Glass Processing Technology
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Lecture - 48
Processing Standards (EN NORMS) & Checks

Hello everyone my name is Chiranjit Roy. I am the national manager for projects and processing in Sengobben India private limited. Today I am going to take you through the processing standards and the checks. We will be discussing on what are the EN norms of different processing standards and what are the checks carried out for doing different processing.

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So, the agenda of today's presentation is processing on glass standards and checks we will be covering fully tempered glasses, then second we will be covering heat strengthened glasses. Then we will be covering insulated glasses and then we will be covering that laminated glasses. The tempered glass standard in European norms is EN EN 12150.

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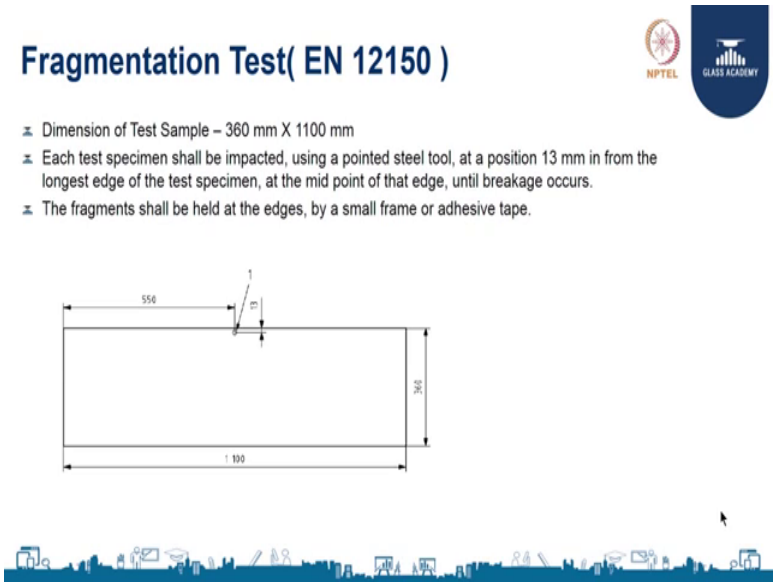

So, first test what we are doing is the fragmentation test. So, for the standard specification of the sample to be tested is 360 by 1100. So, along with every lot we need to set one glass for testing and this is the destruction test and this test is called fragmentation test.

So, we have what we have to do is we have to break the glass at the centre of 1100 mm sizes. So, from the centre you have to come at the 30 millimeter distance and then you have to break the glass with the help of a small tool.

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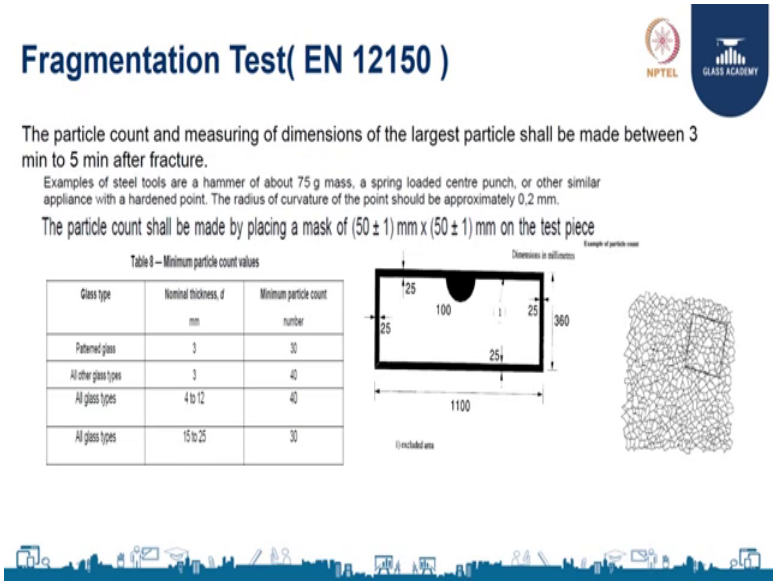

For the fragmentation test you have to break the glass at the centre as I said in the earlier slide. And you can see from the point of breakage you have to exclude the area around 100 mm from the centre. And from the edges you can reduce 25 millimeter all across the thing.

And you can count in a am I putting a mask at a in a dimension of 50 mm by 50 mm plus minus 1 mm. And you have to count the number of particles in EN says from 3 millimeter to 12 millimeter the minimum particle count should be 40 and for all other glass thickness is from 15 to 25 which would be minimum 30.

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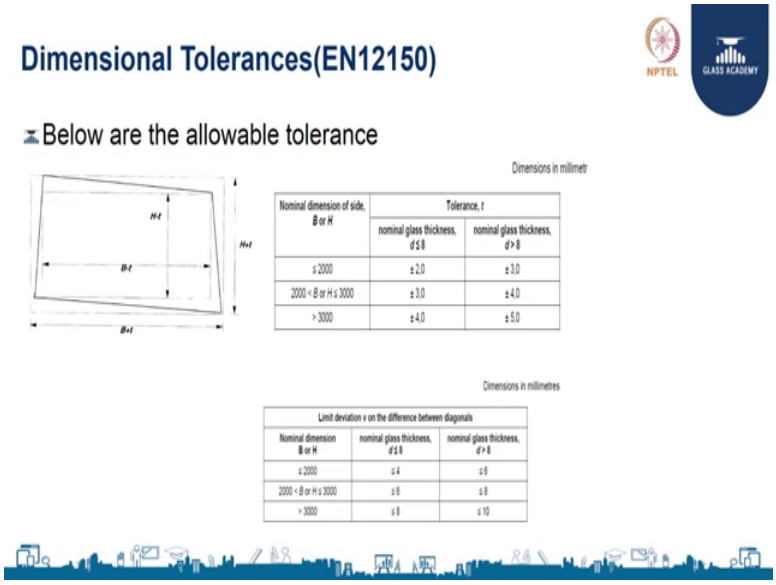

Also EN also says about the dimensional tolerance of the glasses.

So, you can see the chart of depending upon the thickness if it is a with the thickness is less than 8 millimeter and. If the dimension of the glass is less than 2 meter. The thickness tolerance should be plus or minus the dimensional tolerance should be plus or minus 2 millimeter.

So, EN also says about the dimensional tolerances for any glass. So, there are standard you can see this thickness tolerances dimensional tolerances if the thickness is less than or equal to 8 millimeter for a glass of length or a width 2 meter. The dimensional tolerances plus or minus 2 millimeter is possible is allowable when the dimension thickness goes more than 8 millimeter, the same for the same 2 meter or less length the

dimensional tolerance of 3 millimeter also possible.

Similarly, for better than 2 meter and less than 3 meter dimension tolerances of plus or minus 3 millimeter for a thickness of 8 millimeter or less. And for a 8 more than 8 millimeter thickness the dimensional tolerance of 4 millimeter are acceptable.

Similarly for better than 3 meter length or width for a glass of 8 millimeter or less dimensional tolerance of 4 millimeter plus or minus 4 millimeter acceptable. For a class of more than 8 millimeter thickness dimension tolerances of plus or minus 5 millimeter acceptable.

Similarly, you can see the table showing the deviation for diagonals also.

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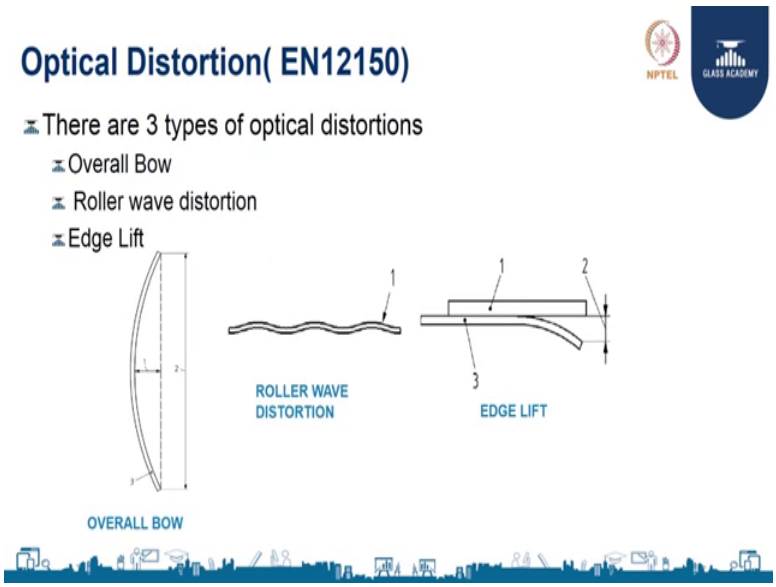

So, in this slide I am going to discuss about the optical distortion there are basically there are three kinds of optical distortion. One is the overall bow which is the overall bend in the glass, second kind of optical distortion is the roller wave distortion, and the third is the edge lift.

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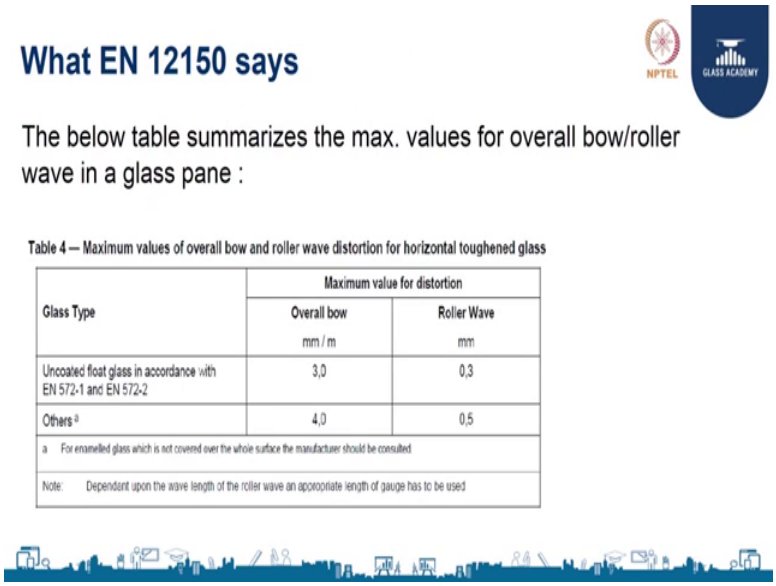

So, EN says the norms for overall bow and roller waves for uncoated glass or a normal clear glass or a tinted glass. The overall bow as per EN is acceptable is 3 millimeter for a meter distance. That means, if the glass length is 1 meter the bend of 3 meter is 3millimeter is acceptable. For the other coated glasses or a ceramic fitted glass is the bend of four 4millimeter acceptable.

So, you can see the in the right hand side roller wave is also mentioned for the clear glass it says 0.3 for 300 millimeter distance is acceptable, for a coated glass or a ceramic fitted glasses 0.5 millimeter of roller wave is acceptable for a every 300 millimeter distance.

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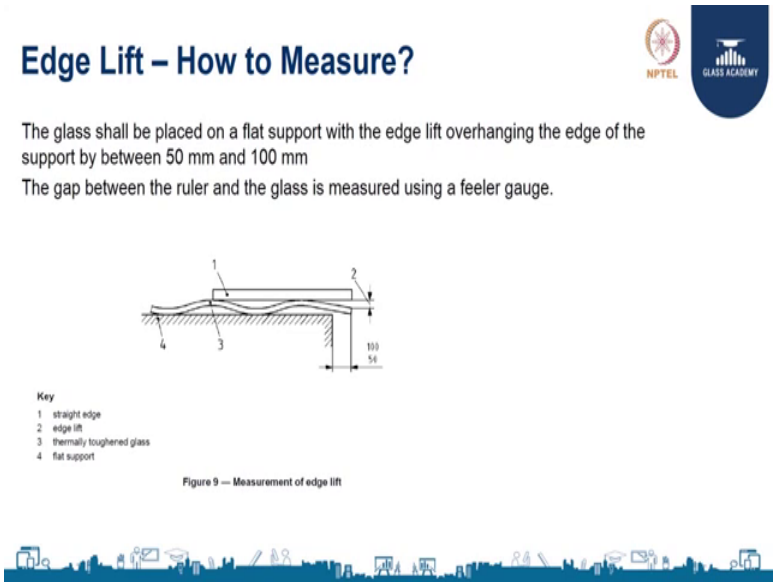

For edge lift how do you measure edge lift. The glass shall be placed in the flat support with a edge lift overhanging the edge of the support between 50 millimeter to 100 millimeter, the gap between the roller and the glass is measured using a feeler gauge.

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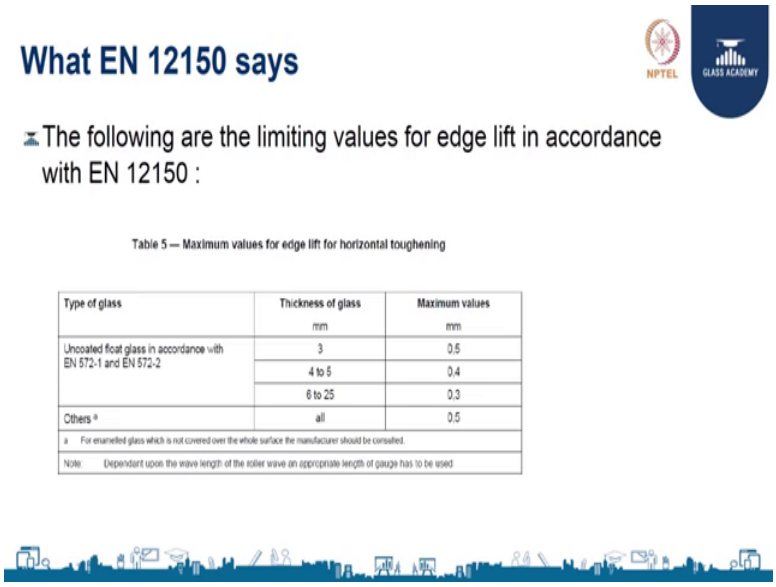

And EN says for a uncoated glasses thickness of 3 millimeter the maximum value of that edge lift is 0.5 millimeter. Similarly for 4 to 5 millimeter thickness it is 0.4 and for 6 to 25 millimeter glasses it is 0.3. For other glasses like coated and all it is covered it is acceptable up to 0.5 value.

Next we come to that heat strengthening glasses standards the EN standard for this is EN a 1863.

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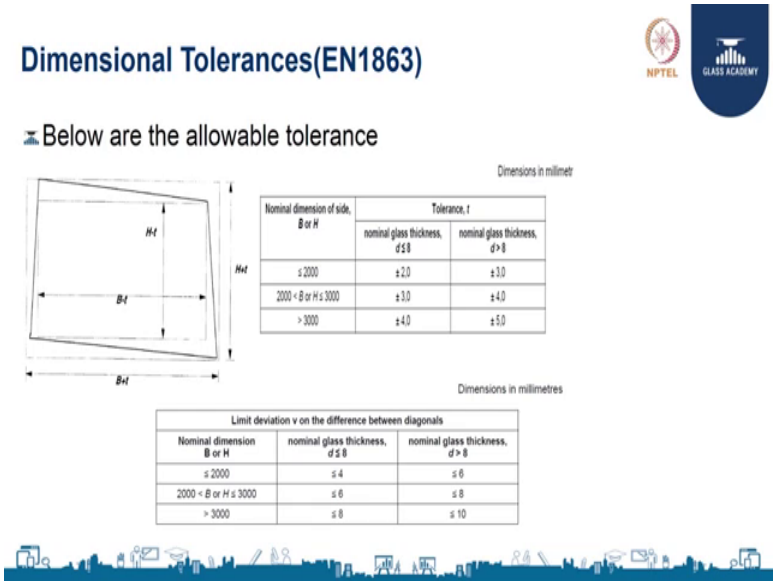

So, the dimensional tolerances are similar to tempering what we have discussed in the earlier slides.

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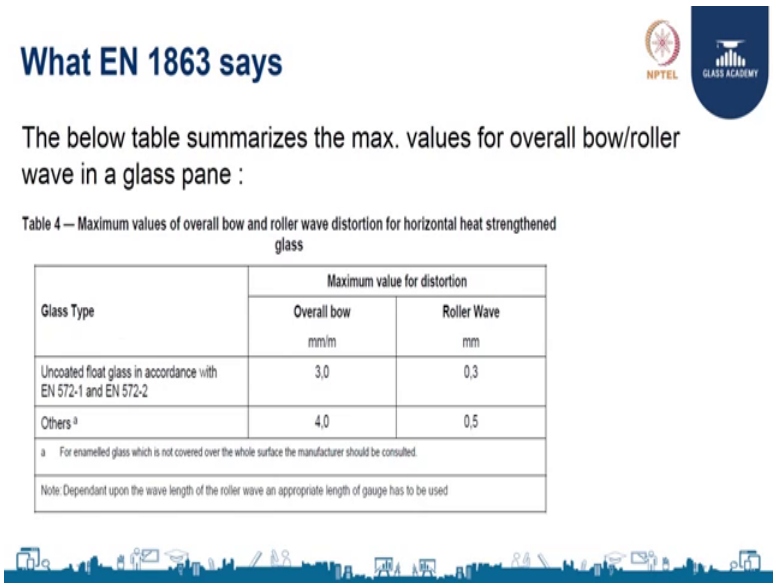

Similarly for a for heat strengthened glasses also the overall bow and roller wave is same like your tempered glasses which you have discussed in previous slides.

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Edge Lift (EN1863)

- The following are the limiting values for edge lift in accordance with EN 1863 :

Table 5 — Maximum values for edge lift for horizontal heat strengthening

Type of glass	Thickness of glass mm	Maximum values mm
Uncoated float glass in accordance with EN 572-1 and EN 572-2	3	0,5
	4 to 5	0,4
	6 to 12	0,3
Others [a]	all	0,5
a For enamelled glass which is not covered over the whole surface the manufacturer should be consulted.		
Note: Dependant upon the wave length of the roller wave an appropriate length of gauge has to be used		

The edge lift also similar to tempered glasses.

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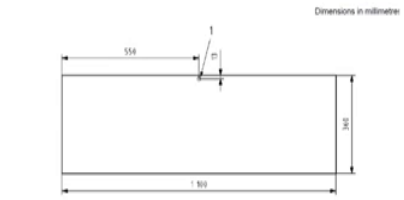
Fragmentation Test(EN 1863)

- Dimension of Test Sample – 360 mm X 1100 mm (5 samples)
- Each test specimen shall be impacted, using a pointed steel tool, at a position 13 mm in from the longest edge, of the test specimen,at the mid point of that edge, until breakage occurs.
- The fragments shall be held at the edges, by a small frame or adhesive tape.



Key
1 – impact point

Figure 21 — Position of impact point

The fragmentation test for a heat strengthened glass is similar to tempered glass. The dimension of the sample is same like 360 by 1100, but in this case we have to take five samples and we have to break the same position like fully tempered glasses.

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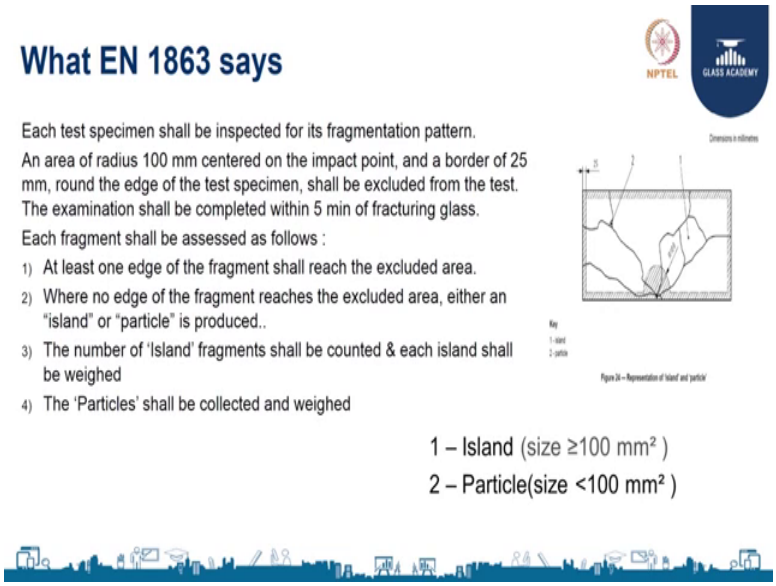

And each test specimen shall be inspected for fragmentation pattern and an area of radius 100 millimetres centre to the impact point and the border of 25 millimeter around the edge of the stress specimen shall be excluded from the test. The examination shall be completed within 5 minutes of fracturing the glasses.

Each fragment shall be assessed as follows at least one edge of the fragment shall reach the excluded area as shown in that photograph.

Where no edge or fragment reaches the excluded area either an island or a particle is produced what is an island? Island is an area of size more than 100 millimetres square whereas, the particle is an area of size less than 100 millimetre square.

The number of island fragment shall be counted and each island shall be weighted.

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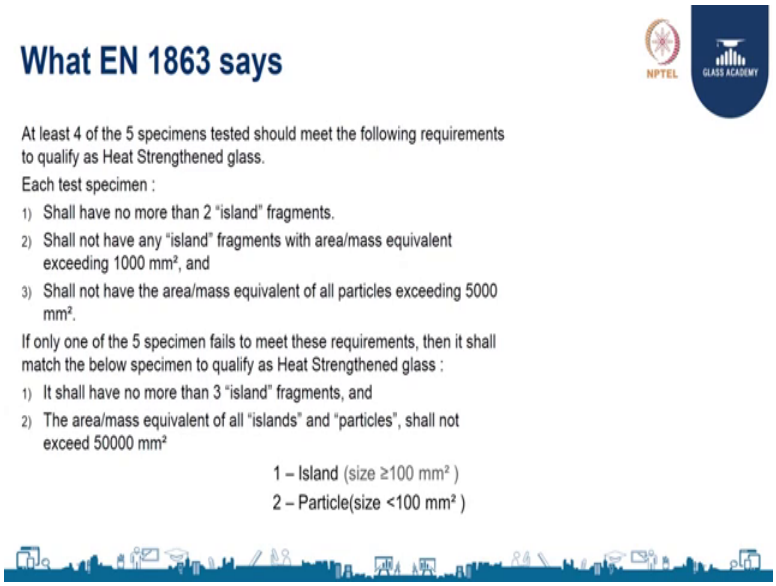

The particle shall be collected and weighted at least 4 of the 5 specimen tested should meet the following requirements to qualify as a heat strengthened glasses. Each test specimen shall have no more than two island fragments. Shall not have any island fragments within the area or must equivalent to exceeding 100 millimetres square.

And shall not have areas or mass equivalent of particles exceeding 5000 millimeter square. If only one of the five specimen fails to meet the requirements, then it shall match the below specimen to qualify as heat strengthened glass. It shall have no more than three island fragments and the area or mass equivalent of islands and particle shall not exceed 50000 millimeter square.

Now, we will be going through insulated glass standards.

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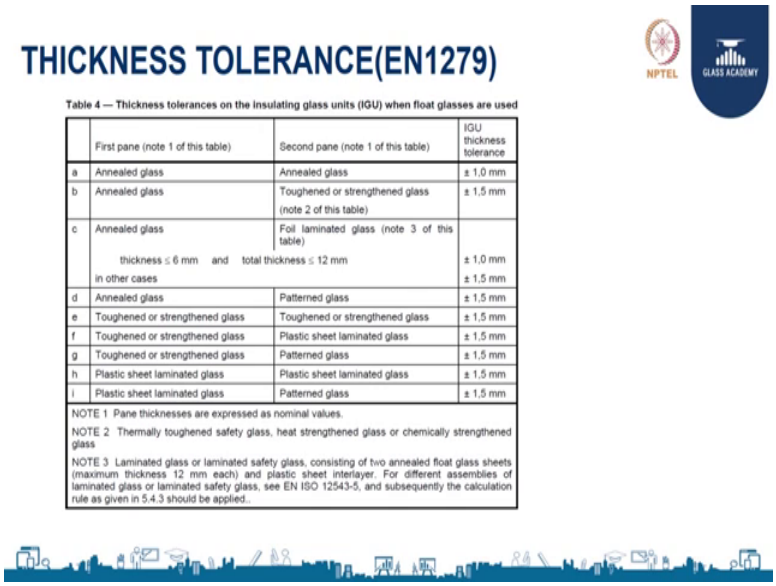

So, insulated glasses it says EN 1279. So, it says some thickness tolerances for the insulated glasses. If both the glasses are annealed and there is a air gap and the thickness tolerances plus or minus 1 millimetres acceptable.

If one of the pane is annealed and the another glass pane is toughened or heat strengthened, then is the dimensional thickness tolerances of 1.5 millimeter is acceptable. Similarly for the other combination it is mentioned in the table.

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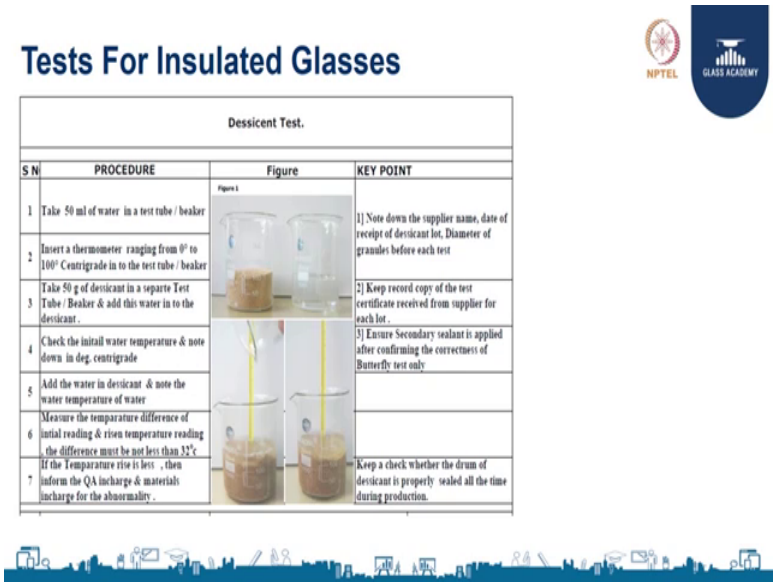

Now, test for insulated glasses; the first test what we do is with the second test in that

procedure is you have to take 50 millimeter of milli milliliter of water in a test tube or beaker. Insert a thermometer ranging from 0 to 100 degree centigrade in the test tube or beaker. Measure the temperature then take 50 grams of desiccant in a separate test tube for a beaker and add that 50 ml of water on the top of it.

You have to check the initially what is the temperature of water and after adding that water on that desiccant beaker you have to measure the temperature after 1 minute and you should see the rise of temperature should be more than 32 degree centigrade. If it is more than 32 degree centigrade rise in temperature is there, then it is the desiccant is good enough for using in a aluminium spacer.

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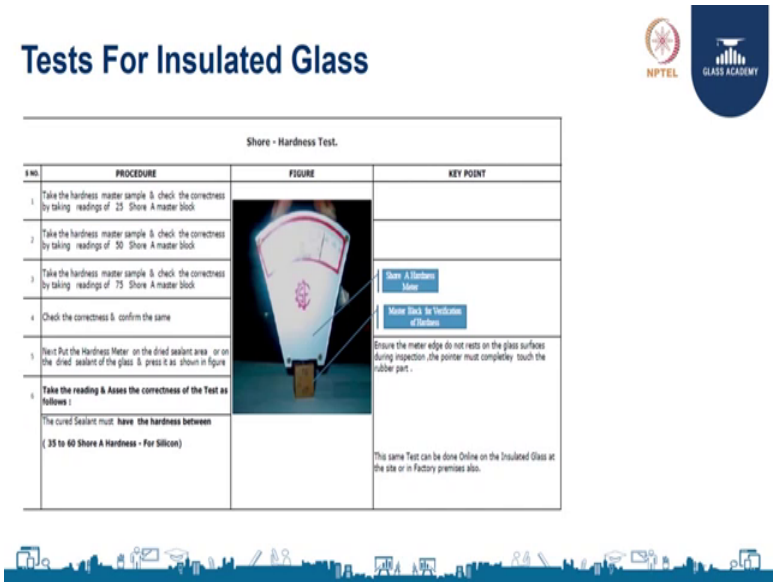

The second test what we do is the shore hardness test for silicone for that you need to have a shore a hardness tester. This shore a hardness you have to check on the secondary sealant like silicone or polysulphide whichever use you are using in a insulated glass unit. And this you should check after 24 hours of applying the silicone. For silicone the the range of the shore a hardness is from 35 to 60.

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The next test is pot life test for this we have to take small container and fill half with this sealant to be which is to be tested. you can place a stake or a pencil in the sealant as shown in the figure and note the time in record books. So, every 5 to 10 minutes pull on the stick as shown in the figure.

If the sealant does not tear itself cohesively when the stick is pulled out the sealant has not snapped. The time at which the sealant tears cohesively when the stick is pulled out the sealant is snap the snap time will vary depending on the atmospheric condition temperature humidity and the individual doing the test a snap time varying more than 45 minutes from what is expected may indicate that the equipment or the sealant is having problem. So, you have to retested.

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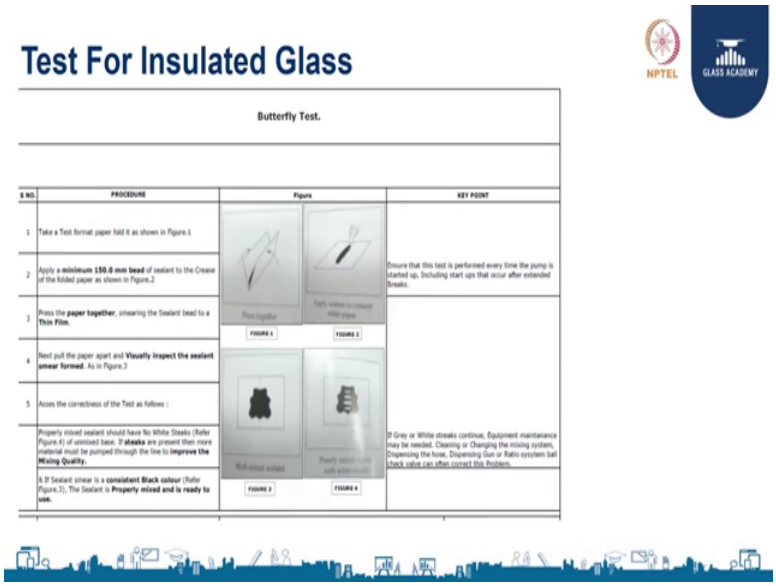

Next test we call it the butterfly test. Normally it is to check the homogeneity in a mixing of silicon. So, you have to put a silicone in a paper and then you have to fold the paper and immediately you have to take open the paper again.

So, you can see in your in the table there are figure three and figure 4. One you can see complete black and the figure 4 you can see there is a white patches are there. So, if figure three appears after the when you open the paper then your mixing is proper the figure four shows there is a white patches that means, the mixing homogeneity is not there. So, you have to remix it again.

Now, we will cover the laminated glasses what are the test we are doing for laminated glasses.

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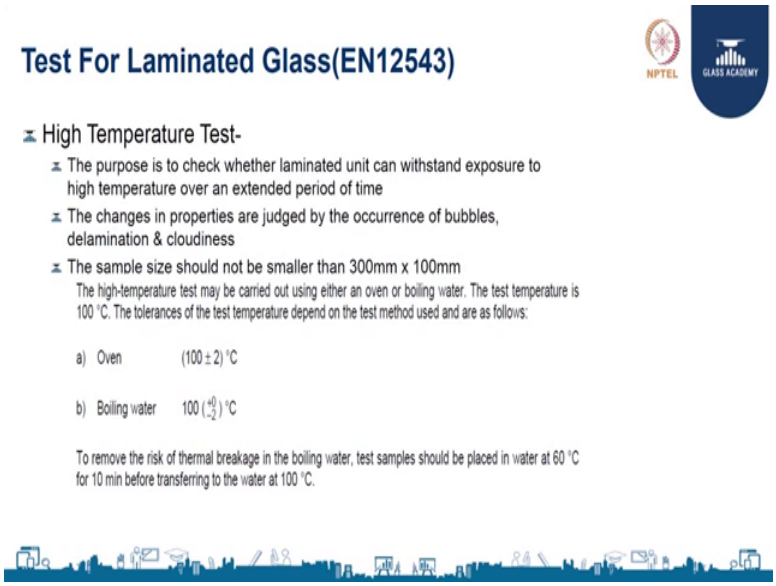

The standard for laminated glass in EN is 12543. The first test is high temperature test the purpose is to check whether the laminated unit can withstand exposure to high temperature over an extended period of time. The changes in properties are judged by the occurrence of bubbles delamination or cloudiness. For this test the sample size should not be smaller than 300 by 100 ml. It should be plus 0 or minus 2 degree centigrade to remove the risk for thermal breakage in boiling water test sample should be placed in water at 60 degree centigrade for 10 minutes before transferring to the water at 100 degree centigrade.

How do you test it for each test we take three specimens procedure a in a oven and procedure b in a boiling water. in a procedure a in oven heat three specimen to a temperature of 100 degrees maintain the test temperature.

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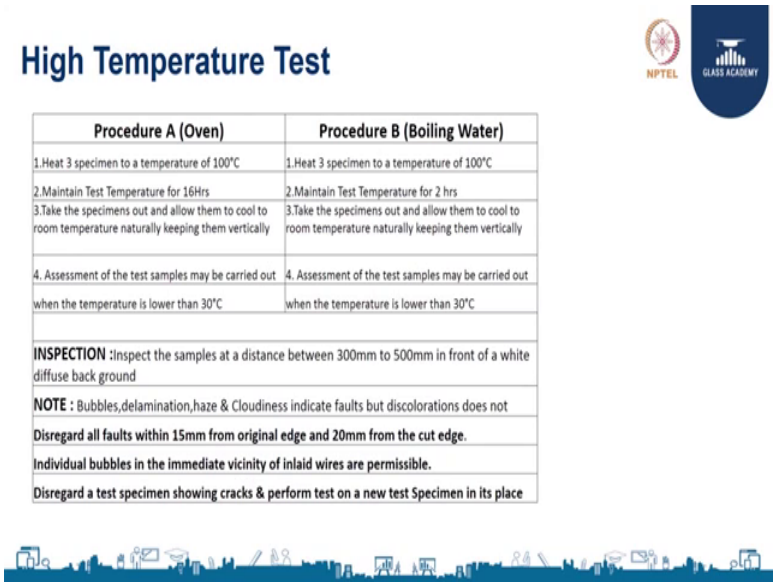

For 16 hours take the specimens out and allow them to cool the room temperature and naturally keeping them vertically. For the boiling water heat the three specimen to a temperature 100 degrees. First as I told earlier we have to keep it at 60 degree centigrade then you have to transfer it for 200 degree centigrade water. Maintain the test temperature for two hours. Similarly you take the specimen out allow them to cool in a room temperature naturally keeping them vertically.

After that we do assessment when the temperature goes down to 30 degree centigrade the inspect the samples at a distance between 300 to 500 millimeter in front of a white diffused background. Note bubbles delamination haze cloudiness indicates faults, but discolouration does not disregard all faults within 15 millimeter of the original edge and 20 millimeter from the cut edge individual bubbles in the immediate vicinity of inlaid wires are permissible. Disregard a test specimen showing cracks and perform test on a new test specimen in its places this is what high temperature test says.

Next test is a bake test. So, as mentioned in EN 12543 only bubbles delamination or cloudiness are taken into account it defects at distance lower than 15 millimeter from the original edge or lower than 20 millimeter from the cut edge is not taken into account.

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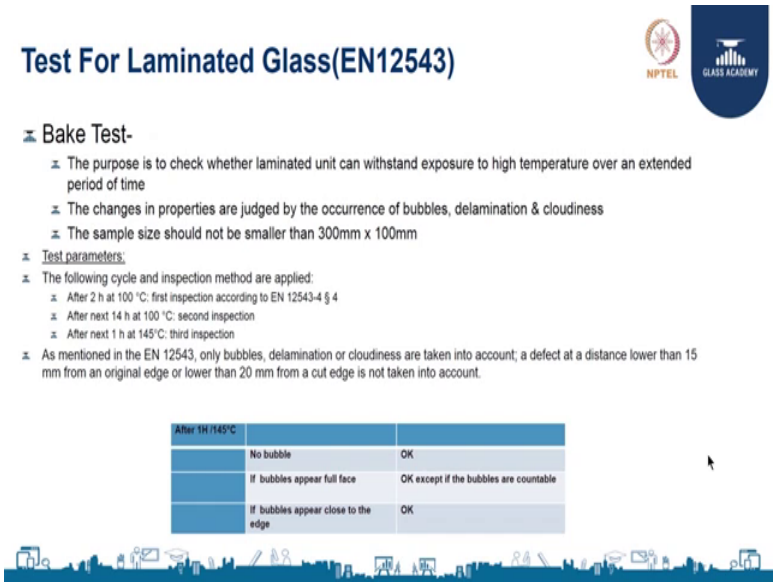

So, after one hour at 145 degree centigrade, if no bubble appears this ok if bubble appears in the full face it is except if the bubbles are countable. If bubble appears close to the edge it is said to be the. So, your land whatever you are laminating is ok.

Next test for laminated glasses is humidity test the purpose is to check whether the laminated unit can withstand exposure to humidity over an extended period of time. This change in properties are judged by the occurrence.

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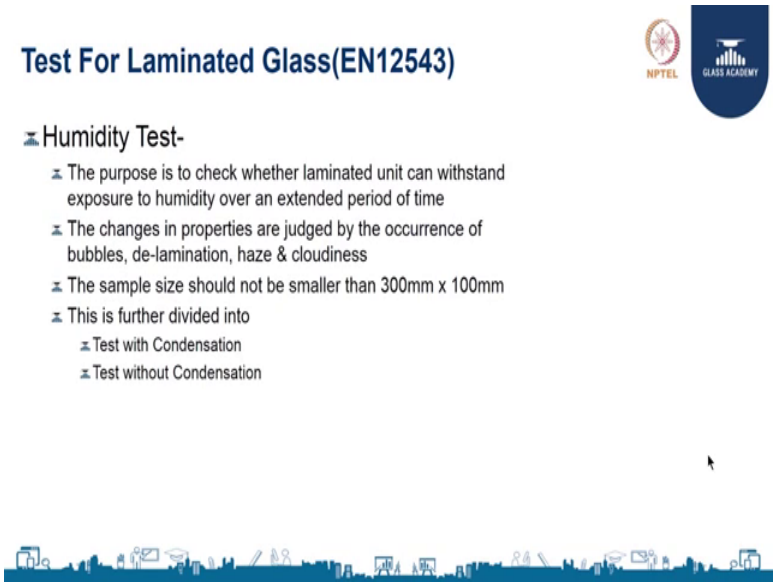

Of bubbles de-lamination haze and cloudiness. Sample size should not be smaller than

300 by 100 millimeter. This is further divided into two categories test with condensation and test without condensation.

Humidity test humidity test with condensation. So, we need to keep three samples vertically closed in a container for two weeks and we have to maintain for at a temperature of 50 degree plus 5 degree centigrade.

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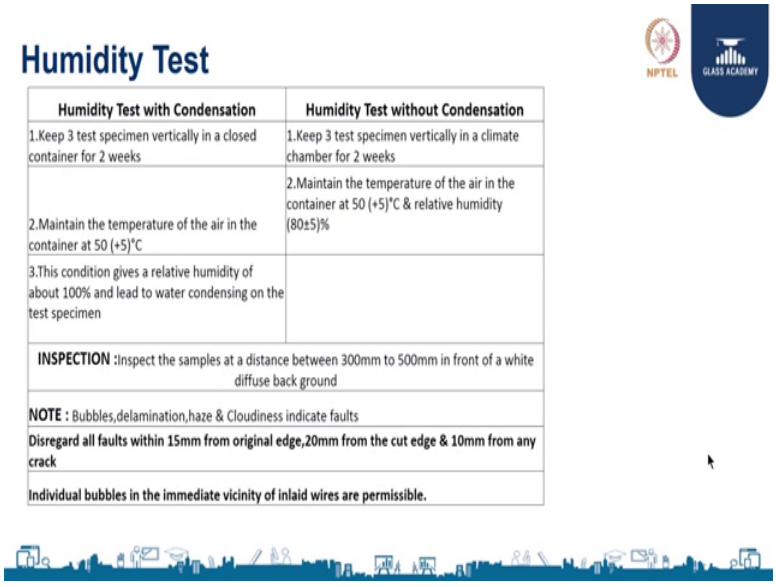

The conditions for test with condensation is about 100 percent humidity. And lead to water condensing on that test specimen for the humidity test without condensation we have to main keep three samples vertically up in a climatic chamber for two weeks. We have to maintain a temperature of 50 degree 50 plus 5 degree and relative humidity of 80 plus or minus 5 degree centigrade.

So, for both the cases we have to do the inspection from similarly at a distance of 300 mm to 500 millimeter against a white diffuse background. Bubbles de-lamination haze and cloudiness indicates faults. So, we have to disregard all faults within 15 millimeter from the original edge, and 20 millimeter from the cut edge. And 10 millimetre from any crack. Individual bubbles in the immediate vicinity of the inlet wires are permissible.