

# TTA CO., LTD



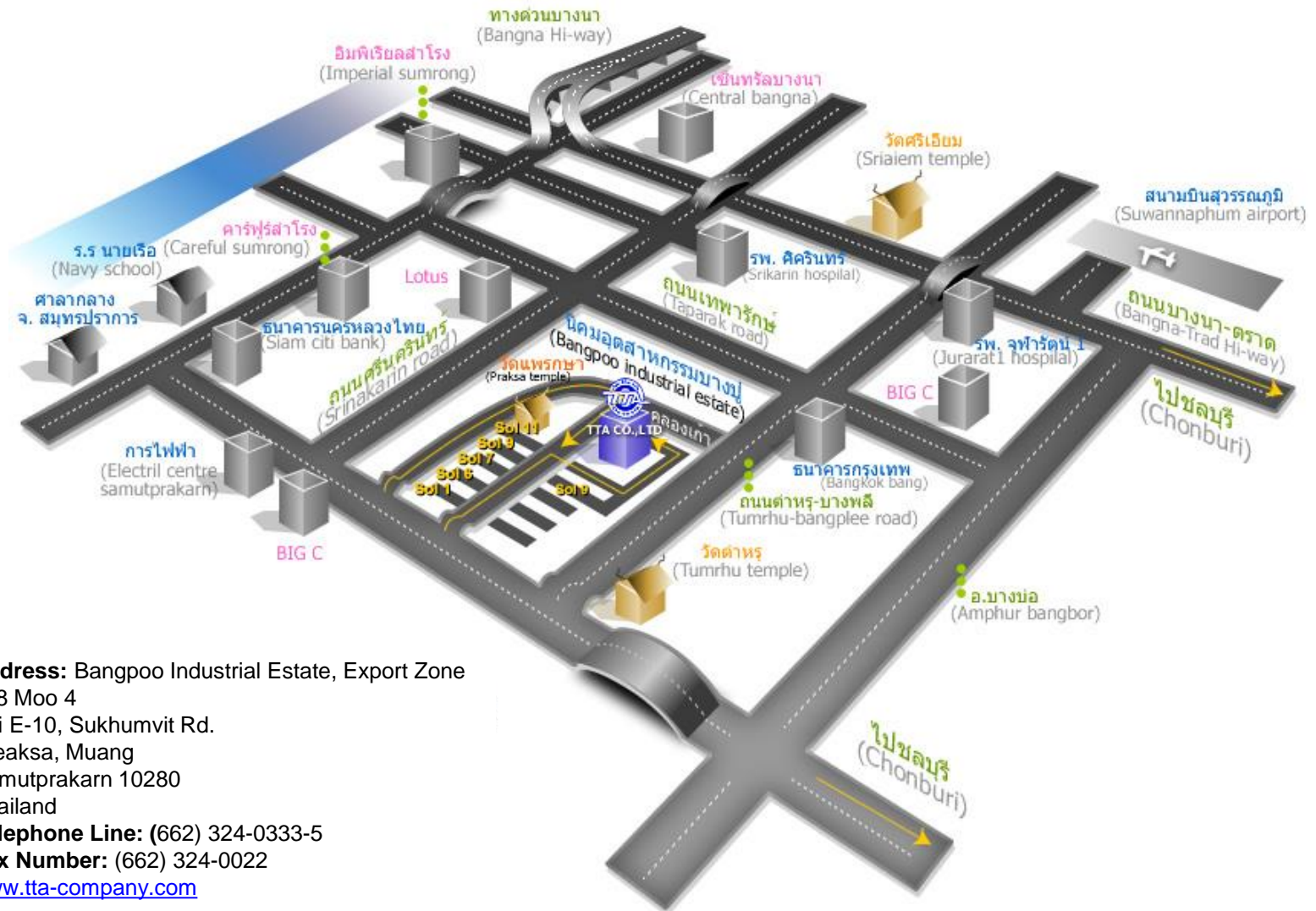
MANUFACTURE OF COPY MACHINE, GLASS AND SCANNER MACHINE GLASS  
เครื่องถ่ายเอกสาร เครื่องสแกนเนอร์ เครื่องระบบการพิมพ์ คุณภาพ  
(ISO 9001 : 2008)



บริษัท ทีทีโอ จำกัด  
TTA CO., LTD.



# Company Profile



**Address:** Bangpoo Industrial Estate, Export Zone  
698 Moo 4  
Soi E-10, Sukhumvit Rd.  
Preaksa, Muang  
Samutprakarn 10280  
Thailand  
**Telephone Line:** (662) 324-0333-5  
**Fax Number:** (662) 324-0022  
[www.tta-company.com](http://www.tta-company.com)



# Company Profile

<b>Company Name</b>	<b>: TTA Co.,Ltd</b>		
<b>Website</b>	<b>: <a href="http://www.tta-company.com">www.tta-company.com</a></b>		
<b>Address</b>	<b>: Bangpoo Industrial Estate, Export Zone, 698 Moo 4, Soi E-10, Sukhumvit Rd., Preaksa, Muang, Samutprakarn, 10280 Thailand</b>		
<b>Area of Factory</b>	<b>: 6,400 sq.m</b>		
<b>Building</b>	<b>: Factory 1</b>	<b>761 sq.m</b>	<b>(Glass Lid Products)</b>
	<b>: Factory 1, 2</b>	<b>1912 sq.m</b>	<b>(Scanner and Copier Glass Product)</b>
<b>Establishment</b>	<b>: June, 1988</b>		
<b>Operation start</b>	<b>: June, 1989</b>		
<b>Capital</b>	<b>: 40 M Baht</b>		
<b>Shareholders</b>	<b>: Thai 80% Mr.Sombath Phanichewa And His Group</b>	<b>78 %</b>	
	<b>: AGC Flat Glass (Thailand) Public Co.,Ltd.</b>	<b>2 %</b>	
	<b>: Japan 20 % Akao Aluminum Co.,Ltd.</b>	<b>20 %</b>	



# Company Profile

<b>Name of Directors</b>	<b>: Mr.Sombath Phanichewa</b> <b>: Mr.Chaikeeree Srifeungfung</b> <b>: Mr.Tanet Phanicheewa</b> <b>: Mr.Keerati Phanicheewa</b> <b>: Mrs.Yumi Akao</b> <b>: Mr.Hirotsugu Orimoto</b> <b>: Mr.Suwit Trivisavavate</b> <b>: Mrs.Chaweewan Sirijansawang</b>
<b>Employees</b>	<b>: 63 (Include 1 Japanese)</b> <b>: Contractor Company (around) 14</b>
<b>Products</b>	<b>: Chemical hardening Document Glass</b> <b>: Scanner &amp; Copier Glass</b> <b>: Tempered Safety Glass For Furniture</b> <b>: Tempered Glass Lid</b> <b>: Car Light Cover Tempered Glass</b>
<b>Turnover</b>	<b>: 197 M Baht (2002)</b> <b>: 194 M Baht (2003)</b> <b>: 170 M Baht (2004)</b> <b>: 155 M Baht (2005)</b> <b>: 114 M Baht (2006)</b>
<b>Bank</b>	<b>:Siam City Bank</b> <b>:The Bank Of Tokyo Mitsubishi</b>



# COMPANY'S HISTORY

- 1988 ESTABLISHED TTA CO., LTD
- 1990 START BUSINESS FOR HEAT TEMPERED GLASS LIDS
- 1995 START PRODUCTION OF COPIER AND SCANNER GLASS WITH CHEMICAL STRENGTHENED GLASS
- 1996 THE NEW DIVISION OF SCALE AND SHEET ASSEMBLY FOR FUJI XEROX PRODUCTS
- 1998 MAKE A NEW CHEMICAL STRENGTHENED FURNACE NO.3 FOR COPIER & SCANNER GLASS
- 2000 START PRODUCTION OF COVER LIGHT GLASS FOR CAR
- 2001 START PRODUCTION OF CHEMICAL STRENGTHENED GLASS FOR FURNITURE
- 2003 MAKE A NEW CHEMICAL STRENGTHENED FURNACE NO.4  
  
CERTIFIED ISO 9001 : 2000 FROM URS QUALITY MANAGEMENT  
(MANUFACTURE OF SCANNER GLASS AND MACHINE)
- 2009 CERTIFIED ISO 9001 : 2008 FROM URS QUALITY MANAGEMENT  
  
(MANUFACTURE OF SCANNER GLASS AND MACHINE)
- 2011 MAKE A NEW CHEMICAL STRENGTHENED FURNACE NO. 5  
START PRODUCTION OF CHEMICAL STRENGTHENED GLASS FOR BUILDING



# Company Customer

## COMPANY'S CUSTOMER

### GLASSS LIDS

- MEYER IND. LTD.
- AKAO ALUMINUM CO., LTD.
- SIAM FUJI WARE (1988) CO.,LTD.
- THAI TOSHIBA ELECTRIC INDUSTRIES CO.,TLD.

THAILAND  
JAPAN  
THAILAND  
THAILAND

**EPSON®**

**AGC**

### COPIER & SCANNER GLASS

- AGC ELECTRONICS (S) PTE LTD.
- CANON HI-TECH (THAILAND) LTD.
- KISHIRO HONGKONG CO., LTD.
- FUJI XEROX FAR EAST LTD.
- SOLARLENS CO.,LTD.

SINGAPORE  
THAILAND  
HONGKONG  
HONGKONG  
THAILAND



### COVER LIGHT GLASS FOR CAR

- YUNGCHIN INTERNATIONAL CO.,LTD.

THAILAND

**Canon**



# Our Product

## Glass Lid



## Copier Glass

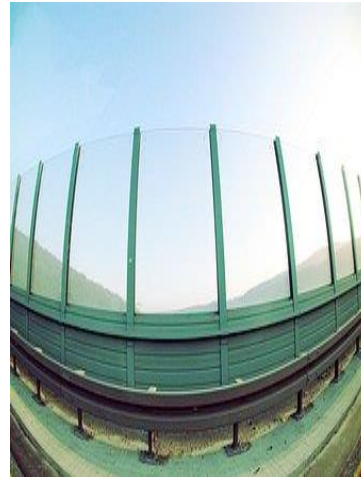


## Scanner Glass



# New Product

## Building Glass



Type of glass	Thickness (mm.)
1.Clear Chemical Strengthened	0.5, 0.7, 1.0-5.0
2.Tinted Chemical Strengthened	3.0, 0.5
3.Chemical Strengthened Laminated	1+1, 2+2, 3+3, 4+4
<b>*Maximum Size 2000x2500 mm. (D=1000)</b>	

**\*Remark: Any sizes, any thickness, any shapes can make it within Maximum size.**

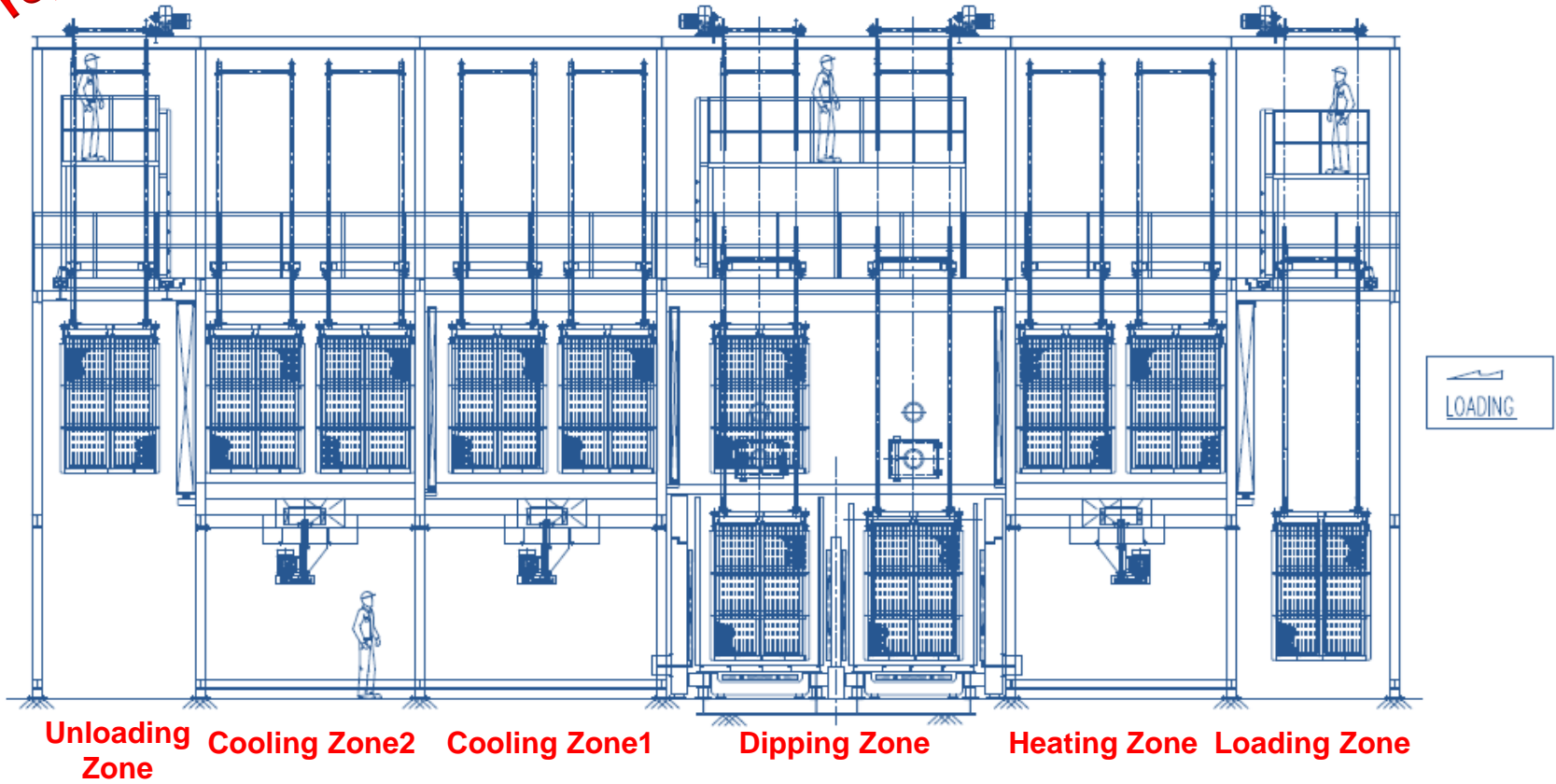




# Chemical Strengthened Glass

## Chemical Strengthened Furnace No.5

**New Project!**





# Chemical Strengthened Glass

## Glass Plate Size





# Chemical Strengthened Glass



**Chemical Strengthened  
Furnace No.5**



**Fill Potassium Nitrate**



**KNO3 Before Melting**



**KNO3 is Melting**



**KNO3 Melting**

# Chemical Strengthened Glass



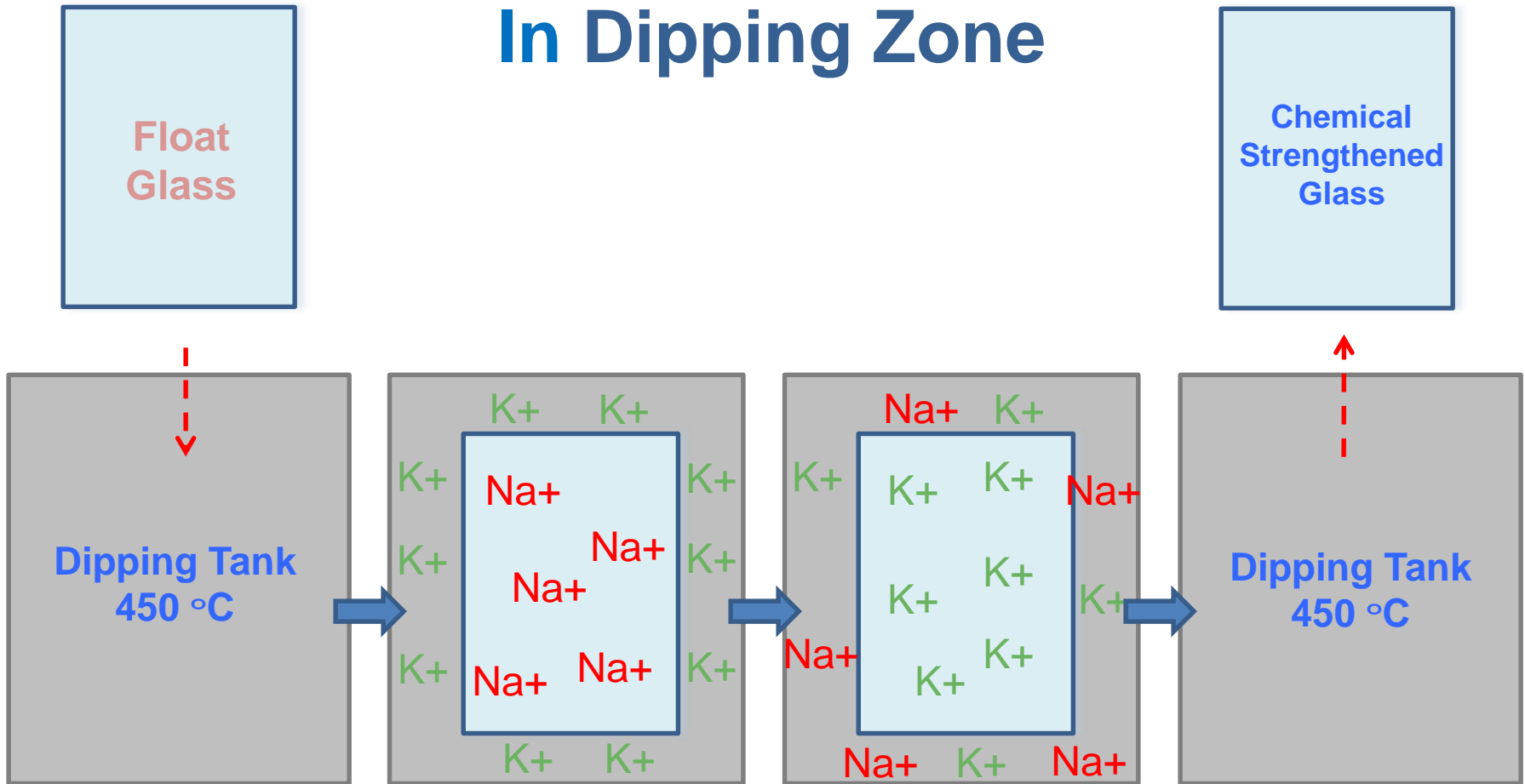
**Arrange Float Glass into the basket**



**Lift up Float Glass into Heating Zone**

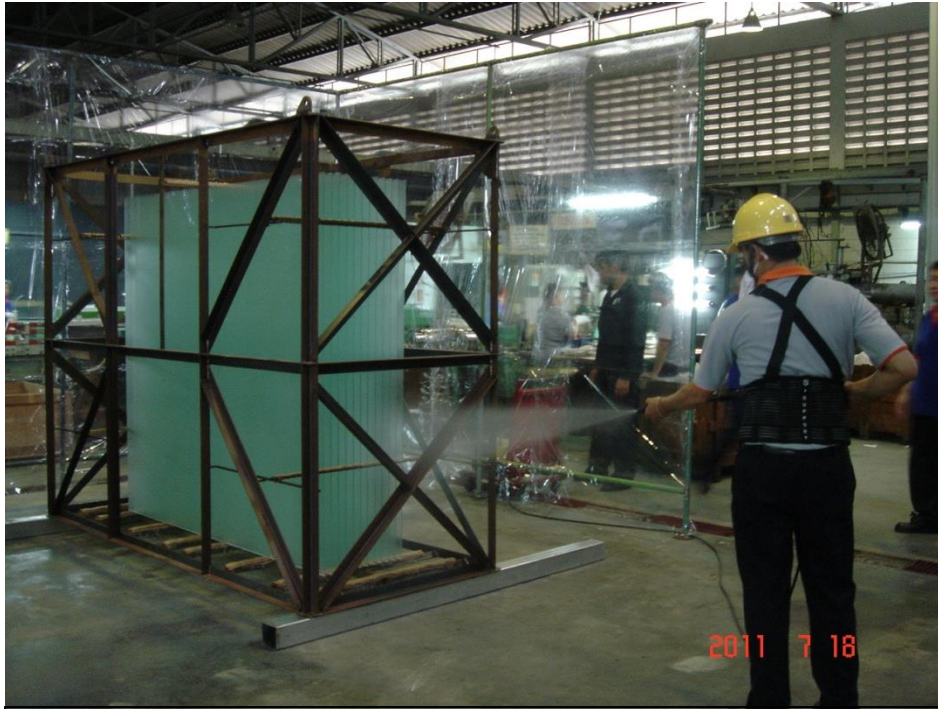
# Chemical Strengthened Glass

## Chemical Ion Exchange In Dipping Zone





# Chemical Strengthened Glass



**Washing**

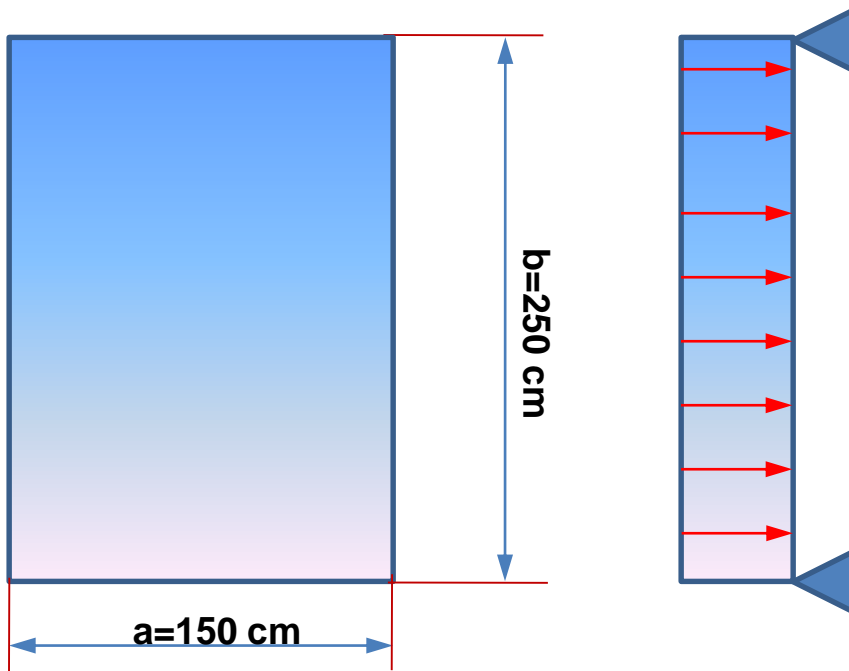


**Packing**

# Chemical Strengthened Glass

## For Example

1. Glass size: 1500x2500 mm.
2. Wind Pressure 200 Kg/m<sup>2</sup>
3. Supporting Condition Four sides Simply Supported



$$E_{\text{glass}} = 7.16 \times 10^{-4} \text{ Kg/cm}^2$$

$$q = 200 \times 10^{-4} \text{ Kg/cm}^2$$

$$W = 200 \text{ Kg/m}^2$$

$$b/a = 250/150 = 1.67$$

$$\beta = 0.527$$

$$\alpha = 0.0982$$

Calculate for what is glass thickness in **Anneal Glass (Float Glass)**  
& **Chemical Strengthened Glass?**



# Chemical Strengthened Glass

## 4. Allowable Stress in Plane

Anneal Glass (Float Glass)  $\sigma_a = 250 \text{ Kg/cm}^2$  (Safety Factor = 2...1/1000)

Chemical Strengthened Glass  $\sigma_a = 2000 \text{ Kg/cm}^2$  (Safety Factor = 2...1/1000)

## 5. Formula of Stress $\sigma$

**Anneal Glass**  $t = \sqrt{\frac{\beta x q x a^2}{\sigma_a}} = \sqrt{\frac{0.527 x 200 x 10^{-4} x 150^2}{250}} = 0.97 \text{ cm} = 10 \text{ mm.}$

**Chemical Strengthened**  $t = \sqrt{\frac{0.527 x 200 x 10^{-4} x 150^2}{2000}} = 0.34 \text{ cm} = 4 \text{ mm.}$

**Fully Tempered**  $t = \sqrt{\frac{0.527 x 200 x 10^{-4} x 150^2}{900}} = 0.51 \text{ cm} = 6 \text{ mm.}$





# Chemical Strengthened Glass

The comparison table among Anneal glass (Float glass) , Heat Strengthened glass, Fully tempered glass and chemical strengthened glass

	Anneal (Float glass)	Heat Strengthened Glass	Fully Tempered Glass	Chemical Strengthened Glass
<b>Raw Material</b>	Silica sand	Silica sand	Silica sand	Silica sand
<b>Production Process</b>	Float process	Horizontal roller	Horizontal roller	Dipping in tank
<b>Tempering System</b>	-	Heat treatment 730 degree to normal temp. Quenching moderately	730degree to normal temp. Quenching quickly	Ion exchange in 450 degree from sodium to potassium
<b>Surface Compression</b>	-	400-500 kg/cm <sup>2</sup>	1000kg/cm <sup>2</sup>	3500-4000 kg/cm <sup>2</sup>
<b>Av. Broken Stress</b>	500-550kg/cm <sup>2</sup>	800-900kg/cm <sup>2</sup>	1400-1500kg/cm <sup>2</sup>	4000-4500 kg/cm <sup>2</sup>
<b>Allowable stress in short time</b>	200-250kg/cm <sup>2</sup>	400-450kg/cm <sup>2</sup>	800-900kg/cm <sup>2</sup>	1800-2200 kg/cm <sup>2</sup>
<b>Allowable stress in short time at edges</b>	180kg/cm <sup>2</sup>	360kg/cm <sup>2</sup>	800kg/cm <sup>2</sup>	1000 kg/cm <sup>2</sup>
<b>Depth of surface compression</b>		t/6	t/6	10-15µm
<b>Spontaneous breakage</b>	Non	Yes-low possibility	Very high possibility even heat soaking test is still some possibility	Non
<b>Cutting after treatment</b>	-	Non	Non	Possible around cutting area 20 mm will be annealed
<b>Stock</b>	Stock	Customer Made	Customer made	Can be stock product
<b>Specific Gravity</b>	2.5	2.5	2.5	2.5
<b>Optical Distortion</b>	Raw glass	Roller wave	Roller wave	As same as float glass
<b>Heat Shock (Degree Celcius)</b>	50 degree	100 degree	150 degree	250 degree



# Introduction

Chemical strengthened glass is 3-5 times stronger than heat tempered glass in terms of impact strength. Ultra thin glass such as 0.5mm could be chemically strengthened. Chemical temper glass could be made in any shapes, any thicknesses and there is no limitation on minimum glass size.





# Principle

## General

### **Chemical Strengthened Glass Is Done By Chemical Ion Exchange Reaction Inside A Tank Bath Filled With Potassium Nitrate & Special Catalyst**

The major structure of the system is a chemical bath tank filled with potassium Nitrate added with some special ingredients which act as catalyst. Chemical strengthening is the name given to glass products that have been strengthened by means of an ion-exchange process. particularly useful for thin glass, tiny glass and shape glass which cannot be tempered by ordinary physical tempering.



# Principle

It is a surface treatment which occurs at a temperature ***lower than glass melting temperature.*** Glass to be treated is submerged inside the bath of dissolved potassium intrate at a temperature about 350-450°C for duration from 4 to 10 hours depending on how much residual stress induced on glass surface. **Chemical ionic exchange is taken place between superficial sodium ions in the glass and potassium ions inside the bath.** The process parameters such as ion exchanging time and temperature would be modified according to the type of glass to be treated and the required strengthen specification. **This process increases the thermal and mechanical strengths of common annealed soda lime silicate glass without affecting its optical properties.** Chemical strengthening is particularly useful for thin glass, tiny glass and shape glass which cannot be tempered by ordinary physical tempering.



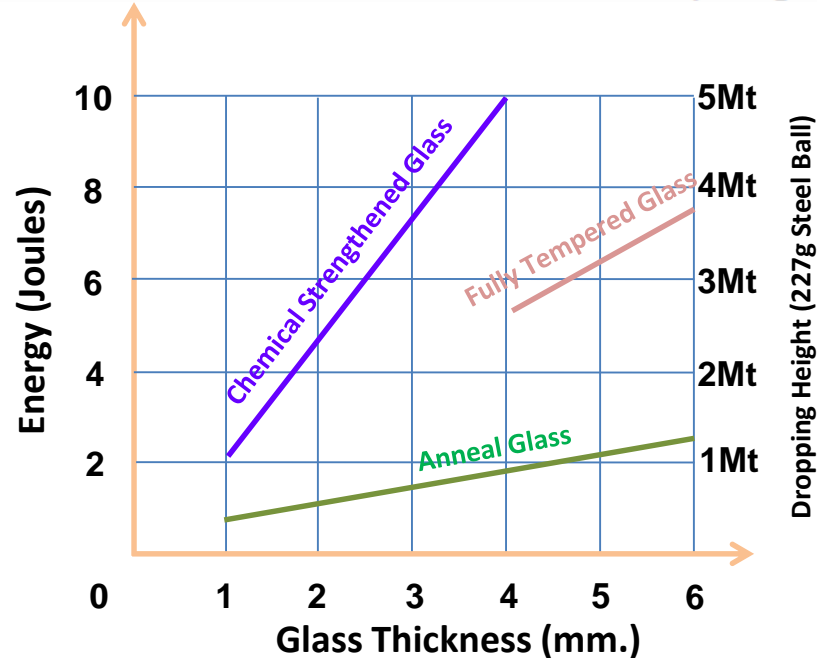


# Principle

## Flexural Bending Strength Vs Coefficient of Variation

Glass Type	Flexural Bending MOR (N/mm <sup>2</sup> ) (MPa)	Coefficient of Variation
Anneal Glass (Float Glass)	41	0.25
Heat Strengthened Glass	82	0.2
Fully Tempered Glass	165	0.15
Chemical Strengthened Glass	300 - 600	0.10-0.15

Impact Resistant Vs Glass Thickness Vs Ball Drop Height





# Glass Advantage

## Excellent Mechanical Strength

### Chemically Strengthened Glass Is Always Excellent At Mechanically Strength

Chemical strengthened glass is 10 to 15 times tougher than ordinary float glass. It has remarkable increase of impact resistance. Compression layer depth could be up to 10 to 15  $\mu\text{m}$  according to chemical ion exchanging time. Surface compression could go up to approximately 300-600 N/mm<sup>2</sup> (Mpa). The longer the chemical reaction, the deeper the depth and the higher the compression

Glass chemically strengthening process improves its mechanical characteristics of residual stress characterized by a superficial pre-compression condition which contrasts the effect due to the presence of the cracks.



# Glass Advantage

## Marvelous Flexural Bending Strength

### Chemical Strengthened Glass Is “Flexible” & “Elastic”

After chemical strengthening, glass central tension is very low and is almost neglected. Fragile and stiff glass becomes flexible and "elastic" while tougher. When there is external force, it acts like a sponge to "absorb" the action and rebound like high elasticity rubber sheet.





# Glass Advantage

## Scratch Proof

### Hard Surface Is Another Remarkable Characteristic of Chemical Strengthened Glass

Chemically strengthened glass surface is restructured. It is more stronger and resists scratch.







# Glass Advantage

## Hardness Test : Vickers Test





# Glass Advantage

## Result of Hardness Test From KMUTT : Vickers Test

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Issued Report No. rpt.2011199

มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี  
King Mongkut's University of Technology Thonburi  
ภาควิชาวิศวกรรมผลิตรวม : Department of Production Technology Education

**HARDNESS TESTING REPORT**

Name of Client : TTA Company Limited.  
Address : 689 Moo 4, Soi E-10 Bangpoo Industrial Estate  
Sukumvit Rd., Praskia, Muang, Samutprakarn 10280

Name of Product : Chemical Temper, Non Temper, Heat Tempered  
Model No. :-  
Project :-  
Material : Glass  
Manufacturer :-  
Testing Item : Hardness : HV  
Date of Testing : 3<sup>rd</sup> August 2011  
Hardness Testing Procedure : Vicker hardness test Load 100 gf  
Reference code: ASTM E92-82(2003) e2

We hereby certify that the testing result is the data shown in the attached sheet.

Name of Accredited Testing Lab. : Material Testing Laboratory  
Center of Research and Technology Services  
School of Industrial Education  
King Mongkut's University of Technology Thonburi

Signature *P. Prachya* Prachya Pearsura Tester  
Signature *S. Sutthipong* Sutthipong Sopha Approval

รายงานผลทดสอบจะถูกต้องและเชื่อถือได้เฉพาะกรณีที่ผู้ส่งมาปฏิบัติตามเงื่อนไขการทดสอบที่กำหนดไว้เท่านั้น  
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126 ถ.ประชาอุทิศ แขวงบางมด เขตทุ่งครุ กรุงเทพฯ 10140 โทรศัพท์ (662) 470-8554-6 โทรสาร (662) 470-8557  
126 Pracha-utis Rd., Bangmod, Toong-kru, Bangkok 10140 Thailand Tel. (662) 470-8554-6 Fax. (662) 470-8557

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Issued Report No. rpt.2011199

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King Mongkut's University of Technology Thonburi  
ภาควิชาวิศวกรรมผลิตรวม : Department of Production Technology Education

**Results of Analysis**

Hardness Unit:HV						
Sample Name	Position 1	Position 2	Position 3	Position 4	Position 5	Average
Chemical Temper	728.5	725.9	726.7	719.8	730.1	726.20
Non Temper	612.3	623.1	645.4	616.0	626.8	624.72
Heat Tempered	578.7	605.5	649.2	649.2	653.1	627.14

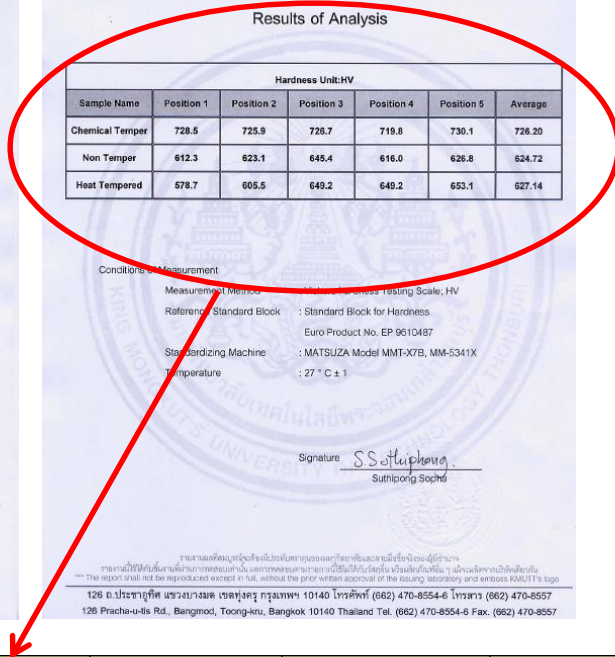
Conditions of Measurement

Measurement Method : Vicker's Hardness Testing Scale, HV  
Reference Standard Block : Standard Block for Hardness  
Euro Product No. EP 9610487  
Standardizing Machine : MATSUZA Model MMT-K7B, MM-5341X  
Temperature : 27 ° C ± 1

Signature *S.S. Sutthipong* Sutthipong Sopha

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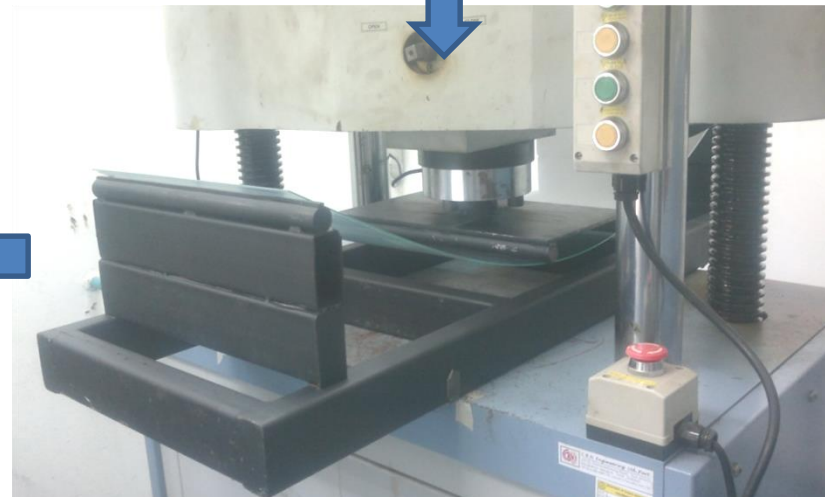
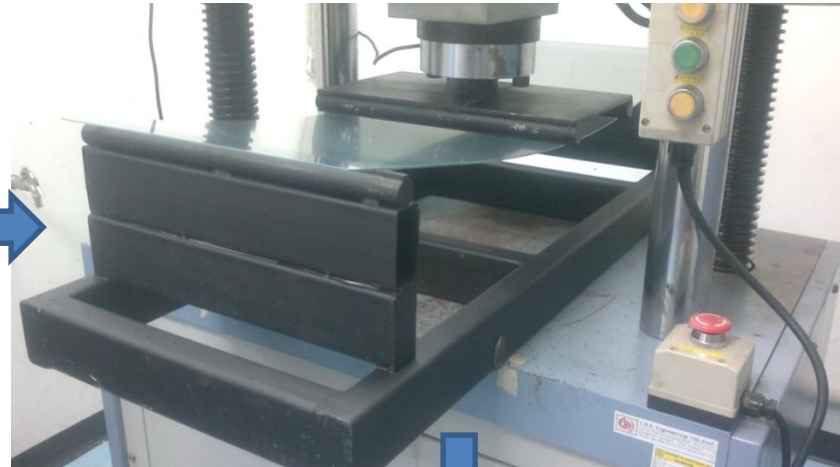
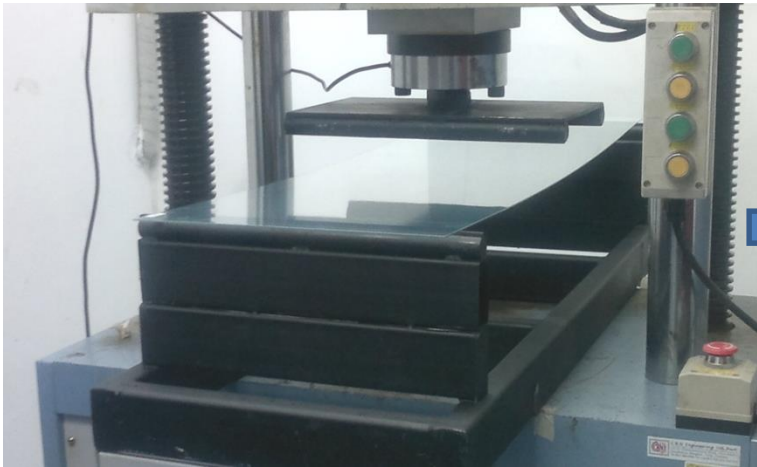
Sample Name	Position 1	Position 2	Position 3	Position 4	Position 5	Average
Chemical Strengthened Glass	728.5	725.9	726.7	719.8	730.1	<b>726.2</b>
Float Glass ( Non-Chemical)	612.3	623.1	645.4	616	626.8	<b>624.72</b>
Fully Tempered Glass	578.7	605.5	649.2	649.2	653.1	<b>627.14</b>



# Glass Advantage

4 Points Bending Test REF: BS EN 1288-3:2000

Chemical Strengthened Glass





# Glass Advantage

## 4 Points Bending Test

### Chemical Strengthened Glass



Glass size: 360x1100x4 mm.

**Maximum Broken = 80 Kg.f**



# Glass Advantage

## Remarkable Thermal Stability

### Sudden Cooling of Hot Chemical Strengthened Glass Does Not Break

Any glass thickness could be chemically strengthened, for example, 1mm or less. This property is helpful especially for flat panel display which requires high impact strength glass.

Temperature Difference about 250 °C  
will be withstand.



# Glass Advantage

## Optical Distortion Free

### Ion Exchange Process Does Not Affect Glass Optical Property

Glass property remains unchanged after chemically strengthening.

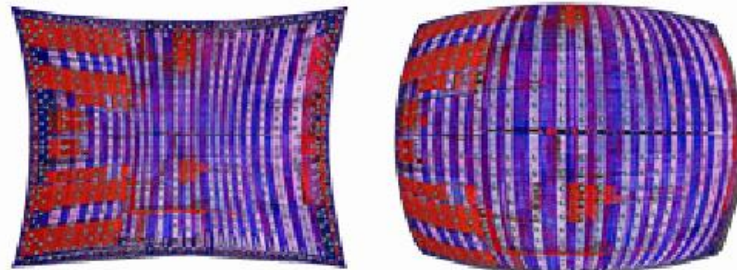


# Glass Advantage

## No Geometrical Distortion

### Glass Does not Deform After Chemical Strengthening

Glass is geometrically distortion free after glass strengthening process. The chemical reaction does not affect glass geometric shape. The form and shape of glass putting inside bath tank does not change when it is unloaded from the tank after chemical strengthening.





# Glass Advantage

## Free Of Roller Marks

### Roller Mark Free Of Chemically Strengthened Glass

There are no rollers in glass chemically strengthened oven,  
so no roller marks shall occur.





# Glass Advantage

## No Thickness Limitation

### Glass Thickness Does Not Matter To Chemical Strengthening Process

Any glass thickness could be chemically strengthened,  
for example, 1 mm or less.

This property is helpful especially for flat panel display which  
requires high impact strength glass.



# Glass Advantage

## Light Weight

Thin Light Strengthened Glass is Always Done By Ion Exchange Process.





# Glass Advantage

## No Minimum Size Limitation

**Any Glass Size Could Be Chemically Strengthened.**

Any tiny glass could be chemically strengthened.

No more restriction in minimum glass size.



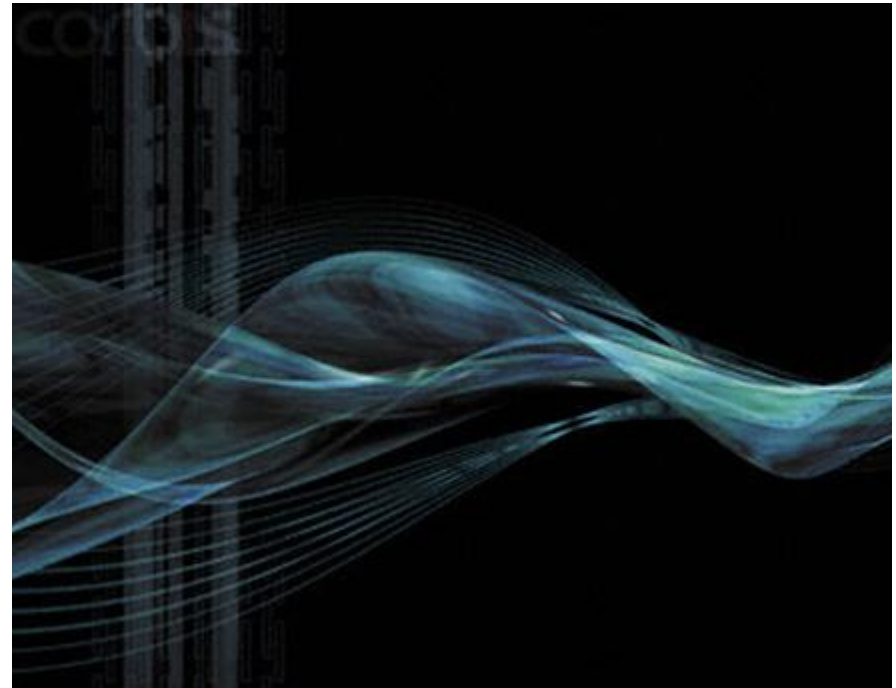
# Glass Advantage

## No Shape Limitation

### Chemically Strengthened Process Is Applicable To Any Glass Shape & Form

Any glass shape could be chemically strengthened, for example, single, double, compound curvature, S or L glass shapes for flat glass processing.

Others include glassware, container glass, pharmaceutical glass, kitchenware, cookware and ovenware, etc.





# Glass Advantage

## Complex Shape

### Chemically Strengthen Of Complex Glass Shape Is As Easy As Flat Glass

When curve chemical strengthen glass shape is required, flat glass is always bent in ordinary bending furnace first. Then it is bath in potassium salt for chemical strengthening. Ordinary bending and annealing oven could make complex glass shape that bending and heat tempering furnace simply could not achieve.





# Glass Advantage

## Allow Cutting

### Strengthen Glass Could Be Cut If It Is Made by Ion Exchange



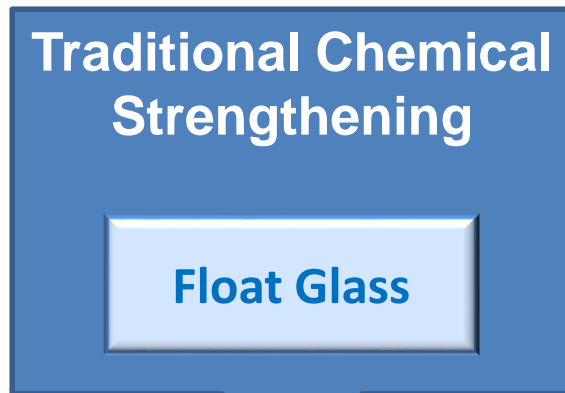
Cutting of chemical strengthened glass is permitted with proper cutting tools and breakout skills. Large pieces of glass are firstly chemically strengthened when final sizes are still unknown. They are then sold out to buyers who only know final sizes at last minutes. This advantage is particularly important when glass distributors would like to keep stocks for immediate delivery.



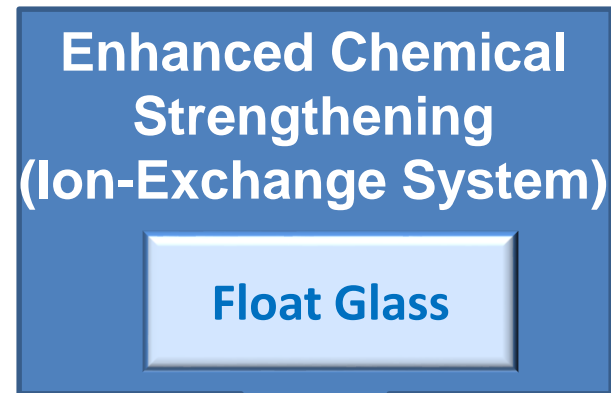
# Glass Advantage

## Cost Saving

**Increasing Ion-exchange Rates Would Yield Stronger, More Cost-effective Products**



**Treatment Time: 8-16 Hours**  
**Cost: 1-3 \$/ sq. ft.**



**Treatment Time: 3-6 Hours**  
**Cost: 0.5-1.5 \$/ sq. ft.**

# Thank you

# ありがとうございます。

# ขอบพระคุณค่ะ

