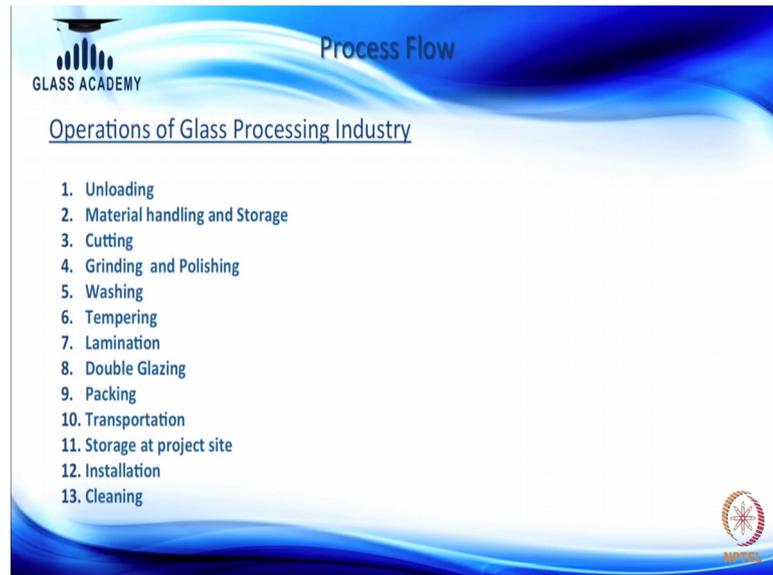


Glass Processing Technology
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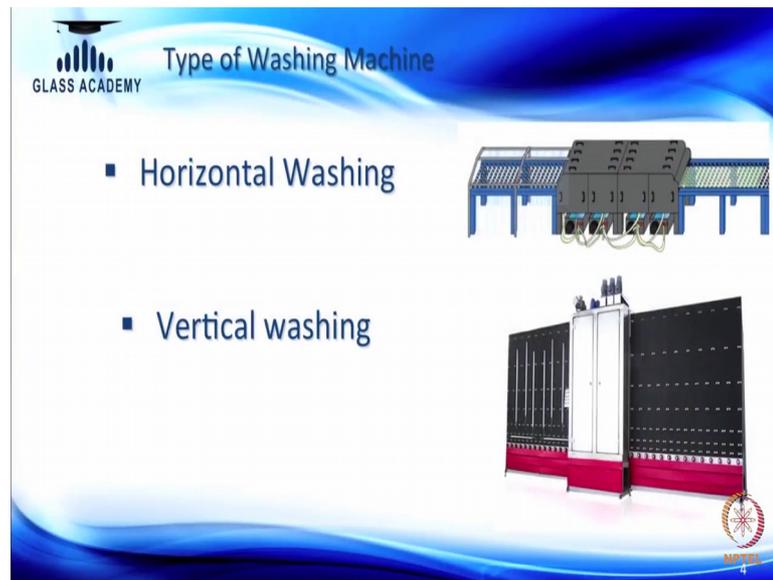
Lecture - 23
Pre-Processing – Washing

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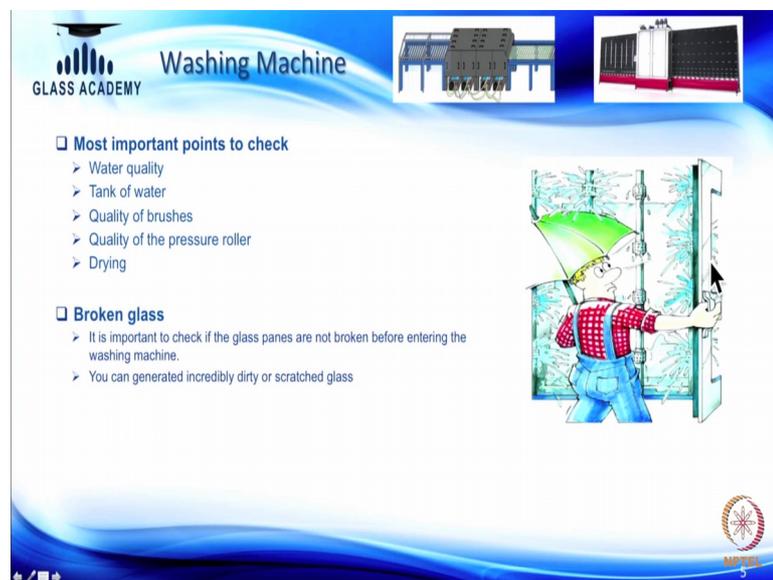
So, we are talking about Operation of Glass Processing Industry. First is unloading, second is material handling and storage, third is cutting, fourth is grinding and polishing, fifth is washing, sixth is tempering, seventh is lamination, eighth is double glazing, ninth is packing, tenth is transportation, eleventh is storage at project site, twelfth is installation and thirteen is cleaning. So, today we are talking about washing.

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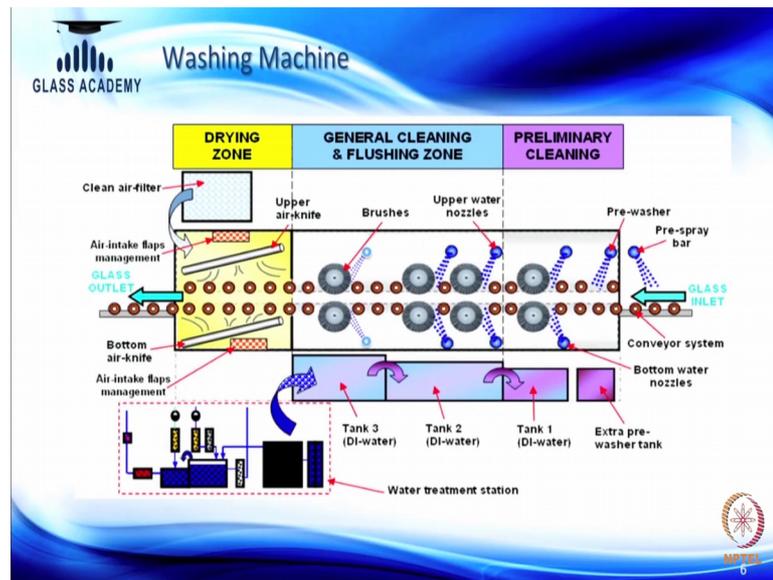
So, washing have two types: first is horizontal washing, second is vertical washing. So, this is a diagram of horizontal washing and this is a diagram of vertical washing.

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So, this is washing machine most important points to be checked. First is water quality, second is tank of water, third is quality of brushes, fourth one is quality of pressure roller and fifth is drying. If the glass broken at washing machine, it is important to check if the glass panels are not broken before entering the washing machine, you can generated incredibly dirty of scratches glass

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So, this is a washing diagram: first we are talking about water treatment station this is a main water treatment station. This is a tank number 1, this is tank number 2; this is tank number 3. So, glass inlet is here, glass going inside washing machine is here, this is a roller, this is brushes, this is pre washer, this is pre spray bar, this is brushes. See this washing machine is divided in three parts; first is primary cleaning, second is general cleaning and flushing zone and third one is drying zone.

So, first is water treatment. The water is circulate on this station. So, first tank number one, second is second tank number, third tank number and this all water are Dm water Dm it means demineralised. So, this is glass inlet, this is rollers, this is pre washer, this is pre spray bar, this is upper water nozzle, this is brushes and this is upper air knife and glass outlet of this way. So, this is glass inlet and this is glass outlet.

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GLASS ACADEMY

Washing Machine Water

- ❑ **WATER QUALITY**
 - Washing zone conductivity < 20 $\mu\text{s}/\text{cm}$
 - PH : 6 to 8
- ❑ **TEMPERATURE OF WATER**
 - 35° to 40°
 - At a higher temperature particles deposit and oil spreads over the water surface.
 - At a lower temperature microorganisms can survive.
- ❑ **VALUE TO REGISTRY**
 - For each batch of production
 - Conductivity water inside the water treatment
 - Conductivity water for the last ramp of washing
 - Temperature of the water
 - PH of water

The slide includes three images: a row of four digital meters (red, blue, green, black) showing various readings; a close-up of a hand holding a meter showing 6.05; and another close-up of a hand holding a meter showing 9.90.

So, we are talking about washing machine water. Water quality is very mandatory to washing machine. Washing zone conductivity is less than 20 and PH is 6 to 8, temperature also you can maintain 35 to 40 degree. If the temperature higher so, at the higher temperature particle deposit and oil spread over the water surface at the lower temperature micro organic can survive. Value of registry; value of registry for each batch of production, conductivity water inside the water treatment, conductivity water of the last ramp of washing, temperature of the water, PH of the water. This is PH and conductivity meter which we are checking in our processing industry. So, PH is required 6 to 8 and conductivity required less than 20.

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What is PH ????

GLASS ACADEMY

- pH
- pH – “power of hydrogen”
- Logarithmic scale from 1 to 14
- pH = 7 is neutral
- pH < 7 is acidic; soft water; unhealthy to drink
- pH > 7 is basic; hard water

What is the pH scale

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Acidic Neutral Alkaline

NIPTEL 8

So, what is the PH? So, PH is power of hydrogen. So, this is PH scale. If the PH is less than 7, so this is acidic water; if the PH more than 8, so this is natural; if the PH more than 10, so this is alkaline reaction is there. So, our glass processing industry PH required is 6 to 8, 7 is remains neutral. So, what is the PH? So, PH is power of hydrogen this is a PH scale. If the PH is 7 so this is neutral. If the PH more than 7, this is alkaline or this is soft water or this is unhealthy to drink if the PH reduce, then 7. So, this is acidic

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What is conductivity ???

GLASS ACADEMY

- Measured in micromhos per centimeter ($\mu\text{mhos/cm}$) or microsiemens per centimeter ($\mu\text{s/cm}$)
- Water is an excellent insulator & does not readily conduct electricity, but water is also an excellent solvent.
- When water has dissolved substances in it, it becomes more conductive.
- Conductivity increased by inorganic dissolved solids
 - chloride, nitrate, sulfate, -phosphate, anions (negative ions)
 - sodium, magnesium, calcium, iron, aluminum cations (positive ions)
- Conductivity lowered by organic compounds (oil, alcohols, phenols)
- Lower conductivity if water flowing through granite
- Higher conductivity if water flowing through clay

NIPTEL 9

What is conductivity? Measured in microsiemens per centimeter or microsiemens per

centimetre. Water is an excellent insulator and does not readily conduct electricity, but water is also excellent solvent. When water has dissolved substance it is it becomes more conductive. Conductivity increased by inorganic dissolve solid chloride, nitride, sulphate, phosphate. This is your negative ion and second one is your positive ion is sodium, magnesium, calcium, iron, aluminium. And conductivity lower organic compound is oil, alcohol and phenol. Lower conductivity is water flowing through granite so this is lower conductivity and higher conductivity if water flowing through clay.

So, this is a washing tank.

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GLASS ACADEMY

Washing Machine Contamination

Organic contamination:

- Bio-films on the tank's walls and washing machine walls
 - Detectable by touching the wall
- Bio-films inside the brushes (between bristles)
 - Detectable by touching the brushes
 - Brushes loose their cleaning efficiency
- Bio films block filters, water nozzles and pipes:
- Bio-films are a perfect media for bacteria and micro-organisms

Inorganic contamination

- Increases the water conductivity, then reduce washing efficiency
- Modifies the pH
- Built a hard crust on the WM surfaces
- Block the water nozzles
- Block air-filter

The diagram shows a cross-section of a washing machine tank with various contaminants: water with ions (inorganic contamination, salts), cutting oil floating on the water, organic bio-film on the walls and in the pipes (organic particles, microorganisms etc.), Residua foreign bodies (e.g. etiquettes, cork-plates etc. paper), and Glass splinters/shells on the bottom of tank.

So, we are talking about organic contamination and inorganic contamination. So, bio film on the tank wall and washing machine walls delectable by touching the wall bio film inside the brushes between bristles. If the brushes is touching, so the brush lose their cleaning efficiency bio-films block filter water nozzle and pipe. Bio-film are perfect media for bacteria and microorganism. If the contamination is inorganic so increase the water conductivity, the reduce washing efficiency, modify the PH, build a hard crust on the washing machine surface, block the water nozzle or block the air filter.

So, this is inorganic contamination. So, first one is cutting oil, second one is your some glass cullet or some glass small particle is there, so your nozzle will be blocked.

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GLASS ACADEMY

Washing Machine Brushes

- ❑ **SPECIFICATION:**
 - Flexible (soft) clean polyamide bristles with a maximum diameter of 0.2 mm
 - Length 20 - 40 mm long.
 - Take care that all the brushes are perfectly clean and regularly maintained
 - Water sprayed directly on glass not on brushes.
 - The glass should not stay inside within the machine
- ❑ **Cleaning**
 - What: Brushes and support
 - How: high pressure water from a distance
 - Frequency: once a week
- ❑ **Adjustment of the level of brushes:**
 - Bristles contact should be set at 1.5 to 2 mm deeper than the real glass thickness
 - Bristles should be longer than 2 cm
 - Bristles should have the same length everywhere!

So, this is a washing machine brushes. So this is a specification of brushes. So, this brushes is very soft and the made is polyamide with the maximum diameter of 0.2. The washing brushes length is 20 to 40 mm long, take care all the brushes are perfectly clean and regularly maintain, water spray directly on glass not on brushes. The glass should not stay inside within the machine. If the glass stay in inside the machine, so the water is not you know the water is the droplet is not gone. So, that is why the glass should not stay inside within the machine.

So, cleaning so what is the cleaning? So, brushes and support, how? High pressure water for distance, frequency: once in a week. Adjustable of level of brushes: bristles contact should be set at 1.5 to 2 mm deeper than the real glass thickness, bristles should be longer than 2 centimetre, bristles should have the same level everywhere.

So, this is operation and position of nozzles.

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GLASS ACADEMY

Washing Machine Nozzle's

- **ORIENTATION AND POSITION OF THE NOZZLES :**
 - When replacing the nozzles and nozzle ramps, take care of the nozzle orientation.
 - In the ideal case the water has to be applied directly on the glass or short before the contact with the glass
- **WATER CURTAIN**
 - Overlapping of the water from each nozzle
 - Flat jet nozzles are preferred compared to spray head nozzles
 - Higher pressure, self cleaning
 - Longer maintenance intervals
- **CLEANING**
 - What: nozzles and bridges
 - How:
 - mechanical (brush) + water (+ RBS 1/10).
 - Best: ultrasonic bath (10 min)
 - Compressed air
 - Frequency: Once a week

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So, this is a brush, this is top brush, this is bottom brush and this is nozzle, this is top nozzle, this is bottom nozzle and this is the glass.

So, operation and position of the nozzle: when the replacing the nozzle and nozzle ramp take care of the nozzle orientation, second is in the ideal case the water has to be applied directly on the glass or short before the contact with the glass. So, this is a water curtain: so overlapping of the water its nozzle, flat jet nozzle is preferred compared to spray head nozzle, higher pressure self cleaning, if the lower maintaining intervals. So, this is a cleaning: so the nozzle and bridges. So, how you clean? So, mechanical brush plus water this is RBS 1 oblique 10, so best is ultrasonic bath 10 minutes and third one is compressed air. So, frequency is once in a week.

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GLASS ACADEMY

Washing Machine Cover Plates

- MATERIAL OF COVER PLATES
 - Metallic
 - Glass : Better to see continually the water flow.
- CLEANING
 - What: cover plates and holding elements
 - How: sponge under running water
 - Frequency : once a week

NPTEL 13

So, this is the washing machine cover the material of cover plate is metallic glass better to see continuously of the water flow and how to clean? What cover plates and holding elements, how? Sponge under running water, frequency is once in a week.

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GLASS ACADEMY

Washing Machine Control of efficiency

WASHING MACHINE : CONTROL THE EFFICIENCE

- How to check : The chalk test. The test consists on marking a piece with a chalk and see the efficiency of the washing machine in washing it. The steps to be followed are:
 1. Place a pre-washing conveyor.
 2. Make a chalk mark on both edges and in the center of the piece.
 3. Send the glass to the washing machine
 4. Check that there are no remaining marks of chalk on the glass after the washing machine. Check also that glass is completely dry
- Frequency : Each shift

NPTEL 14

So, now, we are talking about efficiency of washing machine. So, how you check? So, washing machine controls the efficiency how you check? The chalk test is there. So, this is a chalk. So the chalk test the test consistent on marking a piece with a chalk and see the efficiency of the washing machine in washing. It the step of to be followed at the 1st

step is place a pre washing conveyor, 2nd is make a chalk mark on both edges and the centre of the piece, 3rd step is send the glass to the washing machine, 4th check that there are no remaining mark of chalk on the glass after the washing machine, check also that glass is completely dry and the frequency is each shift. So, these are photos of chalk test.

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The slide features a blue wavy background. At the top left is the 'GLASS ACADEMY' logo. The title 'Washing Machine Drying' is centered at the top. Below the title is a bulleted list of four points, each preceded by a square checkbox. To the right of the list is a cartoon illustration of a worker in a red plaid shirt and blue overalls, standing next to a conveyor belt with rollers. At the bottom right, there is a small circular logo with a gear and a person.

- Glass panes can be dried with a powerful filtered hot air stream and a nozzle working at a specific angular.
- Glass temperature has to be checked during the drying process (if the temperature is too high, water condensates faster) → salt particles can deposit on the surface of the glass pane. You must be respect the temperature of the water
- Problems can appear during the drying process: blocked nozzles, oil in compressed- air and left over water.
- The transportation wheels have to be really clean, otherwise the glass panes can get dirty again.

So, now we are talking about dry. So glass panel can be drying with a powerful filter hot air stream and a nozzle working at a specific angular, glass temperature has to be checked during the drying process. If the temperature is too high, so water condensates are fresh faster so glass temperature has to be checked during drying process. If the temperature is too high, water condensates is faster salty particles can be deposit on the surface of the glass pane. You must respect the temperature of water. So, the temperature is always 35 to 40. So, problem can appear during the drying process, block nozzle, oil in compressed, air left over the water, So, the transportation wheel have to be really clean, otherwise the glass panes can get dirty again. So, this is a picture of cleaning the glass rollers.

So, now we are talking about washing machine drying and maintenance.

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GLASS ACADEMY

Washing Machine Draying & Maintenance

- ❑ A washing machine cleans glass panes, but not itself.
- ❑ Therefore, the washing machine has to be regularly cleaned.
- ❑ Clean with a high pressure cleaner :
 - The brushes
 - Inside the washing machine
 - The tank under the washing machine
- ❑ Frequency for line who produce 2 shifts.
 - Every 2 week, make a full cleaning.
 - Each shifts, control the nozzle and the quality of water
 - Every week, check the filter of drying and the brushes

NPTEL
16

A washing machine cleans glass panel, but not itself. Therefore, the washing machine has to be regularly cleaned. Clean with a high pressure cleaner: the brushes, inside the washing machine, the tank under the washing machine. Frequency line who produce 2 shifts: every 2 week make a full cleaning, it shift control the nozzle and the quality of water, every week check the filter of drying and the brushes. So, this is the picture of cleaning the brushes and the nozzles.

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GLASS ACADEMY

PPE used for washing operation

NPTEL

So, this is a PPE of washing operation 1st is helmet, 2nd is gloves, 3rd one is goggles,

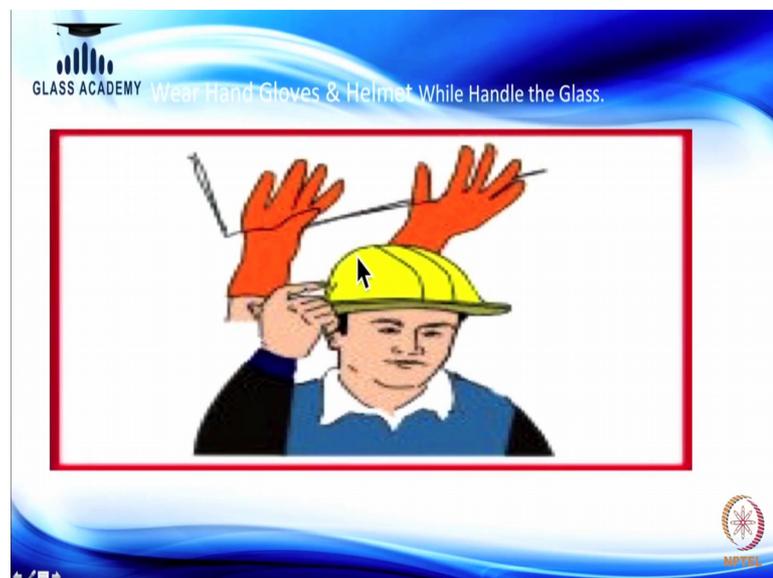
4th one is safety shoes and last one is apron.

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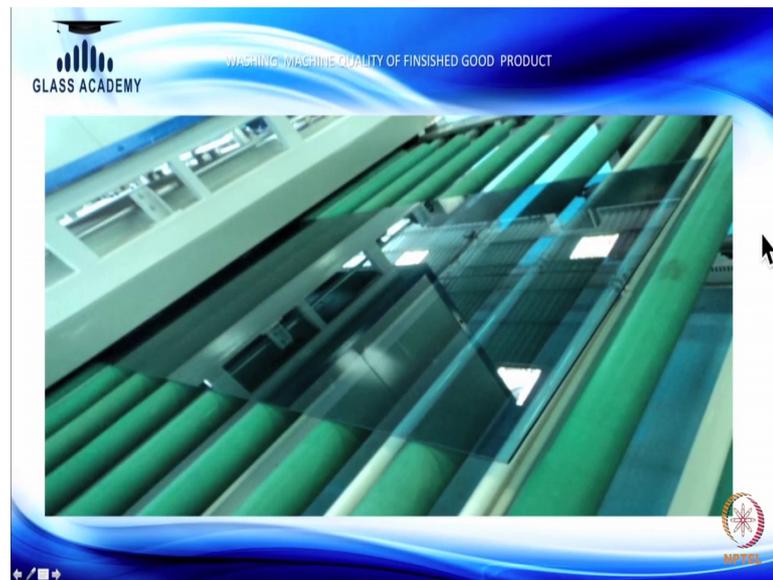
So, mainly we are using this is called as PU coated gloves. So, if you see this is a coating. So if you use this glove so this gloves is protect your fingerprints.

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So, wear hand gloves and helmet while handle the glass. So, this is very main. So, this is the safety photos.

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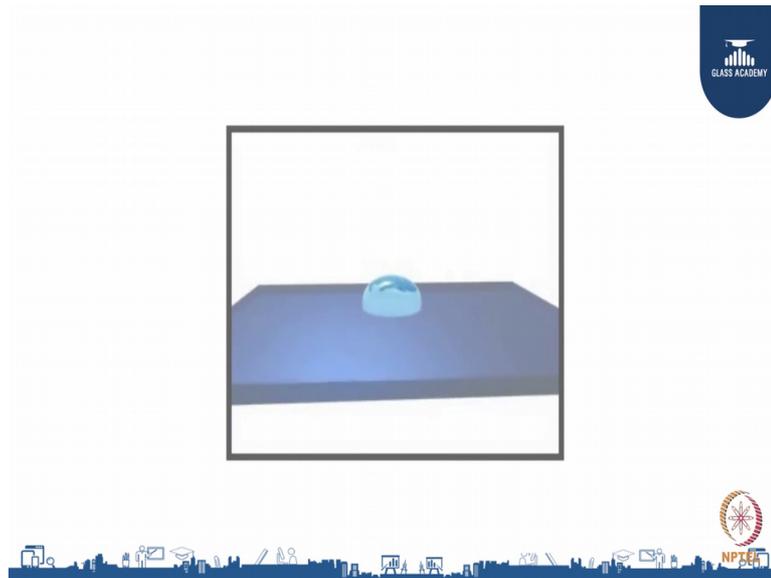


And this is a final finished good product. So, if you see the product, so there is no finger mark there is no dust so this is perfectly wash glass yeah.

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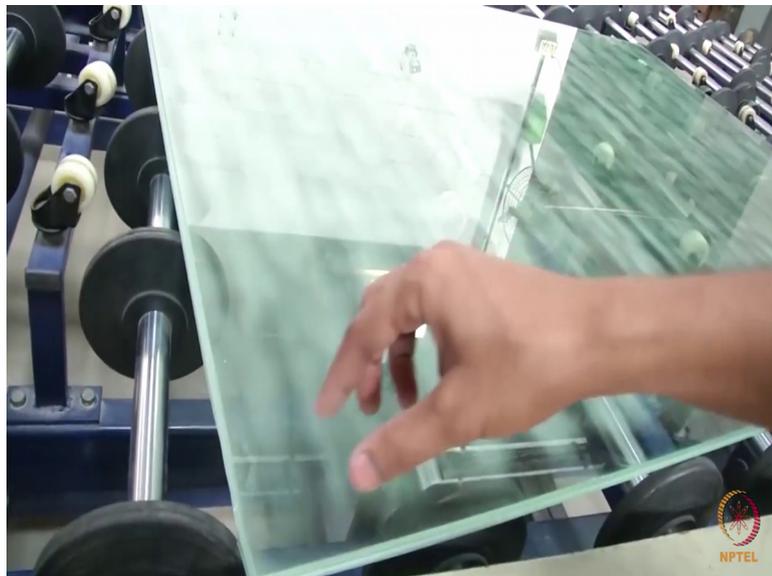
This is the heating section next it goes to pressing section.

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This is known as nip rolling one. Next again go it goes to second heating section again, we have one more nipro section. Nipro section then it goes for unloading and next it comes out for unloading.

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You can say the haziness is there on the glass. Through this pressing we are de-airing the moisture in between the glass and PVB and we are doing basically primary sealing in pressing (Refer time: 15:27).

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This is the temperature gun. This is the temperature gun which will measure the output of the temperature output temperature. You see now it is measuring 58 degree centigrade. Generally it will be on an average of a 60 degree centigrade

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Now, this glass is coming from assembly, now it is going to heating section (Refer Time: 16:13) what (Refer Time 16:15). Yes, from assembly it is going to pressing section here, it is getting heating. This is known as oven heating oven. Next it goes to pressing you take that.

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Next it goes to nip rolling system the speed depends on the glass thickness and the combination now the glass is entering into nip rolling system.

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This is the second heating section or zone and this is the nip roll nip roll to that goes to unloading.

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During pressing during pressing process, primary sealing will be done through de-airing process. You can able to find the haziness on the glass that will be removed inside the autoclave.

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A slide with a background image of a glass factory. The text box contains a summary of the video content.

Summary:

By the end of this video, you have learnt about the:

- Types of washing machine
- Water quality
- Temperature of water
- PH of water
- Conductivity of water
- Washing machines - contamination, brushes, nozzle's, cover plates, control of efficiency, drying, and maintenance
- PPE's used for washing operation