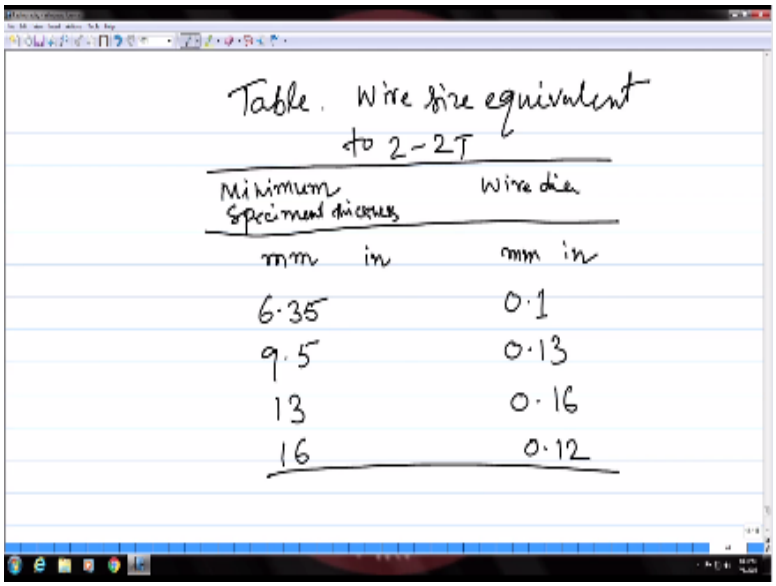

For example, you can convert this wire diameter into an equivalent to 2-2t type image quality with the help of this kind of tables, which is derived based upon that equation and the sensitivity or the image quality would depend on the specimen thickness so this can be taken either in millimeter or inches for a sample thickness for example of 6.35mm the wire that should be visible clearly for a 2-2t type image quality should be of point 1 mm diameter.

Similarly for 9.5 mm sample thickness the wire diameter should be 0.13 mm, for 13 mm it should be 0.16 for 16 it should be 0.12 and so on okay, so this is how a wire type image quality can be converted into an equivalent to 2-2t type of image quality with the help of this table which is based upon the previous equation that we derived, okay.

So this was all about image quality so we have seen and understood what are those parameters which can which will control the quality of the image and just now we have also seen how the image quality can be indicated for the end user to see whether the quality of the image is acceptable or not which can be done by using this kind of penetrameters or image quality indicators which are known as IQI okay, so with this I am going to stop here today and I will see

you next time with the rest of the things that we have for this particular technique, thank you for your attention.

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