



PMMA ACRYLIC
Handbook 2013 - 2014

for building professionals and developers



WORLDBIZZ PTE LTD takes this opportunity to thank all architects, building professionals and clients for their support in using our services for the supply and installation of acrylic panels. It has been exciting to work with so many projects that are challenging and to successfully complete such projects on time.

We will strive to work closely with you on new designs on the application of acrylic for upcoming projects be it commercial, public or residential. The project references in this handbook are some of the many projects that we have done since 2005. We have more photos of other projects but it is not possible to print all of them.

We have the experience and expertise to work with acrylic especially relating to chemical welds, thermoforming for flat panels and we are able to provide vacuum forming for acrylic dome. This is the first of such hand-books to be published on a yearly basis for us to acknowledge the project developers, architects, and all building professionals that we get to work with.

With our sincere thanks and appreciation

*Frozen Tundra - (tank PB1)
at River Safari*

We have successfully completed all acrylic panel works as an ACRYLIC SPECIALISTS for the River Safari Project in year 2012, working closely together with the main contractor - Prelim Construction Pte Ltd





JARED CHEW
Acrylic Specialist

In year 2005,

Jared Chew, through managing GTS Benjamin Industries (S) Pte Ltd, became a pioneer in the creation of a new and niche market of using PMMA Acrylic Viewing panels for application to swimming pools. After a period of studies and assessment, several prominent building professionals took their decision to use PMMA Acrylic for application to swimming pools. This became the starting point and our marketing efforts gained success thereon. Since, we have successfully completed many projects over the past eight years. Some of these project references are listed in this handbook. There are many on-going projects in year 2013 and we shall update the handbook as we go along. Today we brand our product as **SUPERBRIGHT PMMA** Acrylic Panels.

The business operation today has expanded to include workshop facilities for chemical weld and thermo forming, trained specialist technicians for better workmanship on site, and steel fabrication for integration with acrylic. Steel fabrication is an integral part of the acrylic business because engineering techniques are needed in the installation process. We are equipped with fabrication facility that include customized mobile oven necessary for thermo forming on site. Hoisting, lifting and handling of acrylic panels (especially the larger panels) is no easy feat when crane facility is not available. However, we have the experience in such capacity in moving and handling larger acrylic panels inside a building using only manpower and chain blocks.

For turn-key projects, we include Professional Engineer services for design calculation and endorsement; full CAD drafting; and as an option, we can provide BCA submission that concerns only acrylic panels. The structural design calculations on concrete nib fall under the scope by others.

In this handbook, we define facts and information underlying the use of PMMA Acrylic – a truly emerging technology destined to grow in applications outside of swimming pools and water feature projects. In this respect, we aim to give awareness to building professionals and developers on frequently asked information on PMMA Acrylic and we strive to upgrade our expertise with every project completion and taking on challenging designs.

Today the PMMA Acrylic Panels are sold and marketed through associated companies that are managed by Jared Chew - **Worldbizz Pte Ltd, Steel-Product Connectors Pte Ltd and Red Coral Technology Singapore Pte Ltd**. Our factory fabrication facility is located in Jiangsu, China under the incorporation of "Jared – Full Acrylic Products Co., Ltd" – having full business operation facility.

At all times, we will strive to serve you better.

Sincerely

Jared Chew



PMMA (Polymethyl methacrylate) is a synthetic polymer of methyl methacrylate. PMMA Acrylic is a good alternative to glass. PMMA is a tough, highly transparent material with excellent resistance to ultraviolet radiation and weathering. It can be colored, molded, cut, drilled, and formed. These properties make it ideal for many outdoor applications like in swimming pools and water features.

Frequently asked, is PMMA harmful? PMMA does not contain the potentially harmful chemical bisphenol-A subunits found in polycarbonate. Thus, when torched, PMMA vaporizes to gaseous compounds and disappears into thin air without toxic.

The Manufacturing Process

Acrylic is formed by a traditional process called bulk polymerization where the monomer and catalyst are poured into a mold and the reaction takes place.

The mold for producing sheets is assembled from two plates of polished glass separated by a flexible “window-frame” spacer. The spacer sits along the outer perimeter of the surface of the glass plates and forms a sealed cavity between the plates. The flexible spacer allows the mold cavity to shrink during the polymerization process to compensate for the volume contraction of the material as the reaction goes from individual molecules to linked polymers.

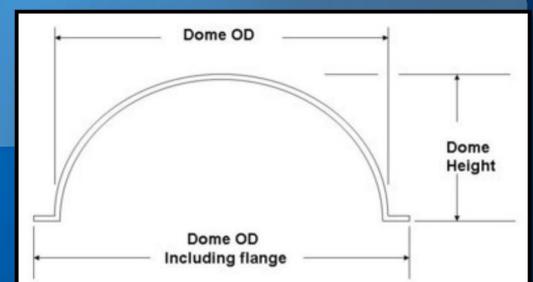
An open corner of each mold cavity is filled with pre-measured liquid syrup of methyl methacrylate monomer and catalyst which flows throughout the mold cavity to fill it.

The mold is then sealed for the reaction to take place. In the reaction, heat is generated but is fanned off in air ovens or is totally immersed in water. A programmed temperature cycle regime will ensure proper cure time without additional vaporization of the monomer solution. This will prevent the bubbles from forming. Cure time takes an average of 5-7 days depending on the thickness. When curing is done in a dry kiln facility, it allows high temperature above 110° Celsius. The high temperature reduces residue stresses or impurities in the material that might cause warping and other dimensional instabilities.

In the dry kiln, and after curing, acrylic panels can be formed to any shapes and curves according to templates.

ACRYLIC DOME

The forming of acrylic dome is a process called “vacuum forming”. The size of the dome could vary from 1 meter to 4 meters in diameter. The dome height can be up to 4 meters. The thickness of the panel to use depends on the span of the diameter.





Frequently asked

What is the maximum per length of acrylic panel without joint?

We can produce up to a maximum of 9m per length by 3.2m height for a panel with minimum thickness of 50mm. Above 9m per length, chemical weld is necessary.

What is thermo forming?

Acrylic is flexible to form shapes and designs. Whatever the shape, the acrylic panel are thermal heated in a factory-based oven or a customized mobile oven on a custom mold. The acrylic panel thickness of 10mm to specified thickness can be formed to many shapes and designs. The maximum thickness for mobile oven thermoforming is limited to 70mm. Above this, thermoforming has to be done in the factory based oven.

What is a chemical weld?

Chemical weld joins two acrylic panels or more either in straight series joints, angle joints and or curved joints, at vertical height. Horizontal joints are not recommended as it is difficult to control the flow of the chemical on plane level. For horizontal joints, often bubbles form as the curing time cannot be determined and is dependent on the reaction. Being on a horizontal plane surface, there is no pressure against the chemical (as in a vertical height joint), thus making an unstable reaction.

Chemical joints can only be performed by trained specialist technicians who follow a strict regime under a controlled environment. The next diagram shows the International Standard concerning the Inclusion and Bubble Standard when doing chemical welds.

Long Span Panel in one length



Thermo Forming

Chemical Welds Standard

Inclusion and Bubble

The count area and the permitted area per ONE square meter of the viewing size are shown below:

Inclusion	Count Area	2.5~30	mm ²
	Total Permitted Area	100	mm ²
Bubble	Count Area	2.5~50	mm ²
	Total Permitted Area	150	mm ²

- Those which size is smaller than count area, should be acceptable.
- The maximum length of inclusion and bubble at the butt-joint part should be less than 10mm per ONE meter of the view size.

The Product Specification describes the working specification for the supply and installation of **SUPERBRIGHT PMMA** acrylic panels for swimming pools and water features. They are in accordance to the method statement deployed by Worldbizz Pte Ltd and the manufacturer's **Code of Practice**.

Specification:

SUPERBRIGHT PMMA clear, opaque, tinted or translucent Acrylic Panels in custom dimensions and thickness to manufacturer's specification. PMMA acrylic panels become ultra violet resistant during the fusion process. All panels are cured in dry kiln or under water curing facility. SUPERBRIGHT PMMA acrylic panels uses only 100% of Lucite raw materials required of PMMA specifications as opposed to poor quality non-standard PMMA acrylic panels that uses a mix of raw components and plastics. The high temperature allows for better strength panels as it removes all impurities. Only high temperature process ensures high strength PMMA structural acrylic panels. PMMA acrylic panels thus maintains clarity throughout without turning yellow.

Product Warranty

The product warranty is for five (05) years limited to the manufacturer's specification and application. Terms and conditions apply. The warranty does not cover damages made by third parties when foreign chemical agents are applied. The factory of manufacture is quality certified by SGS in China. Project Warranty is issued only on completion of the works. Warranty on workmanship is in accordance with the defects liability period of the project.

Scope:

To supply and install SUPERBRIGHT clear Acrylic Viewing Panels in custom dimensions and thickness to manufacturer's specification. The thickness is based on the design calculation dimensions and endorsed by the appointed Professional Engineer. BCA submission is an option but is not included in our quotation unless requested for. All works are carried out by specialist technicians who are trained in chemical welding, special cut techniques, sanding and polishing skills, and proprietary installation standard of the manufacturer and of **Worldbizz**.

Acrylic Panels are widely used for Swimming Pools and Water Features:

- *Acrylic panel can be formed to shape and curves – an advantage in water feature designs.*
- *Acrylic panel is safe to use against the water force in a swimming pool.*
- *On the same thickness as glass, acrylic is half the weight of glass.*



Test Method: ASTM (3mm)

PROPERTIES		ASTM	UNIT	ACRYLIC
Specific Gravity		D792-60T		1.19
Optical	Refractive Index	D542-50		1.49
	Light Transmittance	D1003-61		
	Parallel		%	92
	Total		%	93
	Haze		%	1
Mechanical	Tensile Strength	D638-61T		
	Rupture		Kg/cm ²	760
	Modulus of Elasticity		Kg/cm ²	3x104
	Elongation at Rupture		%	4.5
	Flexural Strength	D790-63		
	Rupture		Kg/cm ²	1200
	Modulus of Elasticity		Kg/cm ²	3x104
	Compressive Strength	D695-63T		
	Yield		Kg/cm ²	1260
	Modulus of Elasticity		Kg/cm ²	3x104
	Sheer Strength	D732-46	Kg/cm ²	630
	Impact Strength	D256-56		
	Charpy notched		Kg-cm/cm	2.0
	Rockwell Hardness	D785.62		M100
Thermal	Hot Forming Temperature		°C	140-180
	Heat Distortion Temperature 2°C/Min-264psi		°C	100
	Coefficient of Thermal Expansion	D696-44	Cm/cm/°C	7x10 ⁻⁵
	Maximum Recommended Continuous Service Temperature		°C	85
	Coefficient of Thermal Conductivity		Kcal/mhr°C	0.18
	Specific Heat		Cal/gr°C	0.35
Miscellaneous	Flammability (Burning Rate)	D635-63	Mm/min	33
	Water Absorption (Weight gain on immersion for 24 hours)	D570-63	%	0.3
	Soluble Matter Lost after immersion		%	0.0
	Odour			None
	Taste			None

MAXIMUM INITIAL DEFLECTION

All edges supported
 $\leq 1/300$ of shorter opening length
 Top and bottom edges supported and both sides silicone jointed
 $\leq 1/500$ of shorter opening length

MAXIMUM STRESS

\leq long term allowable stress
 $\sigma_{al} = 50 \text{ kg/cm}^2$ at butt joint
 $\sigma_{al} = 70 \text{ kg/cm}^2$ without butt joint

DIMENSIONAL TOLERANCE

Thickness $\pm 5\%$ (normal thickness) panels $< 100 \text{ mm}$
 $\pm 3\%$ panels $< 100 \text{ mm}$
 Length $\pm 8\%$ mm of length and width
 Flatness $\leq 1/200$ (shorter length)
 Warp & Twist $\leq 1.5 \text{ mm}$ per 300mm when measured unrestrained on flat surface
 Edges Edges to be chamfered $\approx 45^\circ$, refer drawings
 Poisson's Ratio $\nu = 0.35$



SUNTEC CITY LOGO

SQUARE PEG DESIGN ASIA PTE LTD

KINGSMEN ENVIRONMENTAL GRAPHICS PTE LTD



For the **SUNTEC CITY logo**, **WORLDBIZZ** contracted the supply & installation of acrylic domes from **Kingsmen**. The bigger domes measure 4000 mm in diameter and weighs some 600 Kg each. In view of the large dimensions, police escort was required for the delivery.

The dome was formed to shape using vacuum thermoforming to achieve a height of 500mm at the highest point. The colors and LED lightings are by **Kingsmen**. All the works are carried out only after 12 midnight.



ACRYLIC DOME



The water feature design posed a real challenge in this project as there were 40 Nos. of panel to panel joints to be chemically welded. Some of the panels were straight, but others had to be shaped to form a circular design, which could only be done through thermo forming on site. Considering that parts of the curve formation were to bend out from the inside while others were to bend in from the outside, we had to do chemical welding at various points of the curve panel. In total, **the acrylic panels amounted to approximately 26 tonnes.**



DANIEL LIBESKIND

REFLECTIONS AT KEPPEL BAY

DCA ARCHITECTS PTE LTD

WOH HUP (PTE) LTD





RIVER SAFARI – RIVERS OF THE

DP ARCHITECTS PTE LTD

PRELIM CONSTRUCTION PTE LTD



River Safari – has a new experience for visitors. Watching animals and exhibits up close, through acrylic panel. GTS-Worldbizz cooperated with **Mitsubishi Rayon RYOKO of Japan** for the contract of the Acrylic Panels for Rivers of the World Series.





RIVER SAFARI – RIVERS OF THE



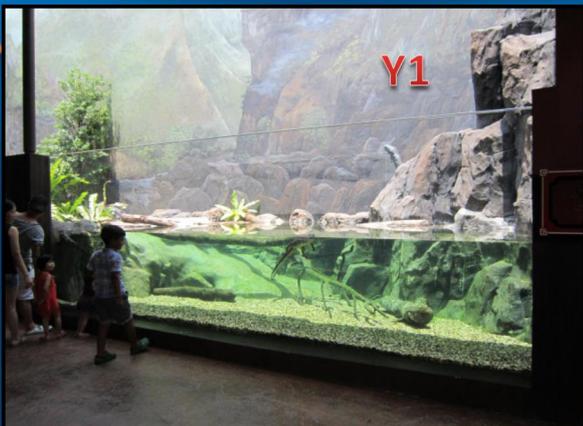
RYOKO Japan Project Team:
Oki Hiroshi, Ooshima Hirofumi and Chiba Kiyoshi



Photos:
Jared Chew with Oki Hiroshi of RYOKO Japan and Harry Ho, Project Director of Prelim Construction Pte Ltd



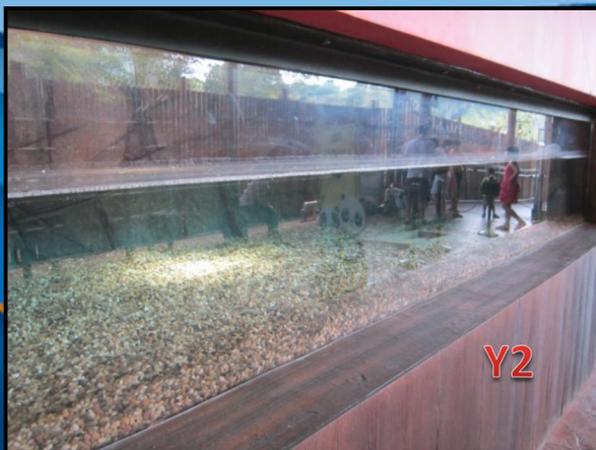
Jared Chew with Yasuhisa Kitahara and Chiba Kiyoshi of RYOKO Japan



Demonstration using **RYOKO proprietary Marine Sealant GX** for sealing points between the acrylic panel and the mock-up concrete nibs. **Marine Sealant GX** has high bonding strength and is greatly elastic.

**Photo:**

The Specialist Team consists of GTS Project Manager Kim JIN, RYOKO Sealant Master Specialist Yasuhisa KITAHARA, Worldbizz Acrylic Technician Md HARUN and RYOKO Sealant Specialist Hiroshi SHIMOHIGOSHI. Six other RYOKO acrylic specialists were deployed full-time on site for the chemical bonding of the MK 3 acrylic panel 14,870 x 3370 x 185mm.



LARGE PANELS were used for
 Y2: 9940 x 880 x50 mm
 Y3: 9320 x 2000 x160 mm
 The panels come in one single panel with no joint





RIVER SAFARI – RIVERS OF THE

*State of the Art
Technology in acrylic
installation techniques by
RYOKO Team*



Kim JIN and RYOKO Yasuhisa KITAHARA working closely. KITAHARA is considered a **Master Specialist** in sealant works in RYOKO Japan.

There are great skills in preparing the use of the proprietary Marine Sealant GX that requires a proprietary mixer machine to blend the four components to make the final product. The application of Marine Sealant GX must be carried out by trained technicians.

*Innovative
Methodology*



Members of RYOKO Japan team during a site inspection with GTS and Worldbizz project team.


RIVER SAFARI – SUNKEN FOREST

DP ARCHITECTS PTE LTD

PRELIM CONSTRUCTION PTE LTD

River Safari – The contract for the acrylic panels under the Sunken Forest and Frozen Tundra Series, GTS-Worldbizz cooperated with Shanghai Red Coral Technology Development (Group) Co., Ltd.


Photo – from left to right:

Interpreter for RYOKO, Shen Yi Xuan - owner of Shanghai Red Coral, Calvin Soh of Prelim Construction, Ooshima Hirofumi of RYOKO Japan, Harry Ho of Prelim Construction, and Jared Chew of GTS-Worldbizz at the inspection of acrylic panels for Sunken Forest and Frozen Tundra Series at Shanghai Red Coral manufacturing plant.



All acrylic panels are thoroughly checked on size and dimensions, clarity, surface and thereafter labeled with quality checked sticker. The same panels were shipped out with the quality mark.



Perfect Coordination by working closely is the essence to timely completion

RIVER SAFARI – SUNKEN FOREST

The acrylic panels in this project are mainly large and thick panels and more so, crane services are not accessible to many areas. Thus lifting and moving of these large panels using only labor force could only be achieved through engineering skills, experience and good project management.

Working closely with the main contractor was the essence to perfect coordination and at all time, observing safety.

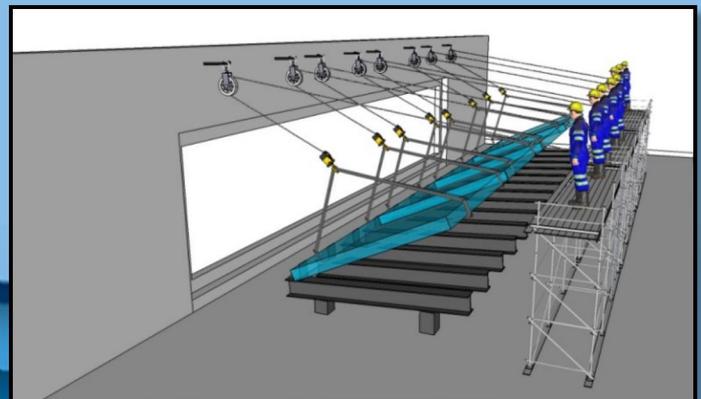


Observing Safety First at all times – zero accident throughout the work period



W14 – the biggest panel in River Safari measures 22,000 x 4,000 x 325 mm thickness comes in four pieces of equal dimensions and was put together with chemical weld on site.

The challenge was to lift the 40 ton panel from the ground into position without any crane as the building was already constructed over it. A visual mock-up was done for PE load calculation.



“Four panels each of 5500x4000x325mm were joined by chemical weld to make this one large panel weighing 40 tons. Then using only chain blocks and engineering skills, this massive and thick panel was successfully installed.

Kim JIN
GTS Project Manager
Acrylic Specialist

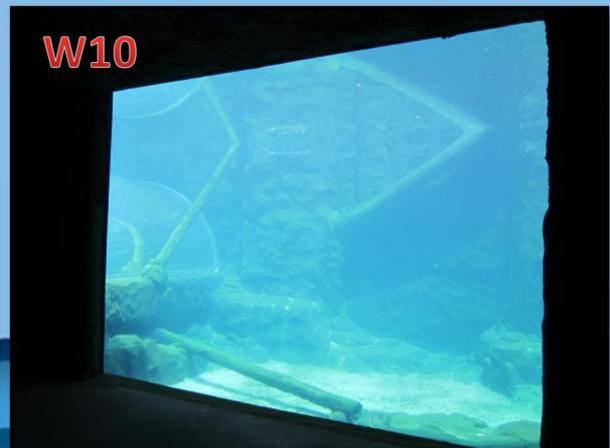




RIVER SAFARI – SUNKEN FOREST



W9 tunnel panel measures 7400 x 1925 inner radius x 70 mm thickness. The thermal bend was done at the factory using a template.



W15 and W16 are floor panels cut to shape. The view from the top sees the enclosure as one pond with two clear acrylic panels.

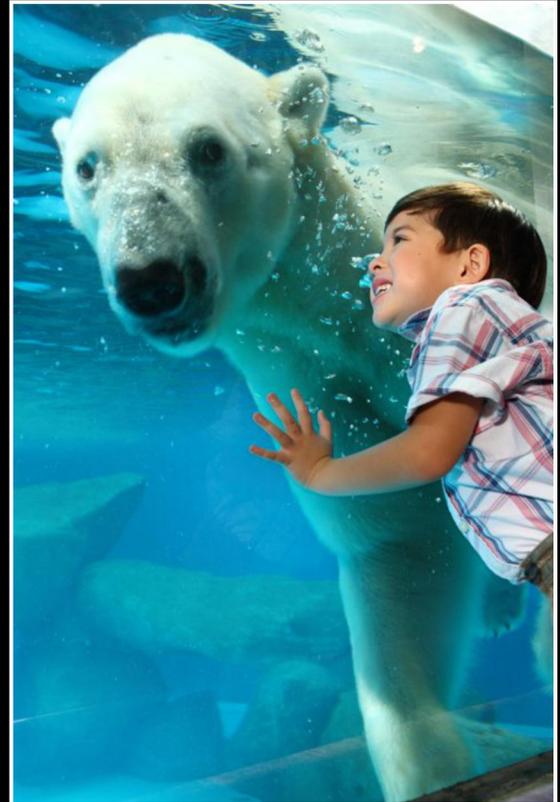

RIVER SAFARI – FROZEN TUNDRA

DP ARCHITECTS PTE LTD

PRELIM CONSTRUCTION PTE LTD

All photos by courtesy of Wildlife Reserve Singapore

PB1 panel measures 23000x5500x130mm curved. PB1 comes in 4 large panels with 3 Nos. chemical joints. The challenge was in the hoisting (using only chain blocks and some 20 men) and placement of the panels for chemical weld.

PB1




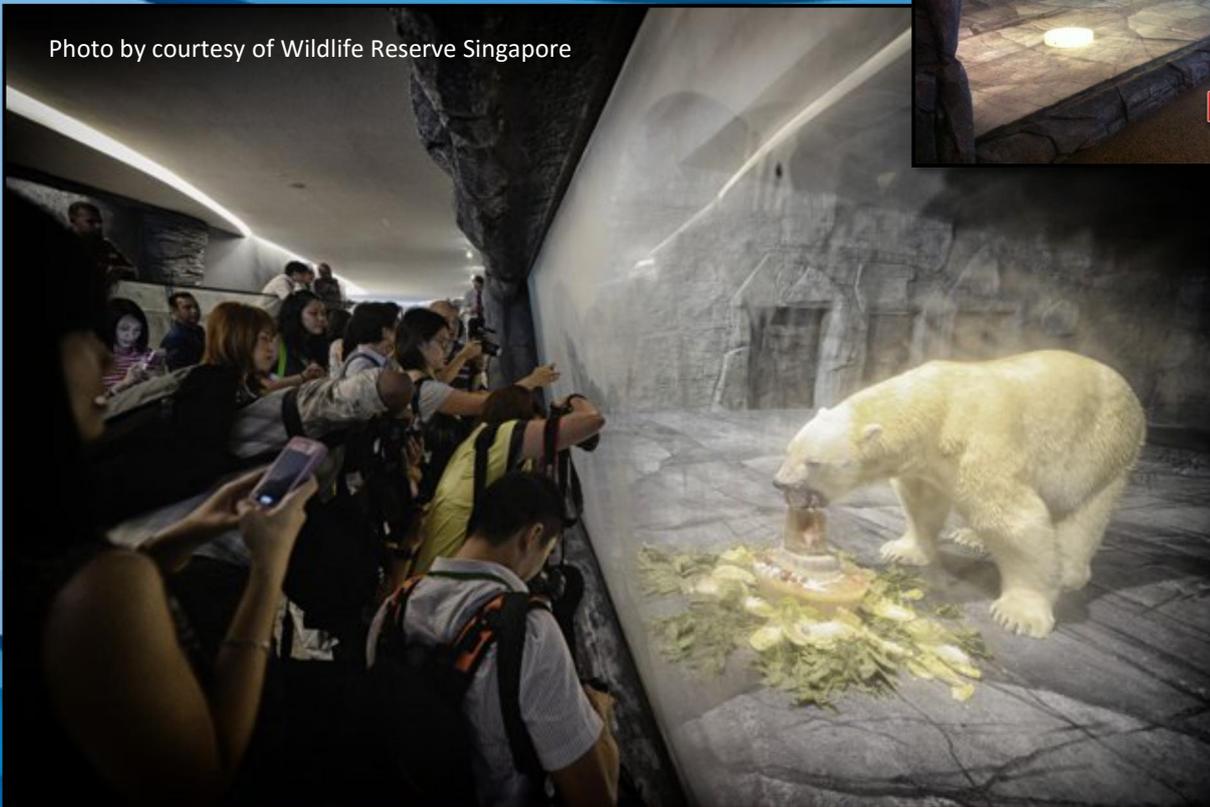
RIVER SAFARI – FROZEN FUNdra



PB2 panel measures 10000x1800x500mm. This was an extremely difficult panel to move into position during the installation. No lifting equipment or chain block could be used except only by manpower. We had to use 35 men to move the panel through a long walkway.



Photo by courtesy of Wildlife Reserve Singapore



PB3 panel measures 7600x1800x50mm had the same lifting issue as PB2 panel. The same 35 men had to physically carry the panel through a long walkway and down a stairway to the placement.

During the installation, the Polar Bear was housed just in the next room separated by a steel door. The place was fully air-conditioned and guarded by a zoo security to keep the noise down so as not to agitate the Polar Bear.

PB4 panel measures 4000x2000x105mm. The panel has a slight curve which was formed at the factory.





MAPS DESIGN STUDIO

KIM SENG HENG ENGINEERING CONSTRUCTION (PTE) LTD



DP ARCHITECTS PTE LTD

ONG & ONG LANDSCAPE

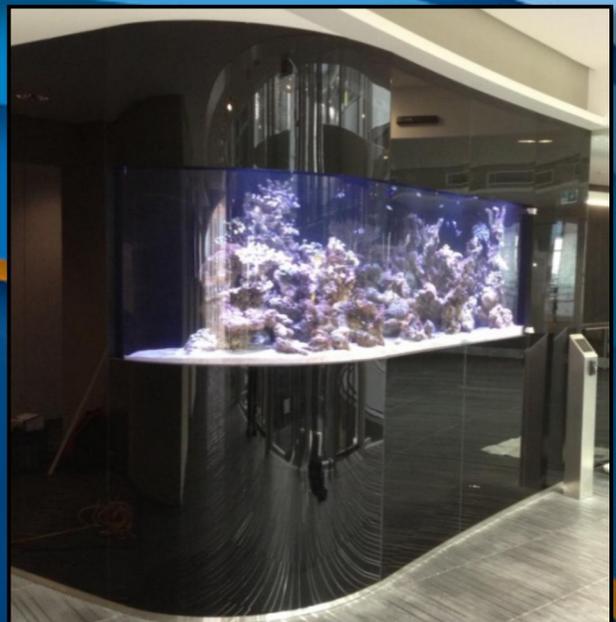
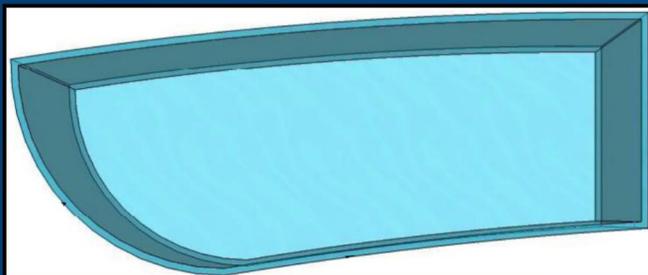
FULLERTON BAY HOTEL AT COLLYER

KIM SENG HENG ENGINEERING CONSTRUCTION (PTE) LTD

Custom Design Acrylic Fish Tank

This fish tank was custom designed for a project in New South Wales, Australia. The aquarium sits in the main lobby hall of a financial house.

View from Top





ANG MO KIO HUB BASEMENT 1 WATER

ATA ARCHITECTS PTE LTD
SPACE-IT DESIGN & PLANNERS PTE LTD



Acrylic Panels are used with stainless steel panels to reflect as a video wall. Constant water streaming down the acrylic panels provides an illusion of running visual.



PRADA - MARINA BAY SANDS

ROBERTO BACIOCCHI
PICO ART INTERNATIONAL PTE LTD

CEBE BANK BRANCH AT CHURCH STREET

MD ASSOCIATES

MILAN DECORATION & CONSTRUCTION PTE LTD



ACRYLIC PANELS USED FOR OFFICE FURNITURE

10 mm acrylic panels were cut to shape and thermoformed to the design. One design was using single panel curve while most were using double panels as LED lightings were incorporated in between. The single panels were given color treatment using color films while the double panels were in Barley White colors. In both designs, stainless steel framings were used. Indeed, this is another innovation using acrylic.



COSMO RESIDENCE - HO CHI MINH CITY,

MA ARCHITECTS LLP

KEVIN DUNG TA - OWNER

Overseas Project

We did the supply and installation of one acrylic panel for the swimming pool of Cosmo Residence project in Ho Chi Minh City, Vietnam.

We deployed two acrylic specialist technicians to the site and completed the job in 4 days.



CHANGI AIRPORT TERMINAL 3

CPG CONSULTANTS PTE LTD

SHIMIZU CORPORATION

The acrylic panels were used as rain shelter over the Terminal roof covering above the arrival hall entrance. In total, there were some 5 meters (wide) x 380 meters (length) of the sheltered area covered in acrylic panels.



Color-Tinted acrylic panels used as shelters at waterbridge



PUNGGOL WATERBRIDGE

CPG CONSULTANTS PTE LTD

MARINA TECHNOLOGY & CONSTRUCTION PTE LTD

water feature at school garden



MAHA BODHI PRIMARY SCHOOL AT UBI

INTERCONSULTANTS PTE LTD

CHIU TENG CONSTRUCTION CO. PTE LTD

There were a total of 15 Nos. x 1300 x 600 x 50mm thickness of acrylic floor panels. Each with white (in acrylic paint finish) border.



Lian Villas @ East Coast Avenue

Parsons Brinckerhoff Pte Ltd

Expand Construction Pte Ltd



B2-20 LAKESHORE VIEW

SCDA ARCHITECTS PTE LTD

MEGABUILDERS & DEVELOPMENT PTE LTD



B18-12 COVE DRIVE SENTOSA

TIMUR DESIGNS LLP
SINWAH TIMBER BUILDERS



6 BINJAI WALK

METAMORPH ARCHITECTURE + INTERIOR
SYSMA CONSTRUCTION PTE LTD



ST. MICHAEL REGENEY AT 38 MAR TAWA

LIM HAI ASSOCIATES
MENG YEOW CONSTRUCTION PTE LTD

CAIRNHILL RESIDENCES

3P ARCHITECTS

KIMLY CONSTRUCTION PTE LTD



There were a total of four acrylic panels, the longest being 26 meters in length using 70mm thickness (see above photos).

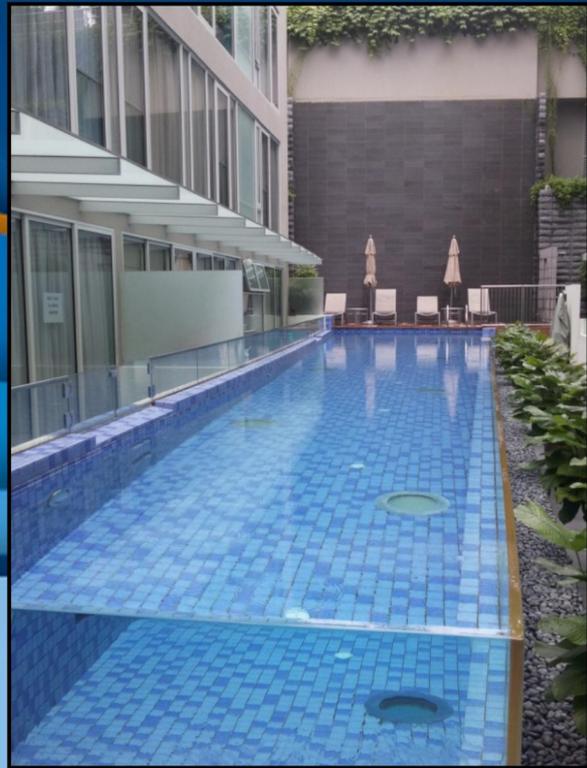
8 NASSIM CONDOMINIUM

CHAN SAU YAN ASSOCIATES

TOKYU CONSTRUCTION CO., LTD



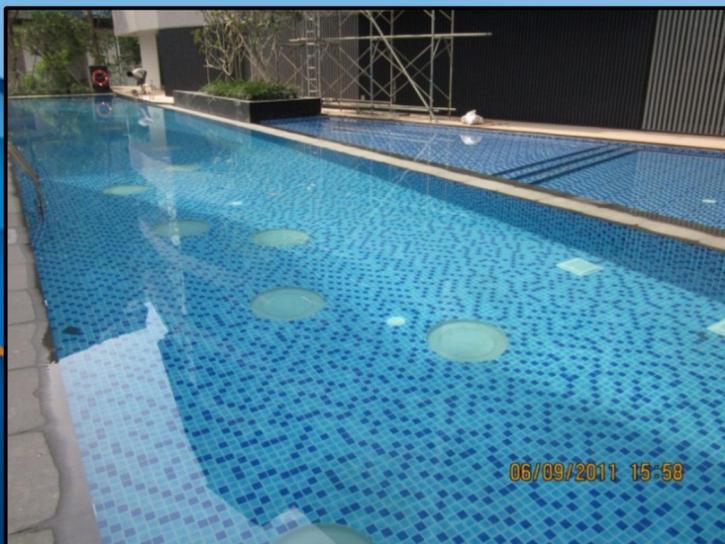
The lower part of the acrylic panel is frosted while the upper panel is clear. The upper panel was added to comply with the BCA requirements which calls for a one meter height safety barrier above the water level. Stainless steel framings were used as structural supports for the acrylic panels.



WILKIE STUDIOS

ADDP ARCHITECTS LLP

TIONG SENG CONTRACTORS (PTE) LTD



HOLLAND COLLECTIONS

CHAN SAU YAN ASSOCIATES

DAIYA ENGINEERING & CONSTRUCTION PTE LTD



Applications

- *infinity edge wall panels*
- *window panels*
- *floor panels*

Acrylic panels have proven as reliable for use in swimming pool regardless of the applications and designs. While most applications are used as infinity edge wall panels, window panels and floor panels are just as popular.

Safety is the main consideration when choosing to use acrylic panel over glass for swimming pool. Moreover glass is more expensive when the thickness increases.

40 MERRYN ROAD

AAMER ARCHITECTS

TKC BUILDERS PTE LTD



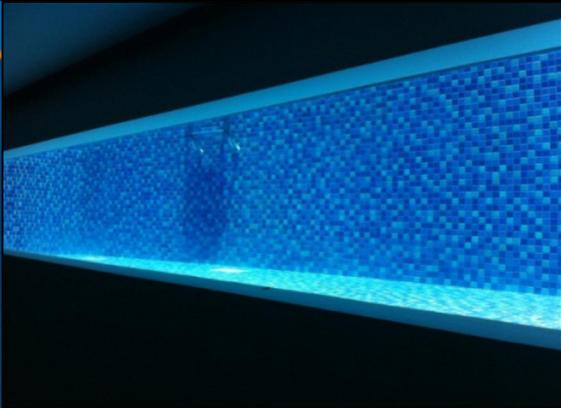
AMBER RESIDENCES

AKDA ARCHITECTS

LIAN BENG CONSTRUCTION (1988) PTE LTD

RICHARD HO ARCHITECTS

HUAT BUILDERS PTE LTD



B19-7 SENTOSA COVE



B29-3 SENTOSA COVE

3PA INTERNATIONAL

HG DEVELOPMENT PTE LTD

B22-4 SENSOSA COVE

ROBERT GREG SHAND ARCHITECTS

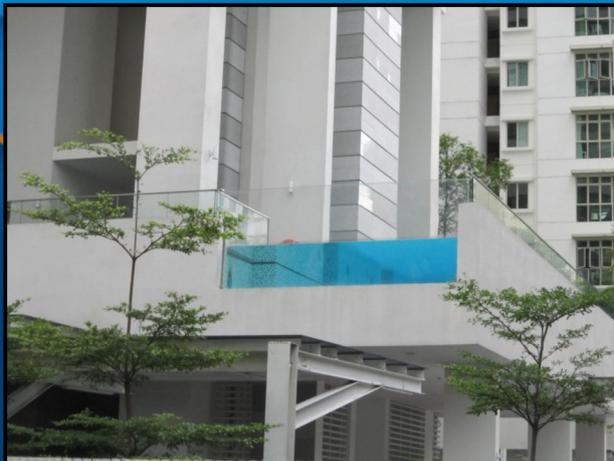
SYSMA CONSTRUCTION PTE LTD



B20-1 SENSOSA COVE

ROBERT GREG SHAND ARCHITECTS

HOLDEN TILING & CONSTRUCTION PTE LTD



LUMA

JGP ARCHITECTURE (S) PTE LTD

NOVELTY BUILDERS PTE LTD

GILSTEAD 68 at Gilstead Road

ONG & ONG LANDSCAPE

KHIAN HENG CONSTRUCTION PTE LTD



There are a total of 4 Nos. acrylic wall panels for individual swimming pools and 8 Nos. of acrylic floor panels for the main swimming pool.

*65 WILKIE ROAD*

CHAN SAU YAN ASSOCIATES

EVAN LIM & CO. PTE LTD



LINCOLN RESIDENCE

METAPHOR DESIGN + ARCHITECTURE PTE LTD

SIM LIAN CONSTRUCTION CO (PTE) LTD

The main swimming pool uses 30 meters length of acrylic panel of 60mm thickness in 3 chemical welds. Water overflows from the infinity edge of the pool. In addition there is another 30 meters length of acrylic panel in 30mm thickness at two meters height used as safety barrier.



17A KING ALBERT PARK

ALTODESIGN ARCHITECTS

OKH HOLDINGS PTE LTD

Theng Residences of 17A King Albert Park uses 50mm thick acrylic panels for the main swimming pool and later 30mm thick acrylic panels were added on top as safety barriers for the swimming pool which is overlooking a tennis court below.



Window Panel for sun-light

120 ENG NEO AVENUE

GK ARCHITECTS

RENOWN BUILDERS PTE LTD

HELIOS RESIDENCES

P & T CONSULTANTS PTE LTD

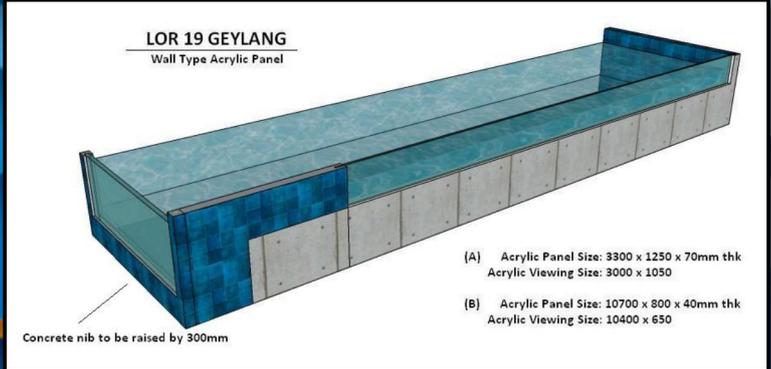
THIAN SUNG CONSTRUCTION PTE LTD



LORONG 19 GEYLANG

JGP ARCHITECTURE (S) PTE LTD

CYBER BUILDERS PTE LTD



583B SEMBAWANG PLACE

FORMWERKZ ARCHITECTS

TECHKON PTE LTD

There are two similar acrylic panels of dimensions 5500x1150x50mm used for window panel application for the pair of detached houses.

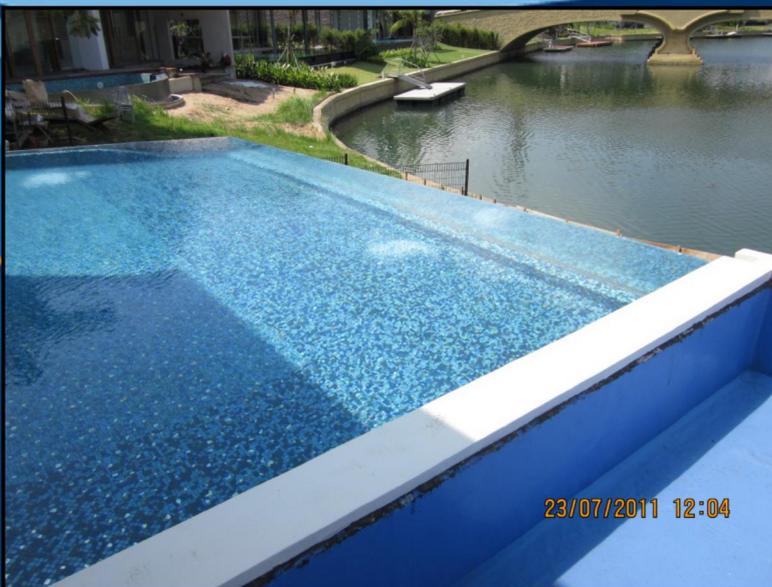


12 mm thickness colored acrylic panels - cut to circular designs, are used as window sun-shade panels with remote control motors to open and shut the panels. The first photo shows a customized Jacuzzi made of acrylic panels formed to design and fitted with complete pumps and jet-nozzles.

FLORENZA CONDOMINIUM

ASSOCIATED CIVIC AKITEK

KOH BROTHERS BUILDING & CIVIL ENGINEERING CONTRACTOR (PTE) LTD



B19-2 SENTOSA COVE

ROBERT GREG SHAND ARCHITECTS

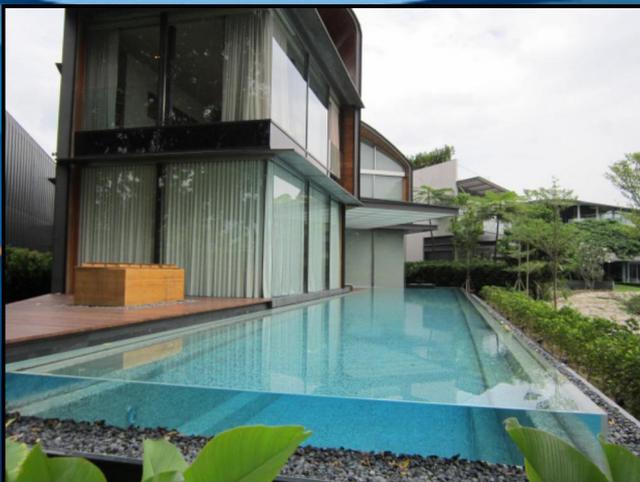
SYDMA CONSTRUCTION PTE LTD



B17-5/6 SENTOSA COVE

ROBERT GREG SHAND ARCHITECTS

SYSMA CONSTRUCTION PTE LTD



B16-4 SENTOSA COVE

ROBERT GREG SHAND ARCHITECTS

BETHNAL CONSTRUCTION PTE LTD

OPTIMA AT TANAH MERAH

ADDP ARCHITECTS LLP

ONG & ONG LANDSCAPE

NAKANO SINGAPORE (PTE) LTD



21 CORNWALL GARDEN

GUZ ARCHITECTS

STRAITS DREDGING (1990) PTE LTD



This project posed a challenge in view of its design. There were some 20 chemical joints and many curve formations. For each formation, we had to do a metal profiled template to allow for the thermoforming works at our workshop.

The original design and construction used glass formed to the curve but these glass panels started to break so very often that the owner and architect then decided to use acrylic panel. The acrylic panels proved to be the correct product as it is flexible to curve formation and does not break like glass.

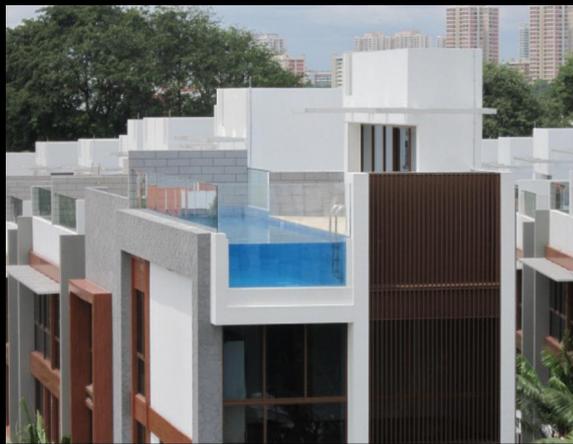
16 KEW DRIVE

LAUD ARCHITECTS PTE LTD

EMMA CONTRACT PTE LTD



VERDANA VILLAS



VERDANA VILLAS

JGP ARCHITECTURE (S) PTE LTD

NOVELTY BUILDERS PTE LTD

38 DALVEY ROAD

K2LD ARCHITECTS PTE LTD

HOLDEN TILING & CONSTRUCTION PTE LTD



During installation



81 CASHEW ROAD

RED BEAN ARCHITECTS

POH SIA CONSTRUCTION & ENGINEERING PTE LTD



VERDURE AT 55 HOLLAND ROAD

CPG CONSULTANTS PTE LTD

ONG & ONG LANDSCAPE

V3 CONSTRUCTION PTE LTD

HOLLAND RESIDENCES

CPG CONSULTANTS PTE LTD

WOH HUP (PTE) LTD



1 ELAISON ROAD

A M ARCHITECTS

NOVELTY BUILDERS PTE LTD

ACE ARCHITECTS & ASSOCIATES

EUROBUILD PTE LTD

B16-3 COVE DRIVE



71 OCEAN DRIVE SENSOSA COVE

ECOID ARCHITECTS PTE LTD

HUAT BUILDERS PTE LTD



17-B LEEDON ROAD

TELLUS ARCHITECTS

STRAITS DREDGING (1990) PTE LTD



MURANO PROJECT AT PASIR PANJANG

JGP ARCHITECTURE (S) PTE LTD

ENVIRON CONSTRUCTION CO (PTE) LTD



B1-1 LAKESHORE VIEW, SENTOSA

Circular Window Panel



K DESIGNER

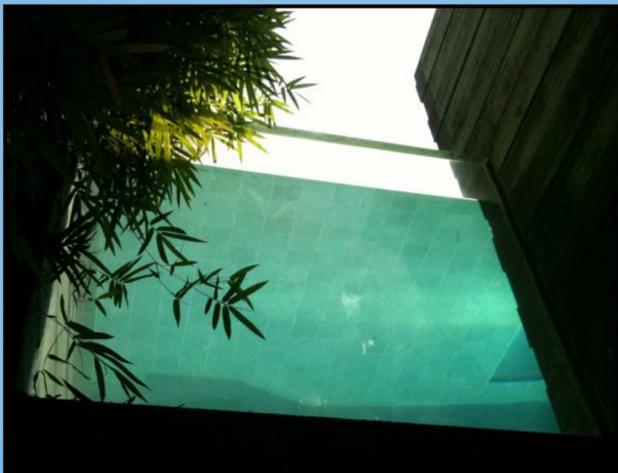
BUILDERS TRENDS PTE LTD



3 TREASURE ISLAND AT SENTOSA

CPG CONSULTANTS PTE LTD

SYMA CONSTRUCTION PTE LTD



B2-8 SENTOSA COVE

K2LD ARCHITECTS PTE LTD

SUNHO CONSTRUCTION PTE LTD

B12-09 TREASURE ISLAND AT SENTOSA

CPG CONSULTANTS PTE LTD

SYSMA CONSTRUCTION PTE LTD



B12-11 TREASURE ISLAND AT SENTOSA

CPG CONSULTANTS PTE LTD

SYSMA CONSTRUCTION PTE LTD



B12-18 TREASURE ISLAND AT SENTOSA

CPG CONSULTANTS PTE LTD

SYSMA CONSTRUCTION PTE LTD





4 UNITS BUNGALOW HOUSING AT ANDREW

ASSOCIATED CIVIC AKITEK

SIL BRIGHT CONSTRUCTION PTE LTD



DETACHED HOUSE AT YUK SONG ROAD

SD ARCHITECTS LLP

KF ONG CO. PTE LTD



DETACHED HOUSES AT LYWOOD GROVE

DWELL PROJECTS ARCHITECTS

LIVERLAND INVESTMENTS PTE LTD

Acrylic Panels for Roofing Application



15mm thickness PLEXIGLAS (GERMANY) acrylic panels of dimensions 3050x2030 mm are used for roofing applications as an alternative and replacement to glass for roof canopy and secondary roofs. These acrylic panels are UV resistant with warranty statement by PLEXIGLAS.

All joints between panels are made with chemical welds to create the perfect bonding instead of using sealants. All structural supports are made with galvanized mild-steel.



All joints between acrylic panels are by chemical welds.

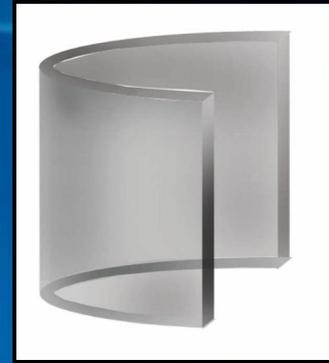


Acrylic panels are chemically bonded to achieve large dimension requirements. Engineers prefer safety in choosing material, architects and designers like the diverse flexibility in shapes and sizes, owners go for durability, and overall, the public reaps all the benefits from the experience of having acrylic over glass, which is twice the weight of acrylic. Today, glass loses its share of use in swimming pool because glass needs great thickness to achieve larger span. Glass requires the use of intermediate stiffeners for large span and thus loses eye appeal. When knocked against, glass chips on edges. Conventional glass breaks on impact which could be caused by expansion of the material (like wood, concrete, etc) which is bonded with glass; due to extreme hot weather. Glass is not flexible and does not deflect.

Acrylic can be designed to withstand any type of impact loading condition, where under such an impact; the acrylic will suffer only cosmetic damage. The acrylic surface can be easily restored to almost the original condition. For large acrylic panels, they can be designed to offer strength and flexibility to which contributes its integrity and safety.

Advantages of PMMA ACRYLIC Panels

- Acrylic is half the weight of glass.
- Acrylic is designed to take load and deflect.
- Acrylic is colorless and optically clearer.
- Acrylic has better insulating properties.
- When scratched, can be easily removed.
- Acrylic seam joints are stronger than glass over large panels.
- Seam joints between two acrylic panels are visually superior to glass.
- Higher tensile strength provides better bonding with building structure.
- UV-treated acrylic will not turn yellow even after long years of exposure to the sun.



Thermoform Flexibility

Major Disadvantages of Glass

- Twice the weight of Acrylic.
- Using intermediate stiffeners loses eye appeal.
- Glass cannot deflect.
- Glass is not flexible.
- Glass needs a great thickness to achieve a larger span by lamination.
- When knocked against, glass chips on edges.



Today, Acrylic has become the favored material for structural and architectural features where transparency and clarity is required. The manufacturing, laminating, forming and bonding techniques allow virtually unlimited shapes and sizes of acrylic designs. The chemical bonding on site capability allows design flexibility in terms of sizes and shapes. The thickness would vary according to the span.

In price comparison, when a panel requires lesser thickness, glass is lower in price and acrylic is higher. When the thickness increases, acrylic then becomes very price competitive than glass. Moreover, for larger span panels and where panels are subject to water pressure, acrylic is the preferred material if not the only material to use.

MAINTENANCE/CLEANING MANUAL FOR ACRYLIC PANELS

Crazing or scratches in acrylic are generally only going to be removed by removing surface material to the same depth as the damage. Depending on the extent, this means polishing with a super-fine polishing compound (recommended by the manufacturer), or multiple steps of sanding with progressively finer sandpapers before finalized with a polishing compound. The following are the “dos” and “don’ts” of cleaning acrylic if ever cleaning is required.

Care and Maintenance

The Dos

1. First, flush the surface several times with water. This removes dust and loose dirt. Stubborn spots can be loosened using thoroughly saturated cotton cloth or finger tips while running water over the surface. The frame must be also be flushed and cleaned to remove the risk of moving dirt to the acrylic when wiping the edges.
2. Second, to finish cleaning, use an acrylic-designed product that removes rather than fills the damage. Use 3M products with each cleaning.
3. Enter into a Yearly Maintenance Contract with Worldbizz Pte Ltd as trying to remove scratches can be quite a chore, and extreme caution should be taken if using a power sander for any of the task; acrylic can easily be ruined by burnishing from a power surfacing tool.

The Don'ts while cleaning Acrylic

1. Never clean with paper towels or cloth containing nylon or synthetic fibers, all of which are abrasive and these will put micro fine scratches into the acrylic surface. Use only 100 percent cotton when cleaning or restoring acrylic.
2. Never employ a used cloth. Only fresh clean cotton should ever be used. Anything less will only have left-over dirt, debris and dust from previous usage.
3. Never use a circular motion when rubbing the acrylic surface. Remaining dirt will cause random, round scratches, dramatically reducing vision and optical clarity when flying into the sun. Vertical patterns are less noticeable than horizontal.
4. Never wipe acrylic that's dry. Dust and foreign particles will scratch the surface. Worse, wiping "dry acrylic" builds up a tremendous static charge, attracting even more dust and dirt.
5. Never use a cover on acrylic. Even 100 percent cotton can ruin a windshield after the wind chaffs it from the dirt that gets blown under the cover.
6. Never use any of the following to clean acrylic: gasoline, benzine, alcohol, acetone, carbon tetrachloride, lacquer thinner or glass cleaner. Each will damage the acrylic in one form or another. You can't go wrong using water alone.
7. Common shampoo and soap will cause damage to acrylic over period of time. DO NOT use any cleaning products containing abrasives or solvents since these could dull the brilliant surface. Products like Ajax, or Lysol are not recommended. Harsh chemicals should never be used on acrylic surfaces.
8. Do not use ammonia based cleaning solutions on the acrylic as it will eat into the sheet and cause it to craze. Mildew should never be a worry because acrylic is nonporous.
9. Never use a wax or filler unless it's specifically designed for acrylic applications. Petroleum-based waxes, for example, will attack acrylic.

The above serves as a reference for maintenance and or cleaning manual for acrylic panels. Acrylic wall panels or window panels used in swimming pool application are self maintained such that the moving water removes likelihood of dust to accumulate on the panel walls. Light or deep scratches are also unlikely as swimmers do not carry sharp objects if any objects at all, into the swimming pool. Swimmers are bare-footed and wear no zippers in their swimming trunks or suits.

However, if need be, the maintenance or cleaning regime removes any crazing, scratches, blurry surfaces, etc making the acrylic panels brand new again.



ASSOCIATE COMPANIES

WORLDBIZZ PTE LTD

Core business in design, supply and installation of Acrylic Panels and Products for Local and Export Markets

WORLDBIZZ MARKETING PTE LTD

Core business in design, fabrication of 3D exhibits Advertising Panels using Computer Cutting Technology and SUPERBRIGHT SEQUINS for advertising

STEEL-PRODUCT CONNECTORS PTE LTD

Core business in steel-works and steel-fabrication products to support the Associate Companies

RED-CORAL TECHNOLOGY SINGAPORE PTE LTD

Affiliated to SHANGHAI RED-CORAL TECHNOLOGY DEVELOPMENT (GROUP) CO., LTD – the manufacturer of Acrylic

RED STAR INDUSTRIES PTE LTD

Core business in sales and rental of Noise Barriers/Fence Barriers for Construction in Singapore and Malaysia

JARED – FULL ACRYLIC PRODUCTS CO., LTD

Core business that includes turn-key design and build, fabrication and workmanship of Acrylic Panels and Products for Construction Industries in China. The design and manufacture of Noise Barriers/Fence Barriers for Construction Industries. Fabrication facility is located in Jiangsu China. Company is registered in China.

*So clear that I can feel you
next to me!*



PB1 Tank Facility at River Safari – Frozen Tundra
Photo by courtesy of Wildlife Reserve Singapore



WORLDBIZZ has acquired:

- **TECHNOLOGY**
- **EXPERTISE**
- **EXPERIENCE**
- **DESIGN FACILITY**
- **FABRICATION FACILITY**
- **A BASE IN CHINA**
- **YOUR TRUST IN US**
- **A REPUTATION FOR SUCCESSFUL COMPLETION**

WORLDBIZZ PTE LTD

3 Toa Payoh Industrial Park Lorong 8 #01-1355 Singapore 319055

Tel: +65 6842 6500 Fax: +65 6842 3983

Email: sales@worldbizzone2.com

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