Glass Processing Technology
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Lecture - 46
Insulating Glass Unit (Process and Lab Tests)

Now we are going to see the defects that are going to rise in DGU process, that is a double glazing unit.

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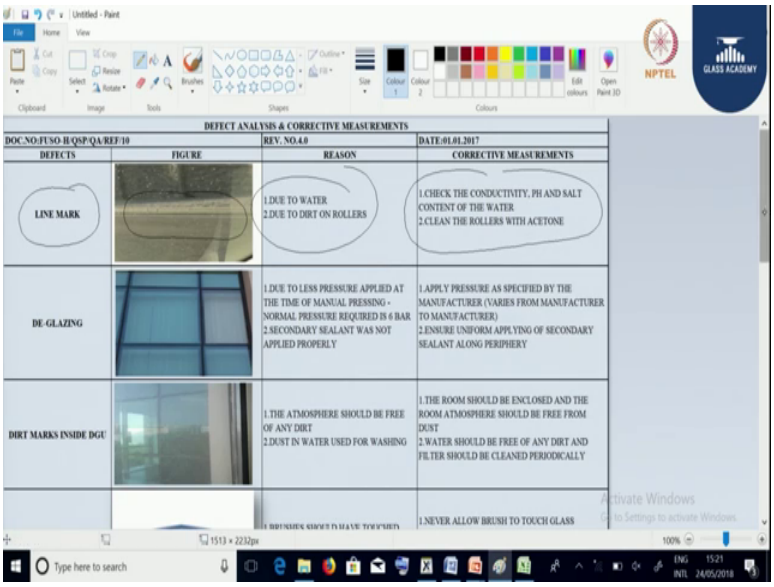

We see, we can see the defect is line marks; means lining on the glass surface. You can see the lining on the glass surface; the reason being because of poor water or because of the dirt on the rollers. We can overcome this issue by checking the water parameters like conductivity pH and salt contains in the water and clean the rollers with acetone on a regular basis.

Next defects what we are going to get is de glazing; means the 2 glasses got separated. You can see in the figure the glass, the one of the glass got fallen down because there is there is the one of the glass got fallen down, the reason being due to less pressure applied at the time of manual pressing normal pressure required is a 6 bar. Secondary sealant was not applied properly. We can overcome these issues by applying a pressure as prescribed by the manufacturer and ensure uniform applying of secondary sealant along the periphery of the glass.

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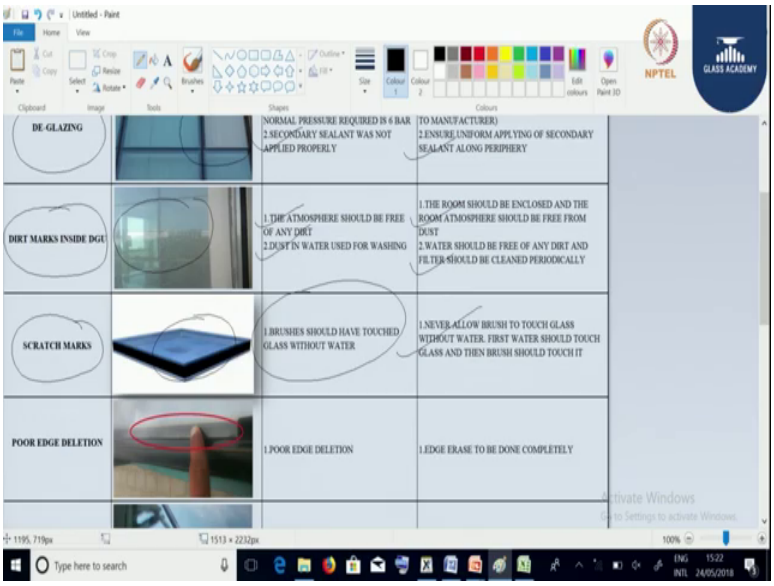

You can see dirt marks inside the DGU. You can see there is a dirt marks inside the DGU in the figure. The reason being the atmosphere should be free from any dirt and dust in water used for washing. We can overcome these issues by the room, by the room should be clean and enclosed and room atmosphere should be free from dust. Water should be free of any dirt and filter should be cleaned periodically.

Next you can see the scratches mark scratches on the glass surface. This is because of the brushes should have touched the glass without water. We can overcome this issue by, we should never allow brush to touch the glass without water. First to water should touch the glass and then brush should touch the water. Next one is poor edge deletion, you can see here in the figure the because the edge deletion, that is the edge deletion what we have done on the glass is not complete.

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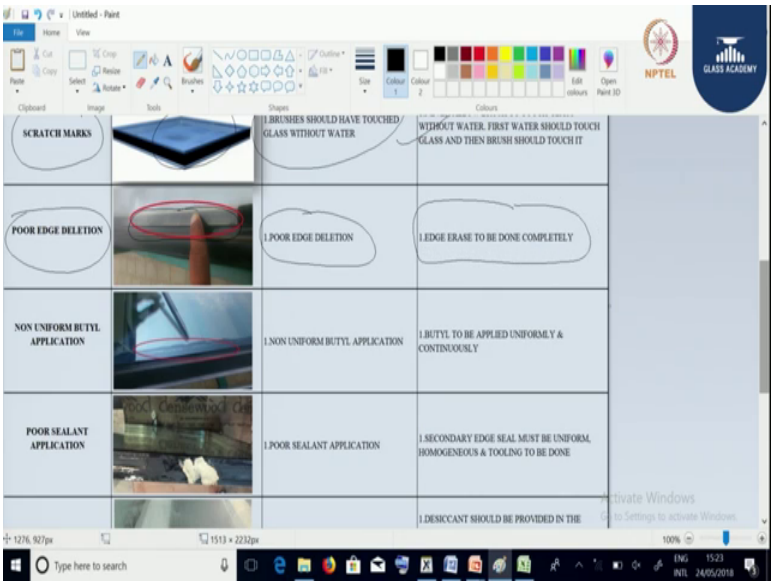

If there is a poor edge deletion you can see the traces of the coating. Our intention is the coating surface should be completely removed, and the surface should be as good as a clear glass. This is because the reason being because, of poor edge deletion and we can overcome this issue by properly doing the edge deletion and with the proper wheel to be used with proper pressure.

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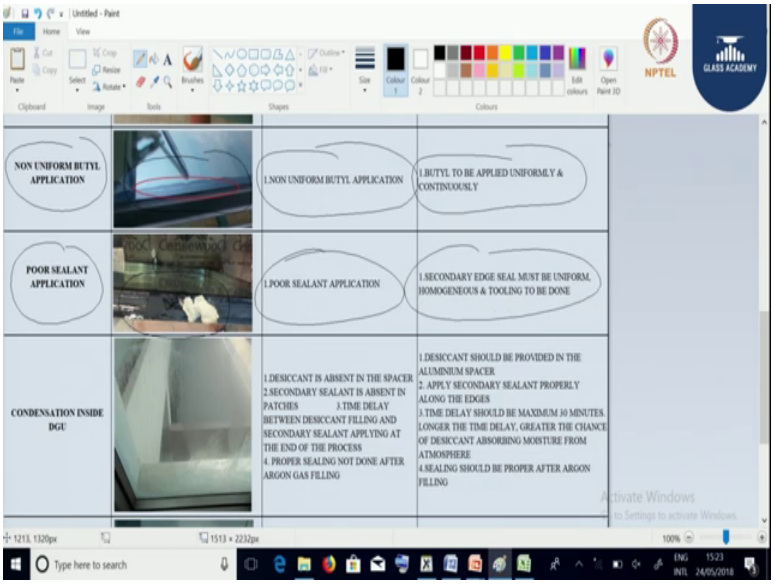

Next one is the non-uniform butyl application. You can see in the figure the butyl is like a zigzag line. Always the butyl should be straight and it should be continuous. The butyl

acts as a moisture barrier. The reason being the zigzag line reason being the non-uniform butyl application, and we can overcome this issue by applying butyl uniformly and continuously.

Next defect what we are going to get in DGU is the poor sealant application. You can see there is a depth insufficient or there is a continuity missing in the sealant. The reason being because of poor sealant application; we can overcome this issue by maintaining a proper edge seal and the uniformity and tuning to be done once the pasting is done.

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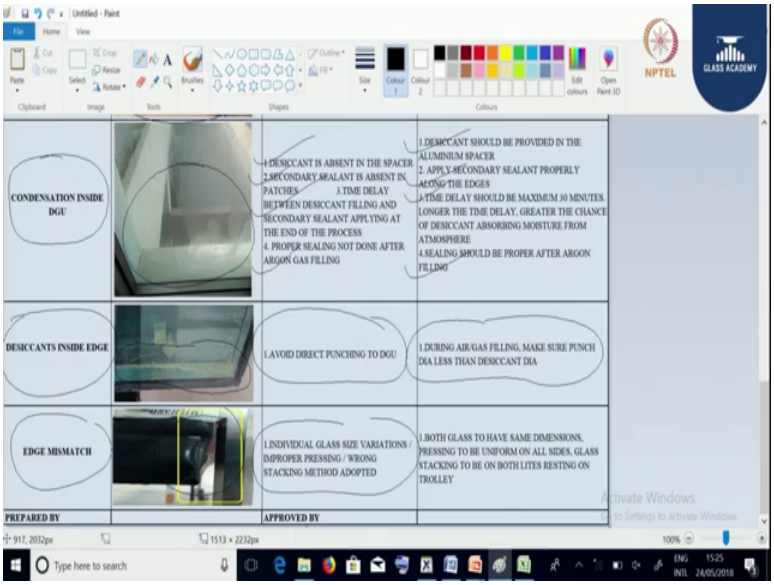

Next defect what we are going to get is the condensation inside the DGU that is, the moisture is trapped inside the DGU. The issue the reasons being, desiccant is absent in the spacer or the secondary sealant is absent in patches or time delay between the desiccant filling and the secondary sealant applying at the end of the process or proper sealing not done after organ gas is filled.

We can overcome these issues by desiccant should be provided in the aluminum spacer, apply secondary sealing properly along the edges, time delay should be maximum 30 minutes, longer than the time delay, greater the chances of desiccant absorb the moisture from atmosphere, and sealing should be proper after organ gas is filled.

The next defect what you are going to get is a desiccants inside the DGU. You can see here; the desiccants are fallen inside the DGU. The reason being avoid direct punching to

the DGU. Generally, we whenever we go to any glass which is having desiccant inside, the major cause is you can see the DGU got drilled. So, we need to avoid the drilling, direct drilling of the spacer. We can overcome this issue by air or gas filling, make sure that the punches in the dia is less than the desiccant dia.

Next defect you can see is the edge offset. You can see with the right angle there is offset of the edge in the figure. The reason being individual glass size variations or improper pressing or wrong stacking method adopted; you can overcome this issue, by both the glasses to have uniform dimensions, pressing to be uniform on all sides, glass stacking to be uniform, resting on the trolley.

So now we will be starting the various tests that are applicable for a insulating glass unit. Let us start with butterfly test. The butterfly test we perform on secondary sealant. The secondary sealant is available in 3 forms in the market; that is, insulating glass unit, sorry structural glazing unit and for weathering sealant.

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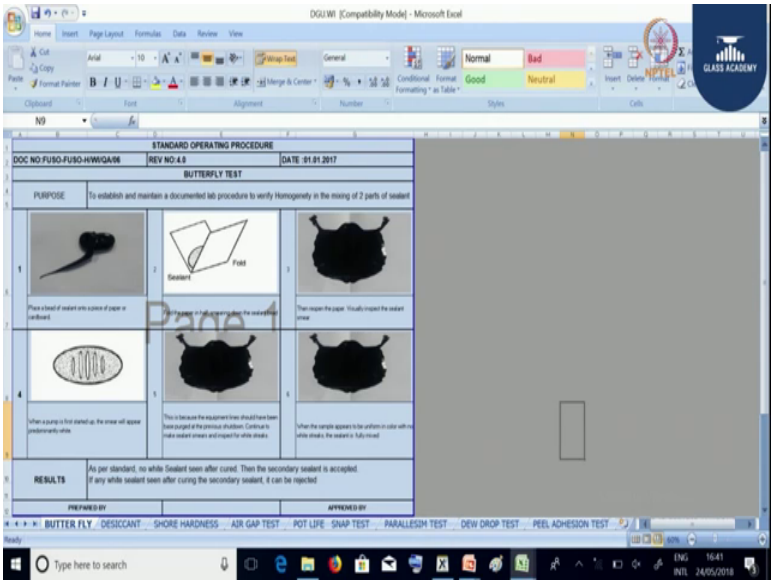

Now, let us take the insulating glass sealant. The purpose of doing butterfly test is as the sealant secondary sealant is a 2-part component. We need to maintain the homogeneity of a 2 parts of the sealant, and one of the tests which is used to see the homogeneity in the mixing is the butterfly test. The procedure what we do is, first we will be taking a piece of, we will be taking a bid of sealant onto the piece of paper, and we will be folding it

and we will be trying to open. When we open the shape of the sealant shall come like a butterfly.

So, that is why it is called a butterfly test, and if you see if at all after once you are open the paper and you are able to see any white patches. Any white patches in the sealant, then you say that there is a mixing issue is there in the sealant. If there is no mixing issue in the sealant, the sealant will come out to be black. So, through this butterfly test we are ensuring that, there is a homogeneity of the mixing of the 2-part sealant is maintained.

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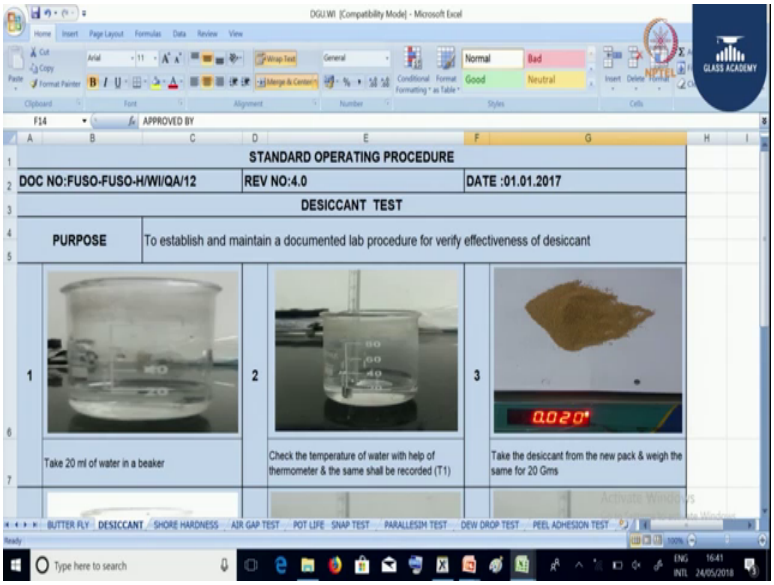

Next test what we do is a desiccant test, that we use inside the spacer to absorb the moisture. If you see here the first what we do is, we will be taking a 20 ml of water in a beaker. Next we will be measuring the temperature of the water, then we will be taking a 20 grams of desiccants and we will be pouring the desiccant inside the water.

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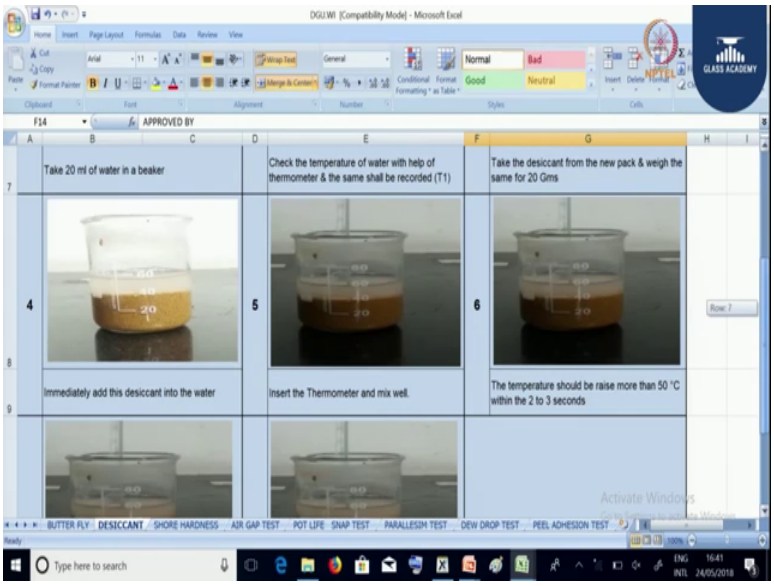

And we will be checking the temperature after the desiccants is kept inside the water. Within a fraction of seconds, the temperature will raise.

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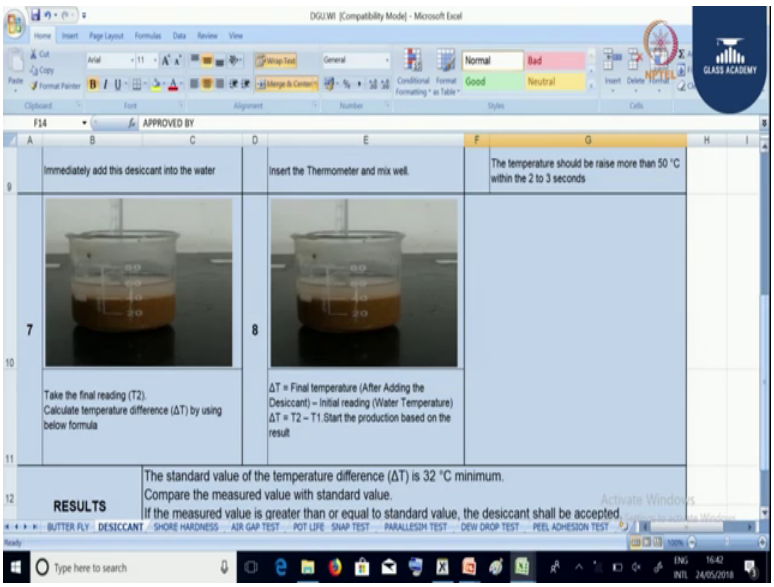

Then we will be calculating the temperature difference; that is, the temperature difference, that is after adding the desiccant what is the temperature minus initial water temperature will give me the desiccant temperature.

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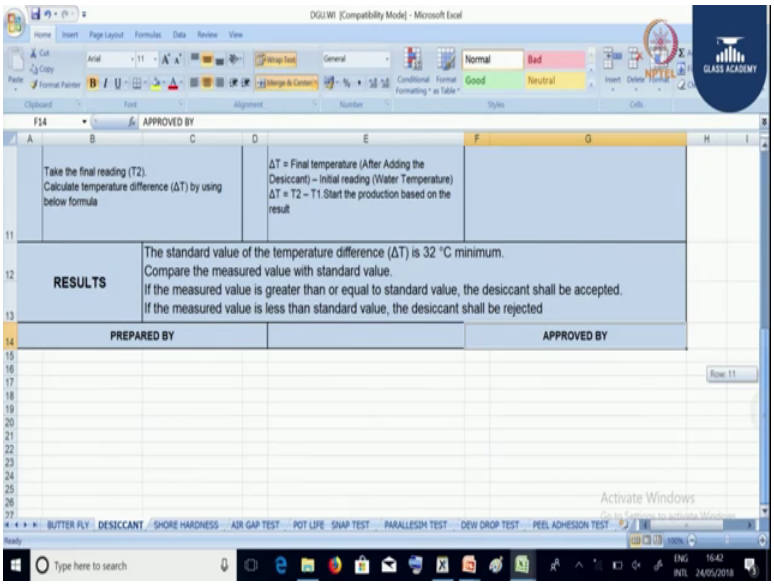

And it should be minimum 32 degrees centigrade. You can see the standard value for temperature difference is 32-degree centigrade minimum, ok.

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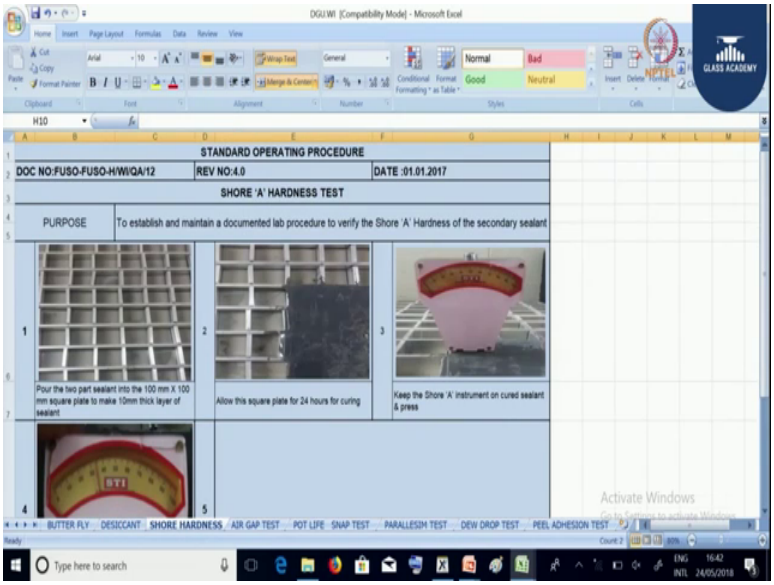

Next we will see the shore hardness test. The shore hardness test is used to check the hardness of the secondary sealant. The procedure what we do is, we will be taking a, we will be taking a 2-part sealant into a 100 mm, 100 by 100 mm square plate of 10 mm thick layer. Then we will be applying a secondary sealant on the area of 100 by 100 mm square area and after 24 hours of production we will be trying to see the hardness with

the help of a shore hardness tester. You can see in the figure 3, we are keeping the shore hardness equipment shore hardness tester on the sealant and we are trying to measure the reading.

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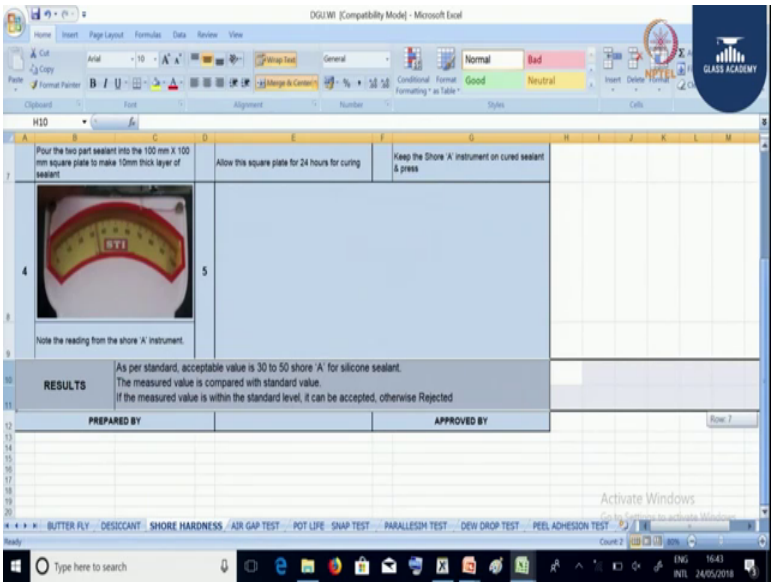

If you are getting more than 30 then it is a good sealant. You can see here as per the standard acceptable value is 30 to 50 shore a for secondary sealant. If you are getting below means, still it requires curing, and if you are getting higher value means always there is a chances of getting the sealant as a sticky material. Secondary sealant should be should act as a rubber material.

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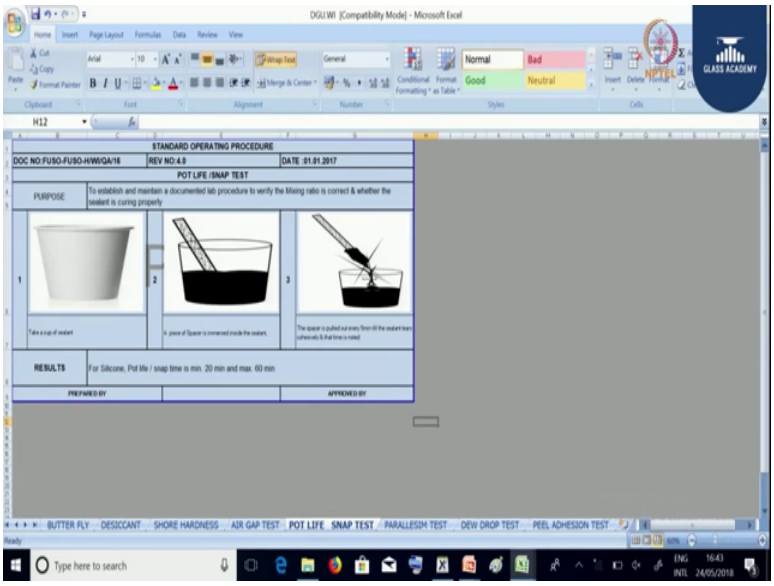

Next if you see we have one more test, known as spot life test or snap test. The test why we use is to the test, why we do is to have the curing snap time will determine the curing time and the curing rate. This test is to you can see here the procedure what we follow is; first we will be taking a cup of sealant inside the sealant, will be we will be taking cup of, first we will be taking a cup inside that will be applying a sealant, and we will be taking a spacer and we will be inserting inside the cup and we will try to remove the spacer every 5 minutes.

At a particular time, it will not come out. We need to see here the whether it is a cohesive failure or adhesive failure, and at what time. If it is tearing within itself and a particular time is we need to note down note down that time. And the result is for silicon the snap time should be minimum 20 minutes and the maximum is 60 minutes. Basically the snap time will determine the curing time between the glass and the spacer.

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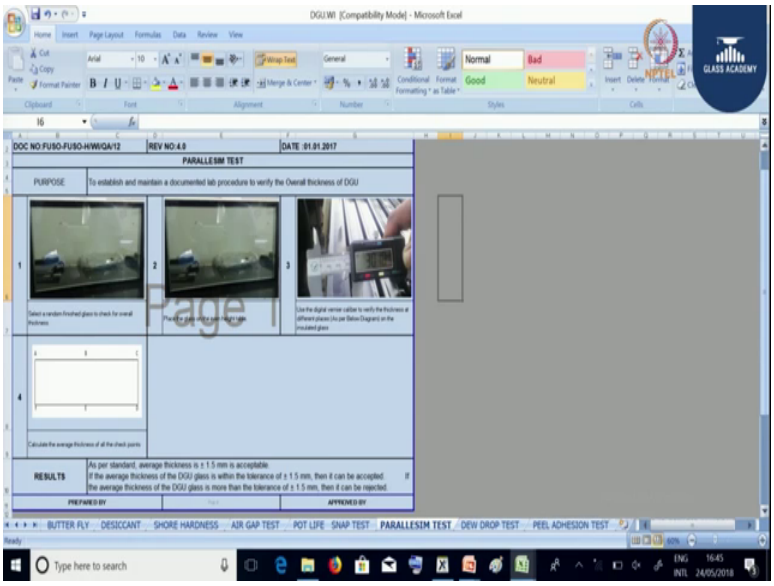

Next test what we do is the parallelism test, that is known as to measure the overall thickness of the DGU. What we do is, first we will be replacing the DGU vertically on at the edges or at the center of the 4 edges we will be measuring the thickness of the glass. Generally, the thickness of the glass includes the individual glass thicknesses and the air gap what the DGU is covering with. So, if you see in the figure 4, we should be measuring the overall thickness at this particular areas a, b, c, d, e, f. And as per the standard as we have seen in the standard the thickness difference shall be plus or minus 1.5 mm is acceptable.

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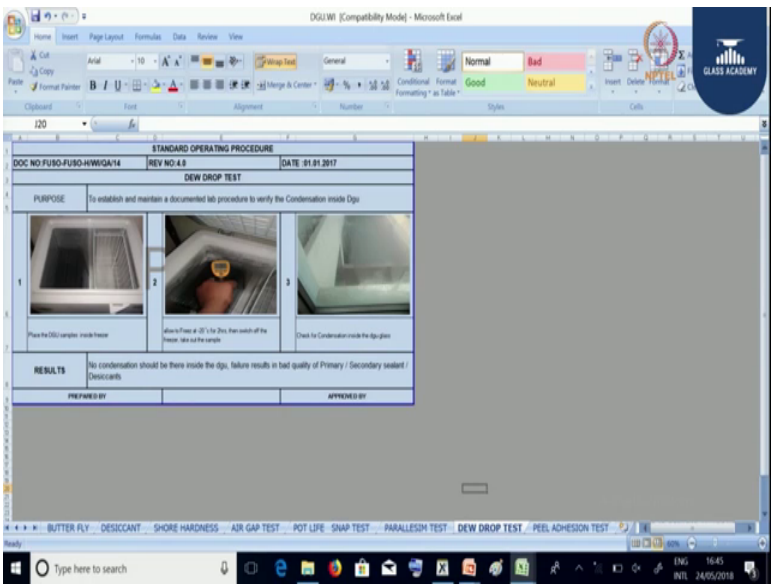

Next test what we do for DGU is a dew drop test. The procedure what we follow is we will be taking a DGU glass, a final DGU product and we will be placing the DGU glass inside the freezer. And we are going to freeze the glass at minus 20 minus 20 to 20 degree centigrade for 2 hours. And with the help of a pyrometer, we will be measuring the temperature of the glass. If at all the glass is properly sealed with butyl continuity and desiccants we will not find any condensation or dew drop inside the DGU.

If you are getting a condensation inside the DGU like figure 3, you can say that this is because of there is a failure of the butyl, that is the butyl is not continuous or there is a gap between there is a no discontinuity of butyl. The desiccants what we place inside the spacer or not in a position to absorb the moisture; so, here we need to for dew drop test, we need to find out 3 things. You can see in the result no condensation should be there inside the DGU. Failure shall result in the bad quality of the primary sealant, secondary sealant and the desiccants.

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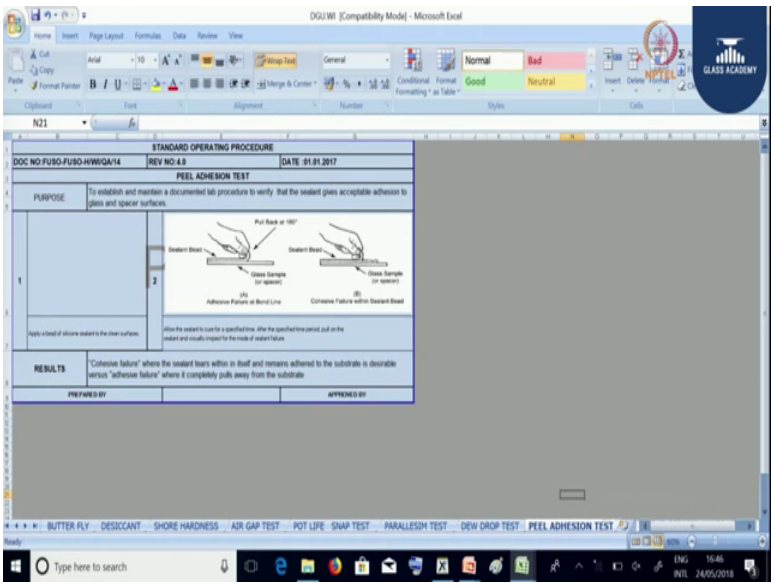

Next we will see silicon peel adhesion test. This is also one of the test performed on the secondary sealant. If you see we try we will be applying the sealant on a spacer, and we will try to remove we will try to remove the sealant. When the sealant is completely coming out, you can say there is a adhesion failure between the secondary sealant and the spacer whereas, in the figure b you can see there is a cohesive failure, where some of the sealant is still sticking to the spacer. So, with the help of a sealant this peel adhesion

test, we can measure the adhesion between the spacer and the sealant. Now we are going to see the test that we do for laminated glass.

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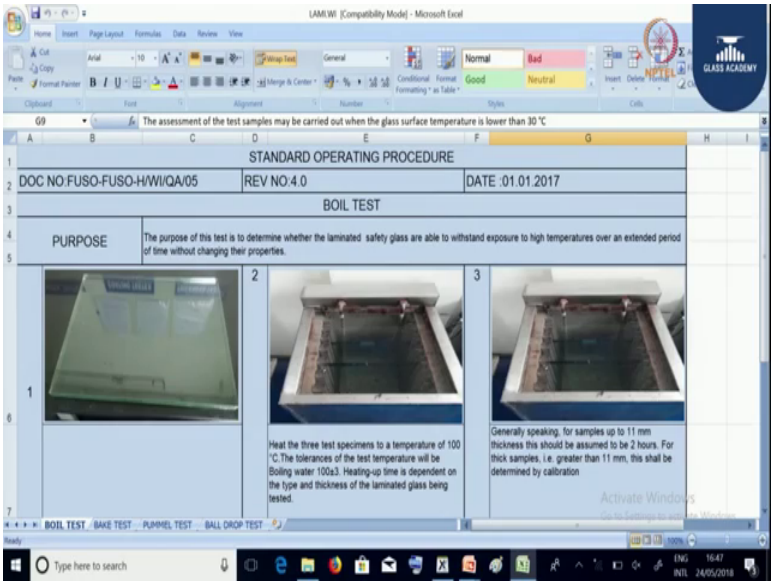

Let us take boil test. The purpose of this test is to determine whether the laminated safety glass are able to withstand exposure to high temperatures over an extended period of time without changing their properties.

The steps what we do is, first we will be taking a laminated glass. We will be placing the; first we will be taking a laminated glass and we need to have a boil test chamber. Here we heat the here what we do is first we will be placing the we will be taking inside the boil test chamber. We will be filling with water and we are going to keep the temperature of the water at 100 degree centigrade. And we will be placing these glass samples inside the water for 2 hours.

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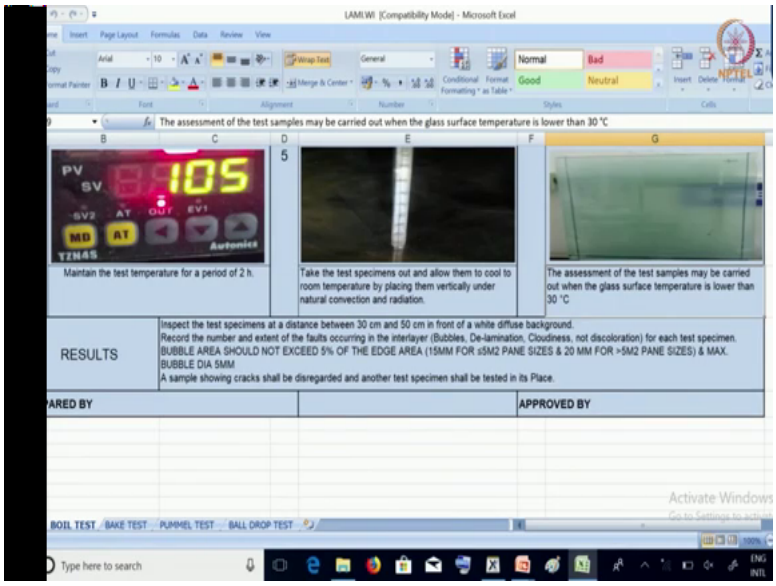

Then we will be trying, we will be opening the glass you can see here the temperatures. You can see in the figure the temperatures. First figure will show you it is a laminated glass, the second figure will show you the glasses are kept inside the boil test chamber, the third figure you can see the temperature of the glass is maintained at 100 degree centigrade for 4 hours, the 2 hours. In the 4th figure also you can see the temperature

And 5th you can see with the help of thermometer also you can measure out. There is a 100 degrees the temperature of the water. And once the 2 hours is completed at a 100 degree centigrade, we will be removing the glass from the boil test chamber. And with the background we will be trying to inspect the glass for bubbles, haziness and discoloration.

The result what we can see is, inspect the test specimen at a distance between 30 centimetres to 50 centimetres in front of a wide diffused background, record the number and extent of faults occurring in the interlayer, in the form of bubbles delamination cloudiness discoloration for each text specimen. Bubble area should not exceed 5 percent of the edge area; that is, 15 mm for less than 5 square meter glass and 20 mm for more than 5 square meter glass. And maximum bubble dia should shall not exceed 5 mm. A sample showing cracks shall be discarded and other test specimen shall be tested again.

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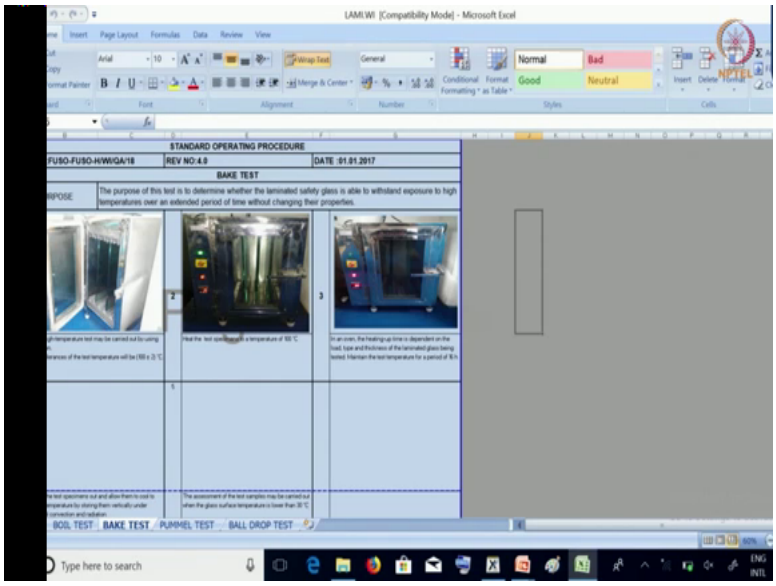

Next we will be understanding the next test, that is used for temperature, that is the bake test. In bake test what we are going to see is, the purpose of this test is to determine whether the laminated safety glass is able to withstand exposure to high temperatures over an extended period of time without changing these properties. First what we will be do is, we will be taking a bake test oven and inside the bake test oven, we will be placing the glasses at 100 degree centigrade for 16 hours, then gradually every 1 hour we are going to increase the temperature by 10 degrees.

For example, if I am keeping the glass at 100 degree centigrade for 16 hours, on the 17th hour I will be keeping 110 degree centigrade, on the 18th hour I will be keeping 120 degree centigrade; like that every hour I am going to increase 10 degrees temperature. And I will be taking out the glass inspecting and again placing back in the oven. For bubbles or any discoloration; at a particular temperature the bubbles started to form, I will be noting the temperature, the minimum temperature that glass has to withstand is 135 degree centigrade.

And beyond 135, I need to say what up to what level my glass is able to withstand. So, basically with the help of bake test I am able to see the durability over the durability of the glass for a high temperature. Next you can see the pummel, next you can see the pummel graph.