Glass Processing Technology
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Lecture - 51
Quality Testing Part III

Now, we are going to see the quality plan for grinding.

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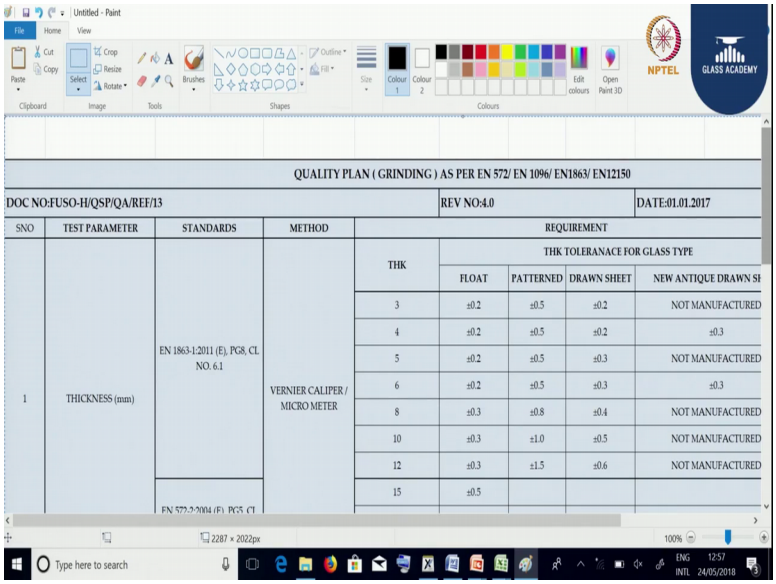

QUALITY PLAN (GRINDING) AS PER EN 572/ EN 1096/ EN1863/ EN12150

DOC NO:FUSO-H/QSP/QA/REF/13			REV NO:4.0			DATE:01.01.2017
SNO	TEST PARAMETER	STANDARDS	METHOD	REQUIREMENT		
				THK	THK TOLERANACE FOR GLASS TYPE	
					FLOAT	PATTERNED	DRAWN SHEET	NEW ANTIQUE DRAWN SH
1	THICKNESS (mm)	EN 1863-1:2011 (E), PG8, CL NO. 6.1	VERNIER CALIPER / MICRO METER	3	±0.2	±0.5	±0.2	NOT MANUFACTURED
				4	±0.2	±0.5	±0.2	±0.3
				5	±0.2	±0.5	±0.3	NOT MANUFACTURED
				6	±0.2	±0.5	±0.3	±0.3
				8	±0.3	±0.8	±0.4	NOT MANUFACTURED
				10	±0.3	±1.0	±0.5	NOT MANUFACTURED
				12	±0.3	±1.5	±0.6	NOT MANUFACTURED
				15	±0.5			

Similar to cutting the grinding also undergoes EN 572, EN 1096, EN 1863, EN 12150.

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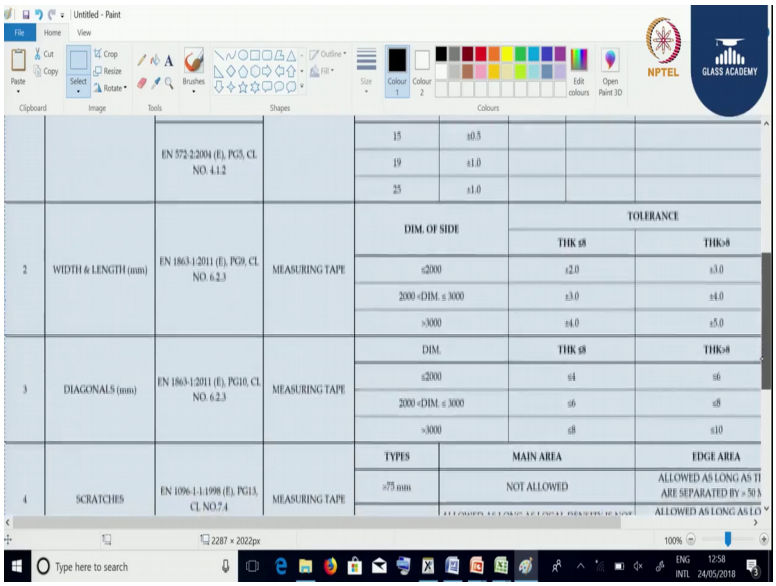

And the test parameters what we have seen in the cutting like thickness, width and length, diagonal, scratches, spots or pinholes, clusters all will be measured in the similar way as we have done for cutting.

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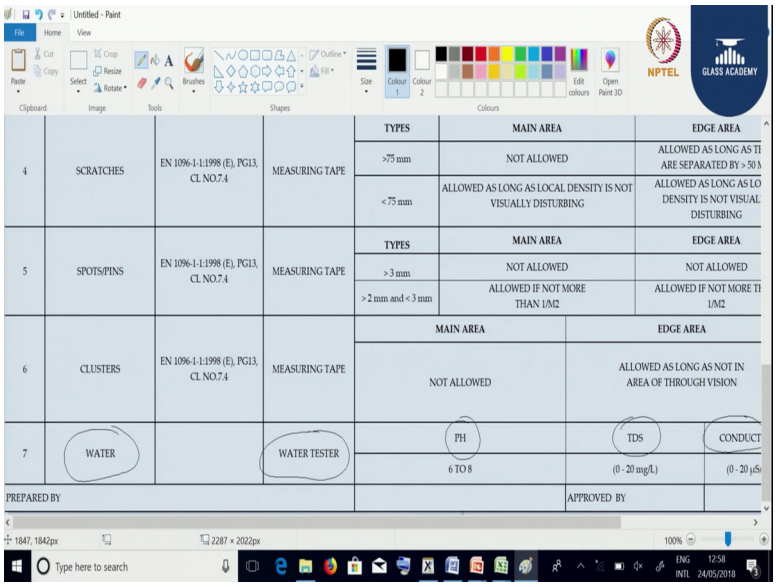

But, the additional one more thing that we need to check is the water. As the glass is going through the grinding it has to undergo washing also. So, we need to measure the water quality. The tool what we use to measure the water quality is known as a water tester, in through water tester we are going to measure pH, TDS and conductivity.

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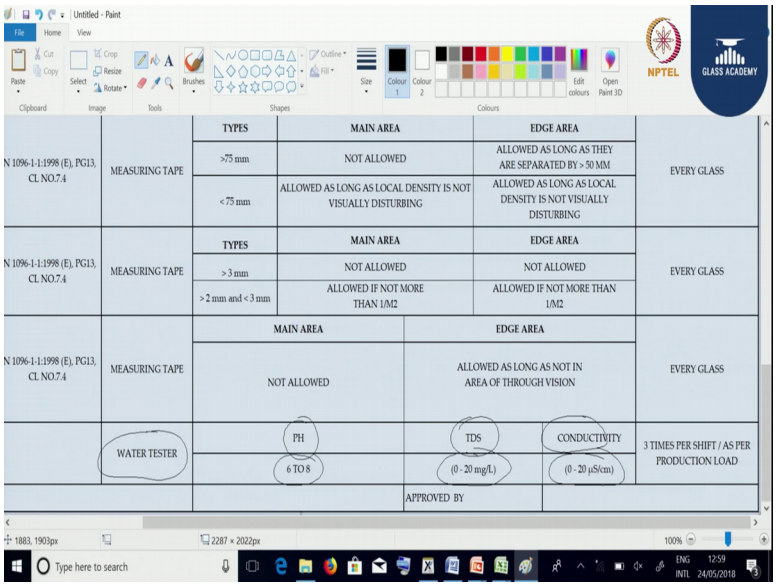

N 1096-1-1:1998 (E), PG13, CL NO.7.4	MEASURING TAPE	TYPES	MAIN AREA	EDGE AREA	EVERY GLASS
		>75 mm	NOT ALLOWED	ALLOWED AS LONG AS THEY ARE SEPARATED BY > 50 MM	
		<75 mm	ALLOWED AS LONG AS LOCAL DENSITY IS NOT VISUALLY DISTURBING	ALLOWED AS LONG AS LOCAL DENSITY IS NOT VISUALLY DISTURBING	
N 1096-1-1:1998 (E), PG13, CL NO.7.4	MEASURING TAPE	TYPES	MAIN AREA	EDGE AREA	EVERY GLASS
		> 3 mm	NOT ALLOWED	NOT ALLOWED	
		> 2 mm and < 3 mm	ALLOWED IF NOT MORE THAN 1/M2	ALLOWED IF NOT MORE THAN 1/M2	
N 1096-1-1:1998 (E), PG13, CL NO.7.4	MEASURING TAPE	MAIN AREA		EDGE AREA	EVERY GLASS
		NOT ALLOWED		ALLOWED AS LONG AS NOT IN AREA OF THROUGH VISION	
	WATER TESTER	PH	TDS	CONDUCTIVITY	3 TIMES PER SHIFT / AS PER PRODUCTION LOAD
		6 TO 8	(0 - 20 mg/L)	(0 - 20 µS/cm)	
			APPROVED BY		

Why we need to focus on these things? Because the glass is having some silver coatings and the water it is a chemical formula H 2 O. So, there is always a probability of the reaction between the water and the glass surface coatings. And our purpose is we need to overcome the reaction between these two. How we are going to achieve? We are going to achieve through the use of DM or RO water. And the parameters what we need to follow is pH 6 to 8, TDS 0 to 20 milligram per liter, conductivity 0 to 20 microsiemen per centimetre, and the frequency of testing shall be per 3 times per shift or based on the production node we need to decide and we need to measure the water.

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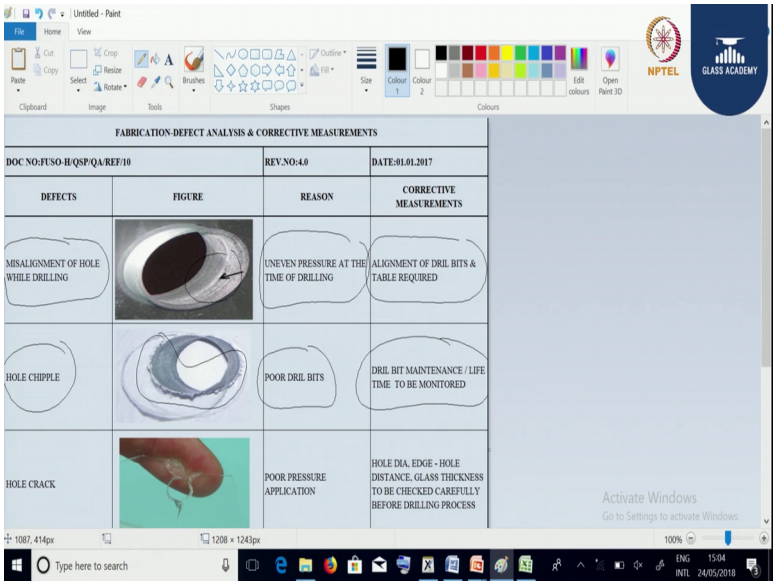

FABRICATION-DEFECT ANALYSIS & CORRECTIVE MEASUREMENTS			
DOC NO:FUSO-H/QSP/QA/REF/10		REV.NO:4.0	DATE:01.01.2017
DEFECTS	FIGURE	REASON	CORRECTIVE MEASUREMENTS
MISALIGNMENT OF HOLE WHILE DRILLING		UNEVEN PRESSURE AT THE TIME OF DRILLING	ALIGNMENT OF DRIL BITS & TABLE REQUIRED
HOLE CHIPPLE		POOR DRIL BITS	DRIL BIT MAINTENANCE / LIFE TIME TO BE MONITORED
HOLE CRACK		POOR PRESSURE APPLICATION	HOLE DIA, EDGE - HOLE DISTANCE, GLASS THICKNESS TO BE CHECKED CAREFULLY BEFORE DRILLING PROCESS

Let us take the fabrication department. What are the defects that are going to arise and how you are going to overcome? Generally if you see the first defect what we face in the fabrication is the misalignment of holes while drilling. You can find out here there is a alignment issue in the top and bottom drilling. The reason being uneven pressure applied at the time of drilling and the corrective measurements what you can tell is alignment of drill bits and table is required.

Next one is hole chipoff. Generally at the time of drilling you will be getting the holes of the glass got chipped off. This is because of poor drill bits what we use the drill bit maintenance and lifetime to be monitored to overcome this issue.

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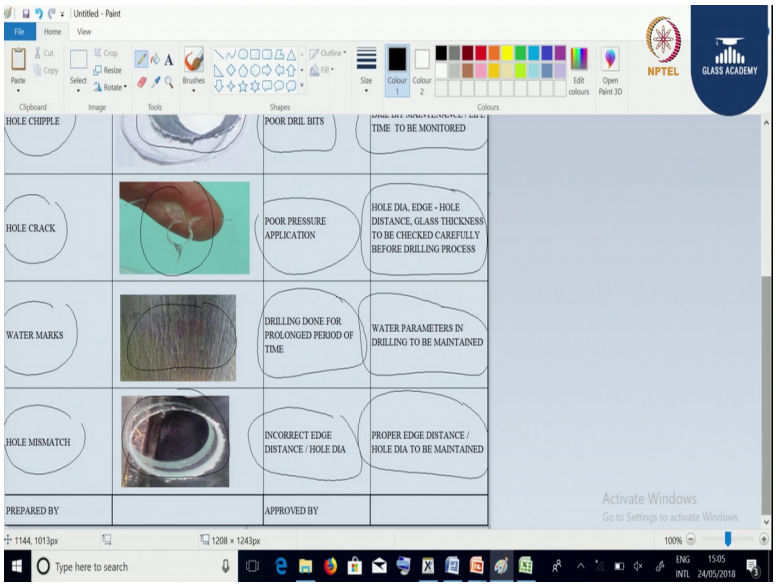

Next we have hole cracks the cracks what we follow what we observe on the holes this is you can you can find the crack. This is because of poor pressure applied and the corrective measures measurements can be hole dia, edge, hole distance glass thickness to be checked carefully before drilling. So, what are all the required for making a hole? All SOPs is to be thoroughly followed.

Next one is the watermarks; you can find on the glass surface the water impressions. Drilling done for prolonged period of time is one of the reason why we get the watermarks, and the water parameters in the drilling to be taken care and maintained to overcome this issue.

Next one is the hole mismatch you can see the holes of the both the glasses are not sitting on top of each other. The reason being incorrect edge to hole distance or whole dia we can overcome with by maintaining a proper edge distance or hole dia's to be maintained uniformly. So, that there is no mismatch of the hole.

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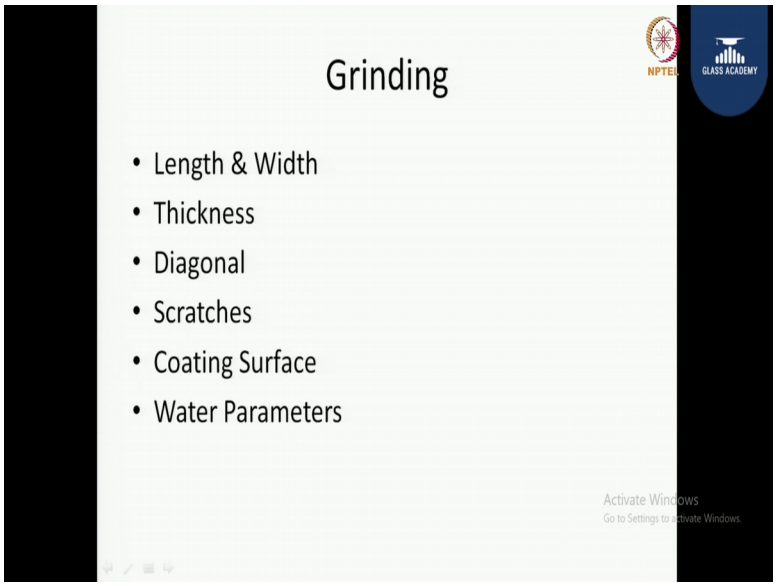

Now, we will be understanding the various lab tests that a glass undergoes. The test that we do for grinding are similar to cutting that is we are going to check the length and width, with the help of measuring tape. Next we will be checking the overall thickness of the glass, diagonally also we will be checking, we will be checking for scratches, coating surface also we should be checking, and the coating should be always on the top side and along with the above parameters we will be also checking the water parameters. So, that we are ensuring that there is a no reaction between the glass and the water by maintaining the pH temperature, pH TDS and conductivity values also the temperature of the water.

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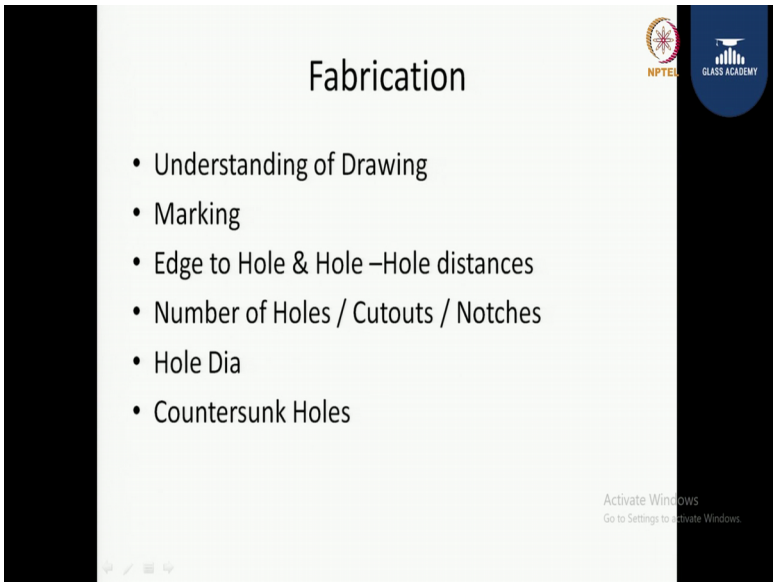

Next let us see; what are the tests we do for fabrication? In fabrication we need to first understand the drawing. What is the customer requirement? Next according to drawing we need to have the marking on the glass. Next we need to understand what is the distance from edge to hole, hole to hole, and the number of holes in the glass cut outs and notches. We need to understand the hole dia and whether the glass is having any countersunk hole.

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Next let us take grinding. If you say in grinding what are the parameters that we need to check. In grinding we will be checking the similar what we check in cutting like thickness, dimension, diagonal, visual inspections apart from all there is one more phenomenon called as water.

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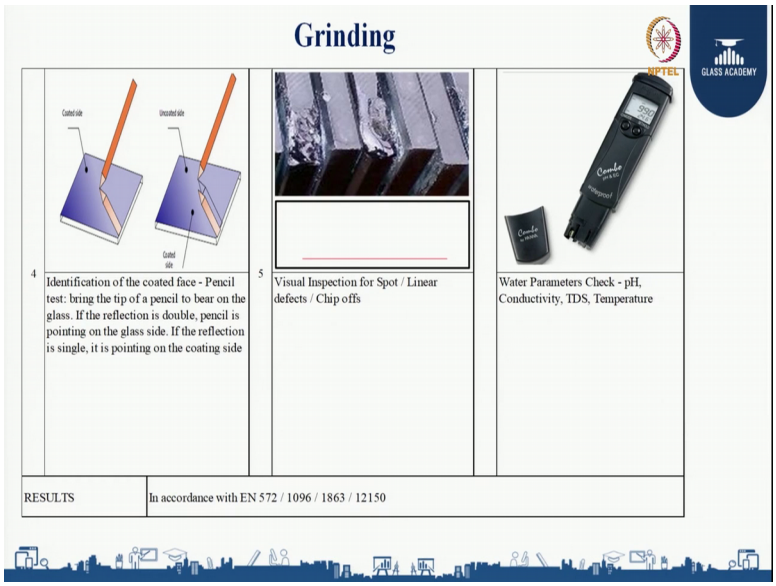

Here water plays a vital role. The reason being when you talk about the performance glasses it shall be having coatings, and if you use a normal water there is always chances of reaction between the water and the coating surface. In order to avoid glass corrosion we need to maintain the water levels the water levels, in terms of pH in terms of conductivity, in terms of TDS and in terms of temperature.

We have a simple tester known as water tester with which can measure pH conductivity TDS and temperature. The pH should be 6 to 8 is the ideal for glass washing, conductivity should be 0 to 20 microsiemen per centimetre, TDS is 0 to 20 ppm and temperature is below 35 degree centigrade.

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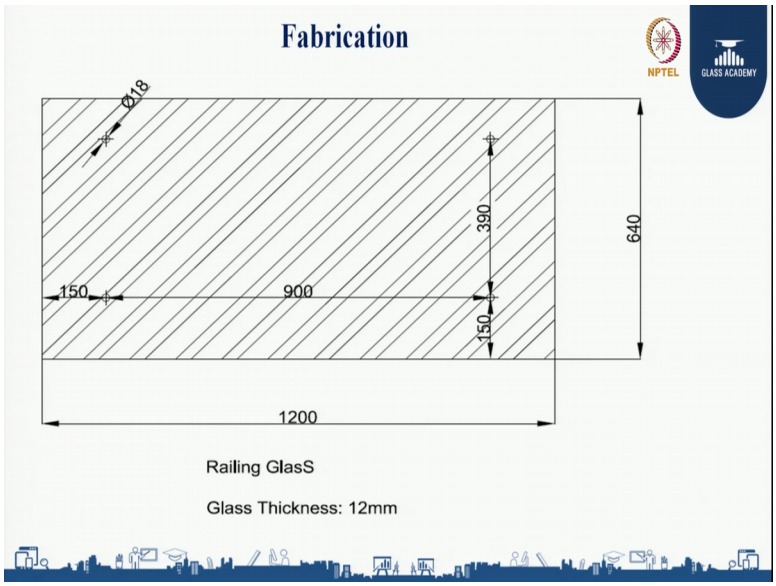

Next checklist is at fabrication. If at all your glass is having any holes or cut outs or notches, how you are going to ensure they are as for the customer requirement. Let us take a simple diagram where you are able to find 4, holes 4 holes in the glass and the dimension of the glass is 1200 is the width and 640 is the height.

If you see the left edge to hole it is 150 mm and from bottom edge to hole it is 150 mm. And the hole to hole distance if you see on the height side it is 390 mm and the hole to hole distance when you see on width side it is 900 mm and the hole dia is 18 mm and the overall glass thickness is 12 mm.

Let us understand each of the topic what we are saying in the drawing one by one.

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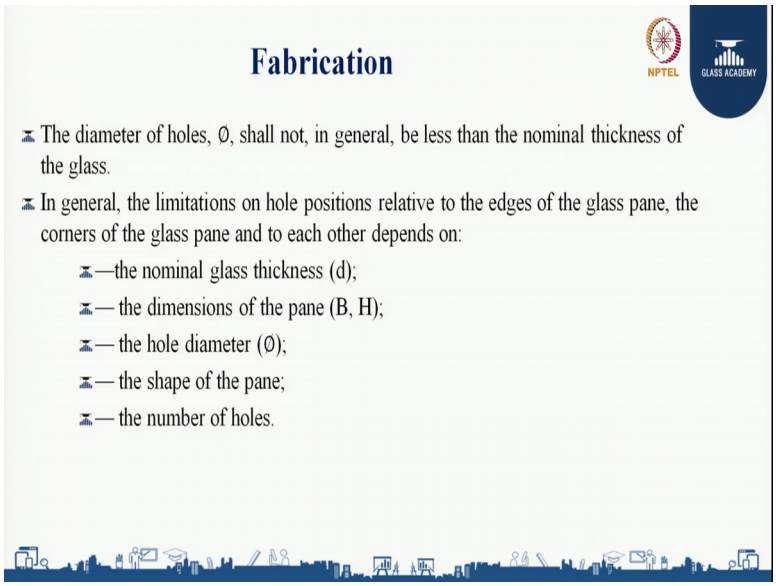

So, in order to make a glass fabrication, first of all the below are the parameters that we are going to focus on. So, the diameters of the hole shall not in general be less than the nominal thickness of the glass. So, when you want to make a hole the minimum or the ideal hole diameter should be equal to the thickness of the glass, and these are the limitations that we need to follow when you are making a hole on the glass.

The nominal glass thickness, what is the nominal glass thickness? The dimensions of the glass, the hole diameter, the shape of the glass and the number of holes in a glass.

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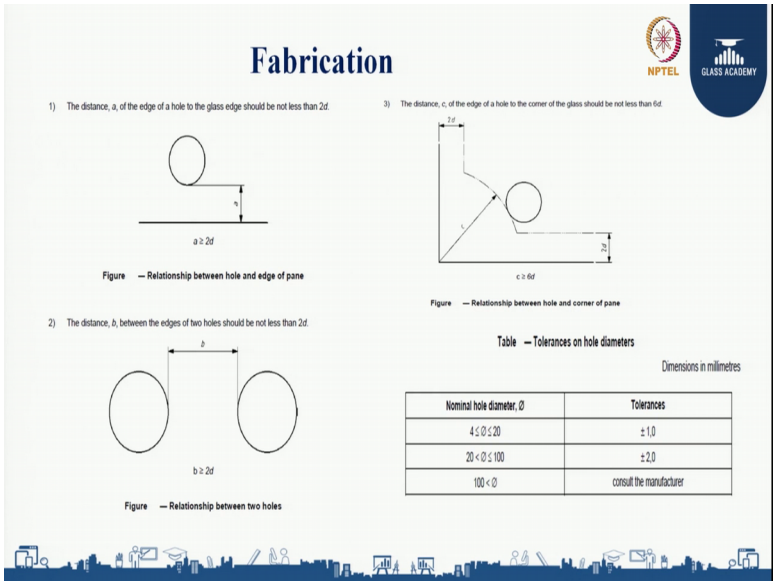

If you see the fabrication if I want to make a hole, the distance the relationship between the hole and edge of the glass it should be always more than or equal to 2 into thickness of the glass. In the figure you can see clearly a, is the distance of the edge of the hole to the glass edge should be not less than 2d.

In the figure you can see clearly the distance from the edge to the hole is should be ideally more than or equal to 2 into glass thickness. If you see the second point it describes about the hole to hole distance, hole to hole distance in general should be equal to more than or equal to the 2 into thickness of the glass.

Next comes is your whole position from corner of the glass. It should be ideally 6 into minimum it should be 6 into thickness of the glass. And the tolerances on hole diameters we can find it when you are hole dia is in between 4 to 20 the tolerance what is applicable is plus or minus 1 mm, if your hole dia is between 20 to 100 the tolerance what we follow is plus or minus 2 mm, if your hole dia is minimum 100 mm then the manufacturer or the customer has to be approached for the tolerances on the hole.

Now, let us take a special type of hole that is known as countersunk hole.

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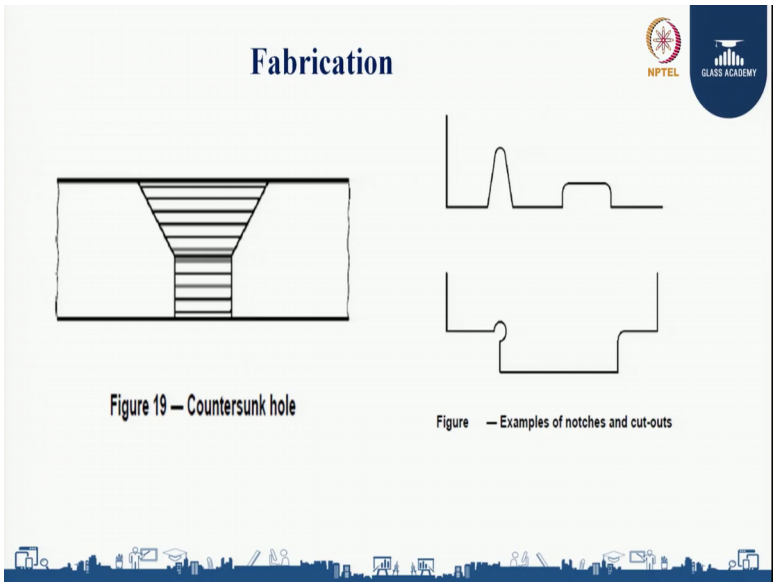

The difference between a normal hole and a countersunk hole is when you make a normal hole you can able to fill the hole on the glass surface, wherein when you are making a countersunk hole you will not be able to fill the hole in the glass surface.

Means the first we will be doing the hole, then with the help of countersunk we are going to expand the hole so that the whole surface is covers with the glass surface. And you can find here the special type of notches and cut outs, all these are required to prevent the breakage of the glass in further process.