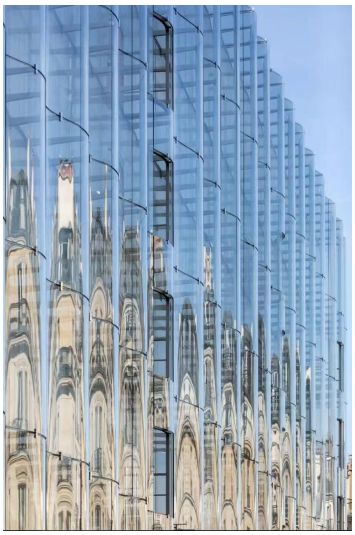
Curved glass

1. Description

Curved glass is meticulously crafted from flat glass through specific processes, presenting a unique curved shape. With an extraordinary appearance, it shatters the monotony of traditional flat glass. It's graceful lines create a distinctive visual effect, adding an artistic touch and a modern vibe to architecture and home decoration. Customizable in terms of curvature, radius, and size as needed, and capable of being made into insulating glass or laminated glass, it is widely used in multiple fields such as building curtain walls and skylights.



Curved glass

2. Reference Standards

As a special glass product widely applied in numerous fields like architecture and decoration, curved glass, by virtue of its unique curved appearance, can add a distinctive aesthetic and artistic charm to various spaces. Meanwhile, it also plays an indispensable role in some special structural designs. Consequently, it is of vital importance to control its quality and performance. The reference standards are as follows:

Standards	Description
ASTM C1036	Standard Specification for Flat Glass
ASTM C1464	Standard Specification for Bent Glass
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ANSI Z97.1	For Safety Glazing Materials Used in Buildings Safety Performance Specifications and Methods of Test
EN14179-1	Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass
ASTM C1172	Standard Specification for Laminated Architectural Flat Glass
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation

3. Classification

According to processing technology and usage environment, curved glass is mainly classified as follows:

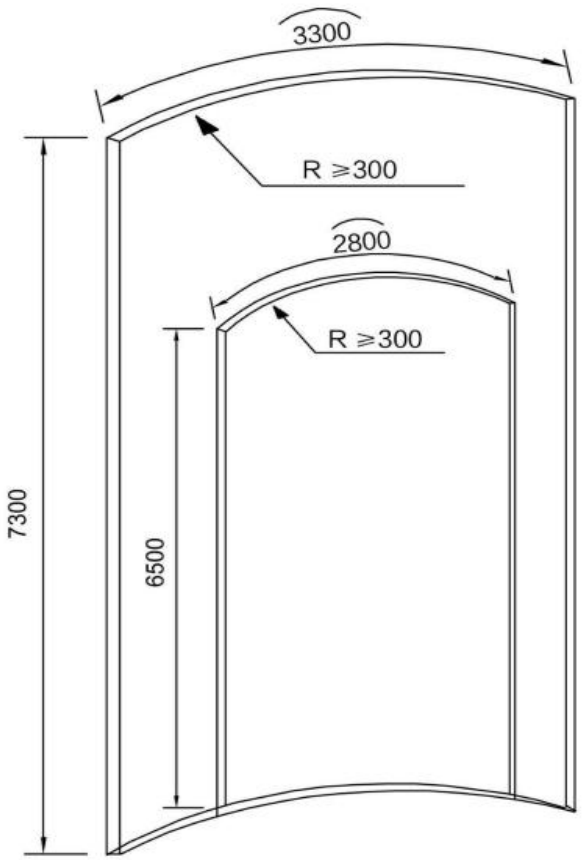
Per Processing Technology	Per Glass Composition			
Hot-bent glass	Hot-bent single panel glass	Hot-bent laminnated glass	Hot-bent insulating glass	
Curved tempered glass	Fully tempered curved glass	Heat strengthened cured glass	Curvedlaminnated glass	Curved insulating glass

Curved glass

4. Hot-bent Glass

The main shapes of hot-bent glass are arc (including arcs of different sizes, which can be used for decorative windows, display cabinets, building curtain walls and domes, etc.), semi-circular shape (often used as architectural decorative elements, such as arches), wavy shape (full of dynamic feeling and suitable for indoor partitions and ceilings, etc.), S-shape (meeting special design needs and commonly seen in art installations and decorative parts of high-end furniture), and irregular shape (able to meet personalized architectural and decorative requirements and providing designers with broad creative space).

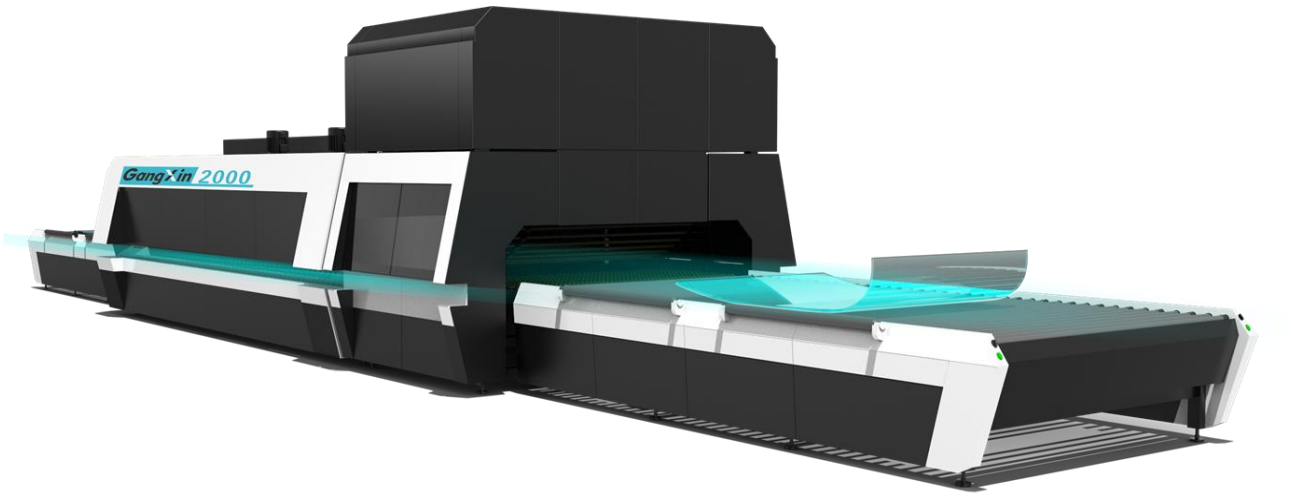
Item	Spec. Sheet (mm)	
Thickness	3~25	
Bending radius	⩾50	
Max arc length(L) * height(H)	L<2800	2800*6500;
	2800⩽L⩽3300	3300*7300
	R<300	Customized
Min arc length(L) * height(H)	Customized	

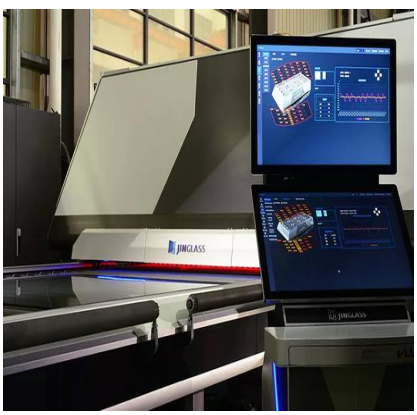


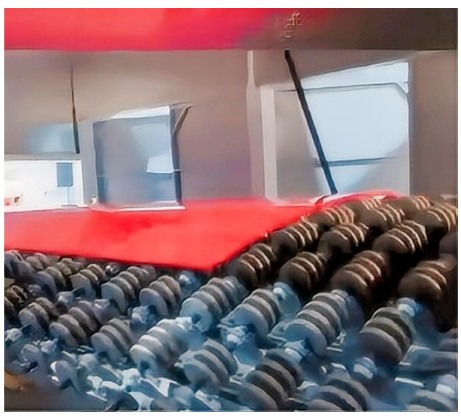
Curved glass

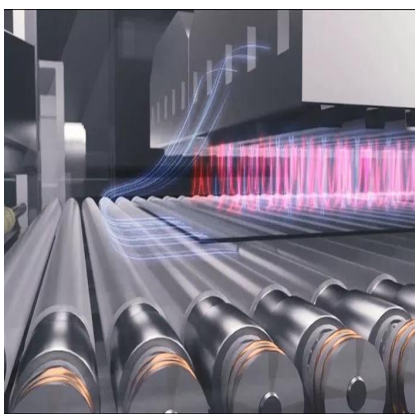
5.Curved Tempered Glass

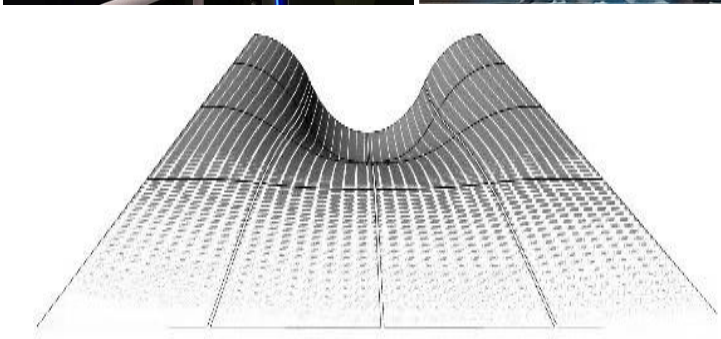
Tempered curved glass can be divided into three types according to its curved shape: single-curved, double-curved and multi-curved. Single-curved tempered glass has a single and beautiful curved arc. It is often used in curved doors and windows, etc., adding a beauty of smooth lines to buildings. Double-curved tempered glass has curved arcs in two different directions. Its shape is complex and exquisite. It is suitable for characteristic architectural designs or high-end decorations, showing unique artistic charm. Multi-curved tempered glass can present a rich and diverse variety of shapes, providing a broad creative space for designers. It is widely used in high-end buildings and unique interior decoration projects. In addition, according to product types and specific requirements, heat strengthening, full tempering can be selected.

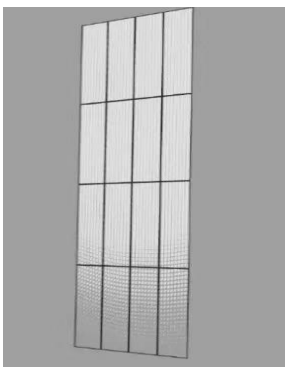


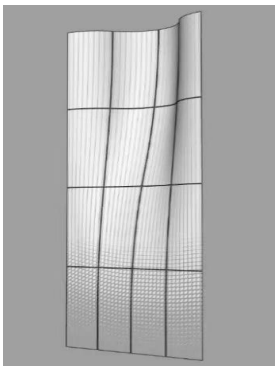








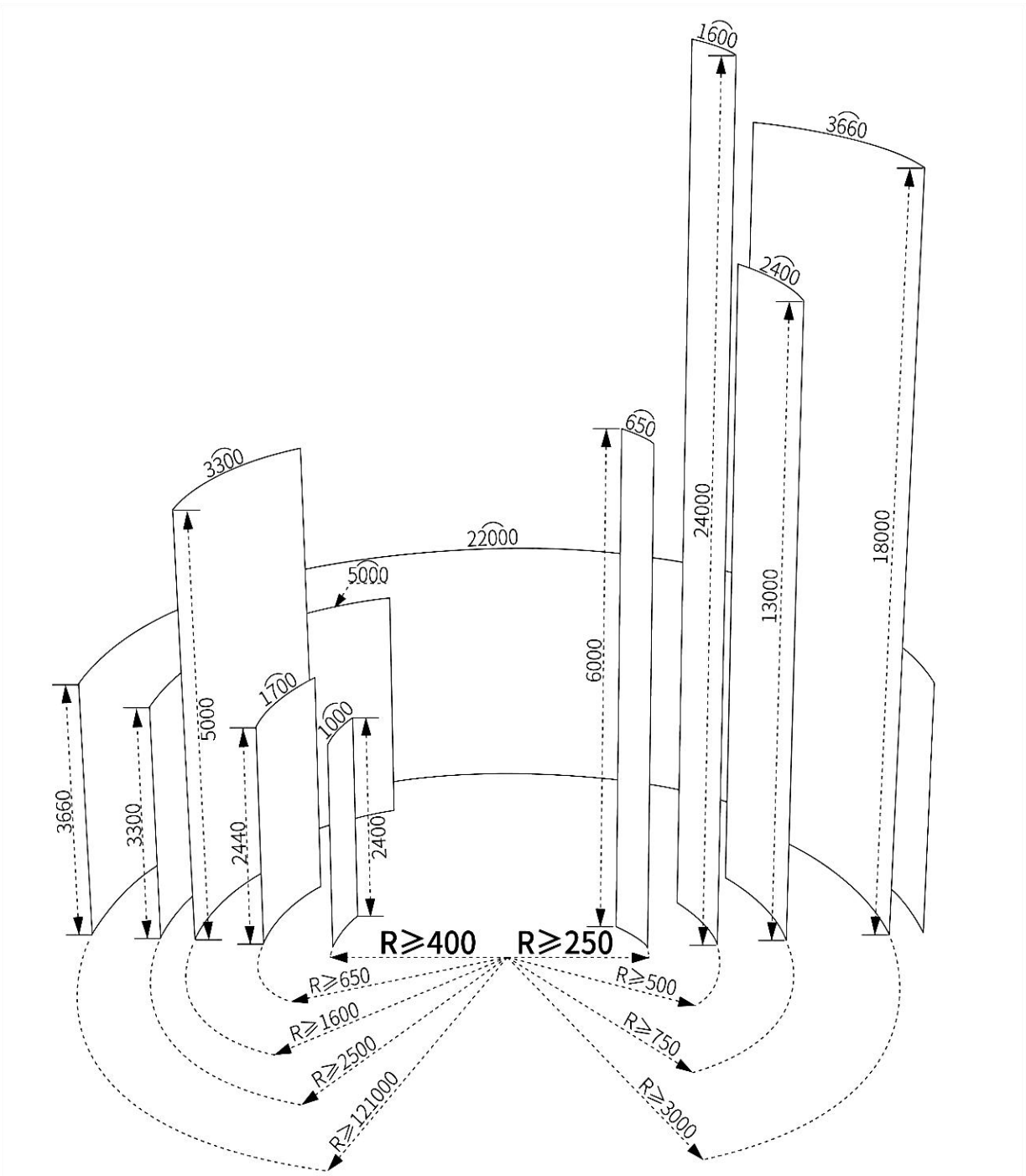




Curved glass

5.1 Typical Curved

The conventional production capacity of typical-curved tempered glass with a regular thickness ranging from 5mm to 19 mm is as follows. (For some special size and shape requirements, they can also be fulfilled through customization. The following is only the regular processing capacity.)

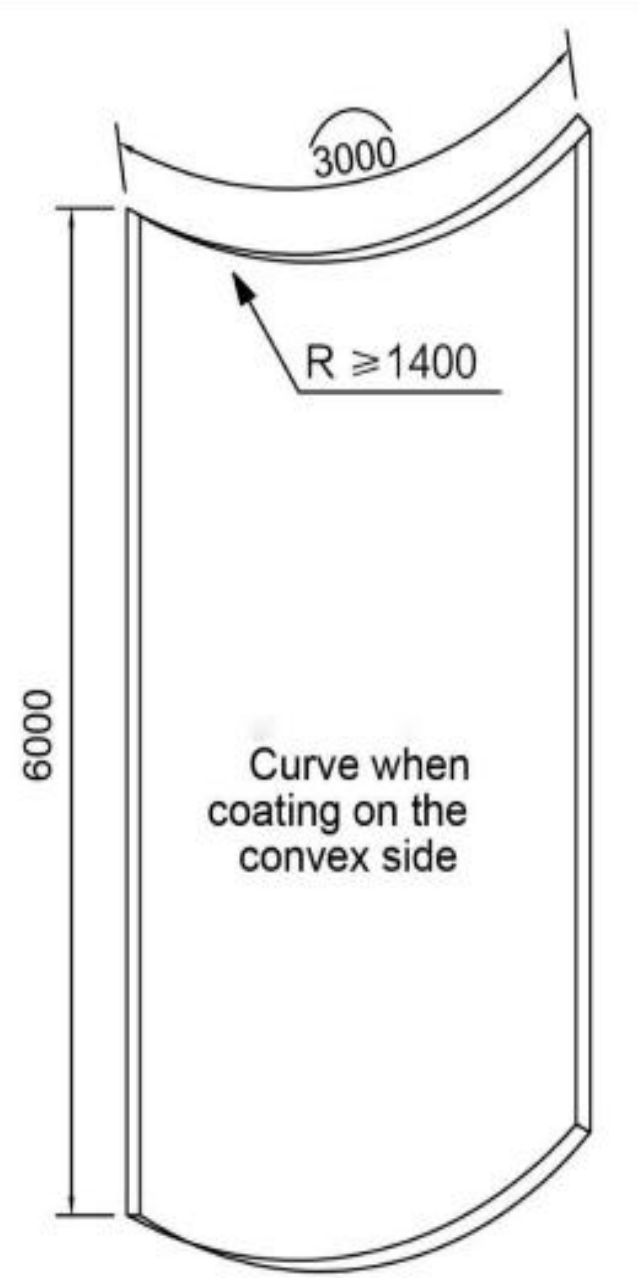


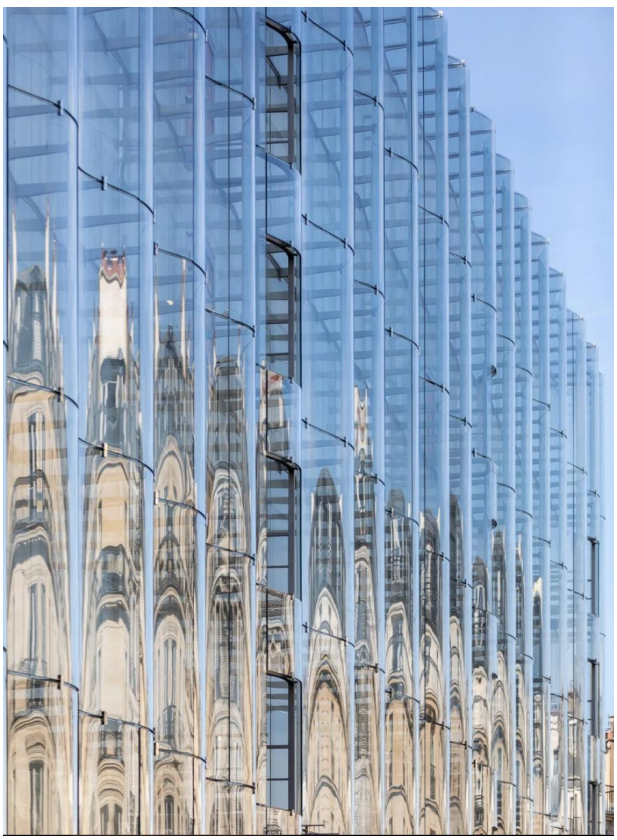
Machining dimension sheet if single curved tempered glass(mm)

Curved glass

5.2 Reverse-curved

Reverse curved tempered glass - The solar control and Low-e coatings are located on the convex surface of the glass. It has a distinct contrast with forward curved glass and a unique visual appearance. Due to its special shape, special design and handling are needed during installation and use. It can be applied in architectural decoration (such as arched ceilings, domes, etc.) to create a unique spatial effect. As the back or side panel of a display cabinet, it can add a three-dimensional feel and artistic sense. When used in art installations, it can infuse unique visual elements. It is more suitable for inwardly contracting spaces. The following are its main production and processing capabilities for reference and can be customized according to requirements.



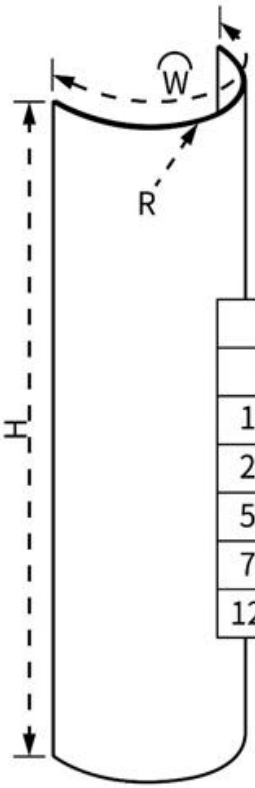


Curved glass

5.3 Special Shaped

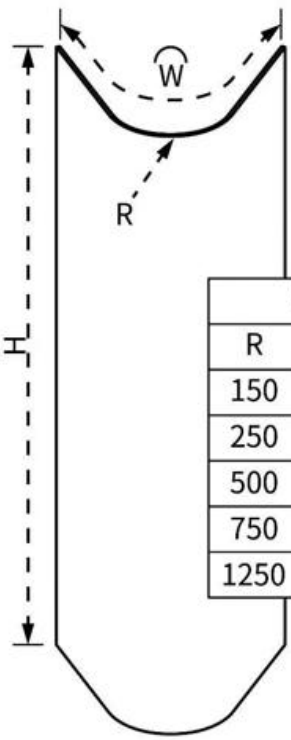
Semicircular curved glass exhibits a graceful semi-circular shape with fluid lines, giving a sense of softness and roundness. V-shaped curved glass has a unique V-shaped contour with distinct edges and corners, full of modern and design elements. Both of these curved glasses can add unique visual effects to a space and become decorative highlights. The following are its main production and processing capabilities for reference and can be customized according to requirements.

Semi-circular curved glass



Dimensions		
R	w	H
150	471	5000
250	785	5000
500	1571	24000
750	2356	13000
1250	3660	18000

V-shaped curved glass



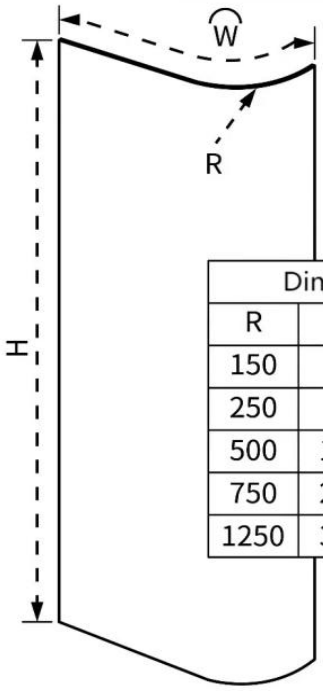
Dimensions		
R	w	H
150	471	5000
250	785	5000
500	1571	24000
750	2356	13000
1250	3660	18000

Curved glass

5.4 Special Shaped

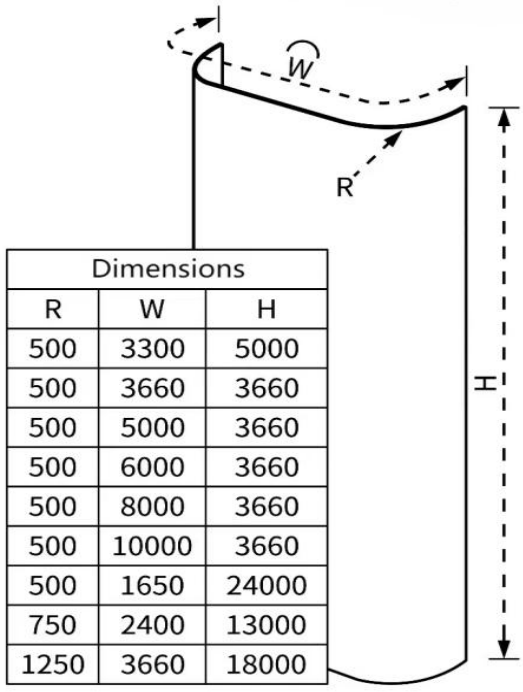
The shape of curved tempered glass is optional. The following are the processing capabilities of some other curved glass shapes for reference only and can be customized according to specific needs.

J-shaped curved glass



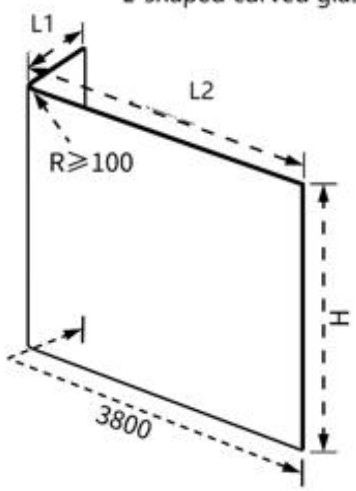
Dimensions		
R	w	H
150	471	5000
250	785	5000
500	1571	24000
750	2356	13000
1250	3660	18000

U-shaped curved glass



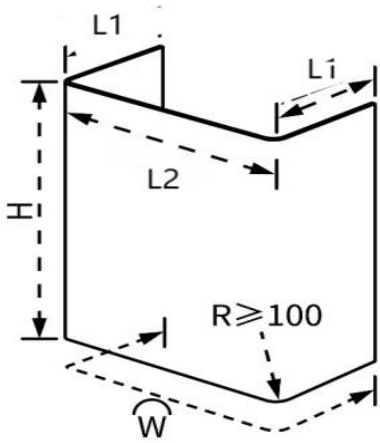
Dimensions		
R	W	H
500	3300	5000
500	3660	3660
500	5000	3660
500	6000	3660
500	8000	3660
500	10000	3660
500	1650	24000
750	2400	13000
1250	3660	18000

L-shaped curved glass



Dimensions		
L1	L2	H
300≤L1≤1200	300≤L2≤2600	≤10000

"[" shape curved glass

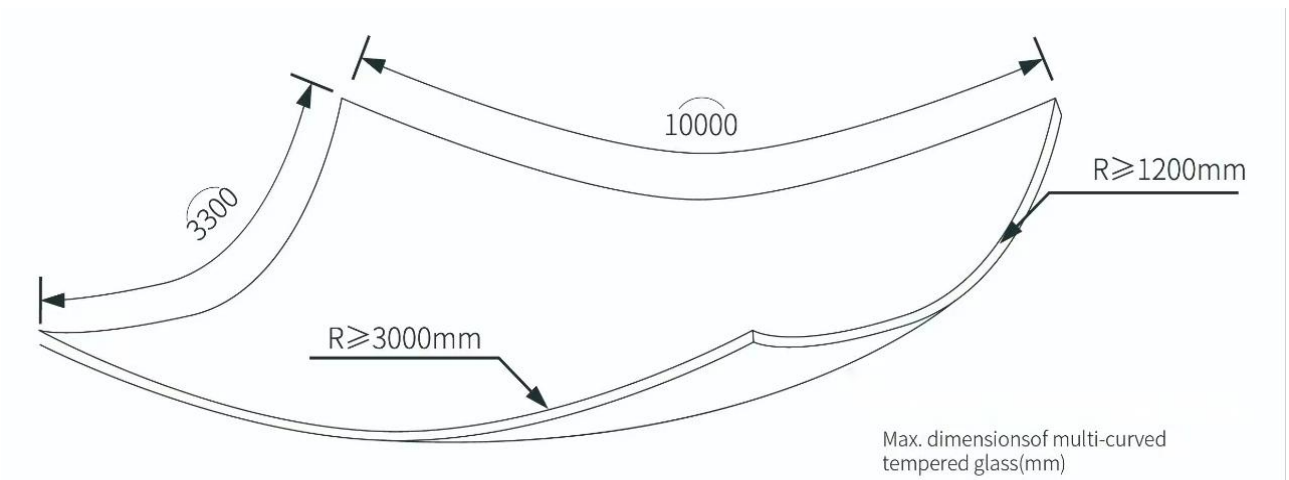


Dimensions		
W	L1	H
≤3660	≤400	≤10000

Curved glass

5.5 Multi-curved

Multi-curved glass is a glass product with a complex curved shape. It consists of curved surfaces in multiple different directions and can present a rich, diverse, and ever-changing form. It has high artistic value and visual impact. It's unique shape can add unique charm and a modern feel to buildings and is widely used in areas such as curtain walls and interior decoration of high-end buildings. In some distinctive architectural designs, multi-curved glass can become the focal point, showing the innovative ideas and bold designs of architects. While ensuring beauty, it can also provide good functionality for buildings. The following is the regular production capacity of multi-curved tempered glass with a thickness of 5mm to 19 mm. For some special size and shape requirements, they can also be satisfied through customization.

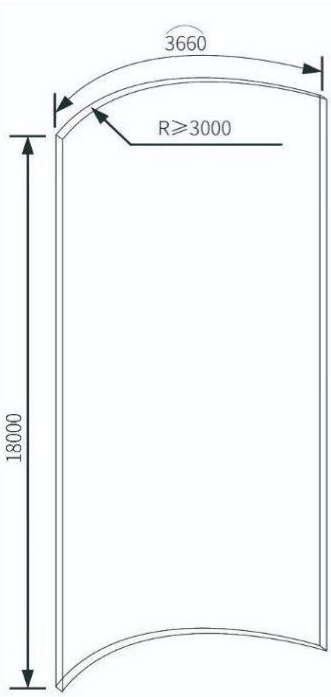


Max. dimensionsof multi-curved tempered glass(mm)

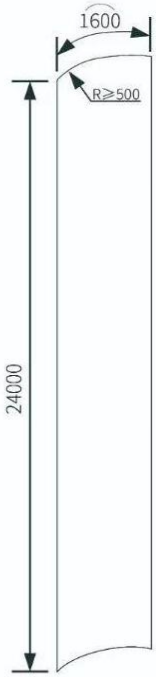
Curved glass

6. Curved Laminated Glass

Curved laminated glass is made up of two or more pieces of heat-bent or curved glass. The producible sizes are basically the same as those of single heat-bent or curved glass. Curved laminated glass has many advantages, including high safety, excellent sound insulation unit performance, and UV resistance. It is aesthetically unique in appearance and infuses artistic charm into architecture and decoration. It is widely applied in curtain walls, windows, domes and other aspects of the construction field. At the same time, it also shines brightly in interior decoration and commercial places. The following are its conventional processing capabilities for reference only and can be customized according to requirements.Interlayers offered include PVB, SGP, EVA, sound-control, and design patterns.



Max. dimensions of laminated curved tempered glass

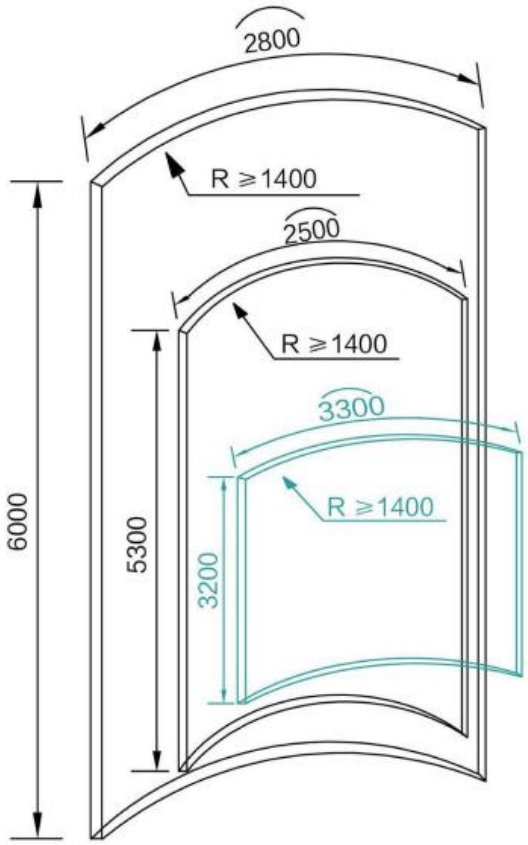


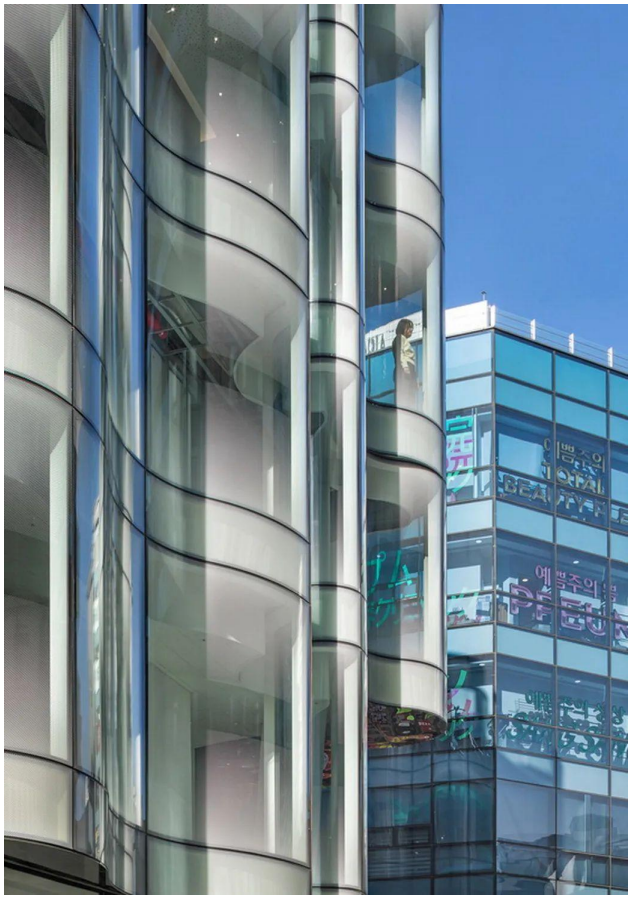
Min. bending radius of laminated glass in Jumbo size(mm)

Curved glass

7. Curved Insulating Glass Unit

Curved insulating glass is crafted by assembling two or more pieces of heat-bent, curved, or laminated glass. It boasts a unique appearance, excellent heat insulation unit performance, remarkable sound insulation unit and noise reduction capabilities, as well as anti-condensation features. Widely applied in building curtain walls, windows, sunrooms and other areas, its producible sizes are largely consistent with those of single heat-bent and curved glass. The following are its conventional processing capabilities for reference only and can be customized according to specific requirements.





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Curving Extrusions

Raw Material for Bending	
T5/T6 can be accepted for simple shape	Typical T4 for bending

Heat treatment	
T5 can be assured	Most of them can meet T6

Painting	
Miscellaneous color available	AAMA 2603, AAMA 2604, AAMA 2605, AAMA 611

Available products:
Curved extrusions for units
Curved base shoe railings
Curved grills etc.

Related curving products available:
Curved panels
Curved glass etc.

Finish available	
PVDF	PPG, Valspar, Akzo, AXALTA
Powder Coating	Akzo, Tiger
Anodize	Class 1/AA20 Black, Clear, Bronze

www.sinhplex.com

BLK 34, Upper Cross Street #04-134, Singapore 050034

Sinhplex Pte Ltd

Curving Ability

Equipment	Capacity	Arc Length Range	Radius Range	Representative
	20 Tons, suitable for section below 100mm	0.8m~6m	250mm and above	
	30 Tons, suitable for section below 200*180mm	1.5m~6.5m	500mm and above	
	60 Tons, suitable for section below 250mm	1.5m~7m	1000mm and above	
	120 Tons, sutable for section below 400*300mm 0r 600*200mm	4.5m~14m	2500mm and above	
	55 Tons, suitable for 3D curving and section below 350*250mm	1m~6m	450mm and above	
	Suitable for small section pipes and tubes, below ϕ63mm diameter	Depending on materials and section	Depending on materials and section	
	300 Type/ 800 Type, suitable for steel beam and spiral stair, below 700mm	3m and above	2m and above/ 12m and above	

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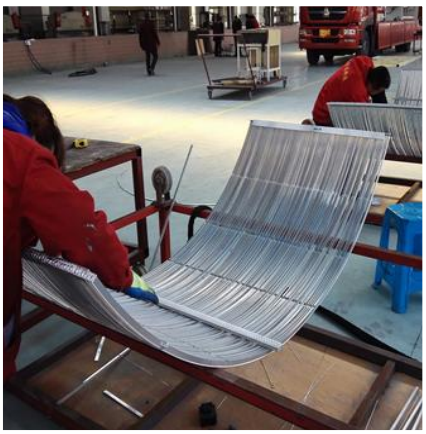
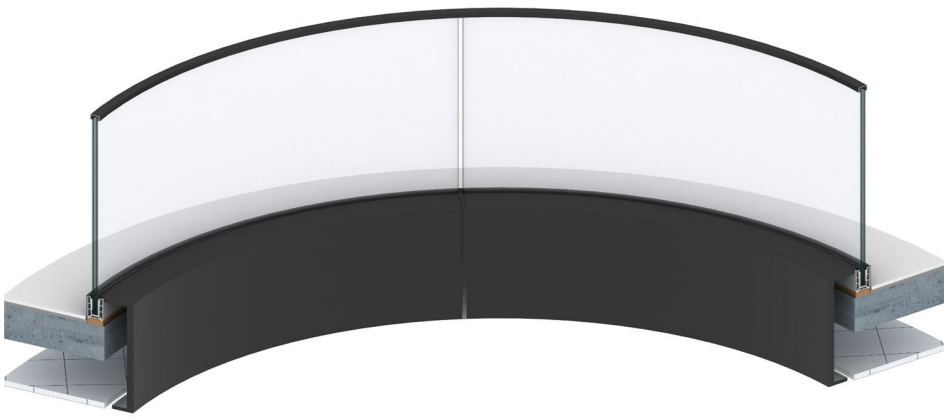
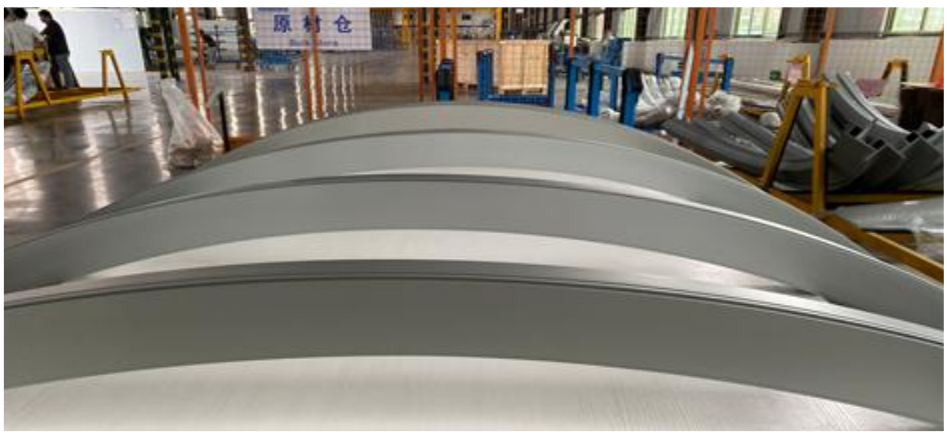
Projects Involved



1100 15th Street NW – Curved Grilles



Royal Mount Phase 1 – Curved Glass Railings and Panels



SAN-T1 – Curved Extrusions

Sinhplex Pte Ltd

Louver

Application

This louver is a 40.5mm deep stationary louver that is primarily designed with a 25.4 mm edge which is easily glazed on curtain wall units, it can be applied where water penetration is not a concern.

Features and Varies

- Easy connection to buildings and unit frames.
- Corrosion resistant, all constructed by aluminum and stainless steel
- Bird mesh and back plates blank off available
- Bird mesh with varies hole size available
- Customized louver blades and frame size

Standard Construction

Frames	Extruded aluminum 6063-T5/T6 1.4mm thickness Frame width 40mm Screw ports for easy connection at corners
Blades	Blade thickness 1.5mm Blade spacing 26.5mm Distance (Variable per project requirement) 57° to vertical face Stiffener added every 1m
Back Plates	3003-H14 aluminum plate, painted surface , same color with frames
Meshes	Aluminum mesh, stainless steel mesh and galvanized steel mesh for options

Finish Available

PVDF	AAMA 2605 PPG, Akzo, Valspar
Powder Coating	AAMA 2603, 2604,2605 Akzo, Tiger
Anodize	AAMA 611 Black, Clear, Bronze

Performance

This louver is tested for pressure drop and wind driven rain, testes are performed in accordance with AMCA 500L.

Air Pressure Drop Test

Core Velocity V (m/s)	Air Flow Q (m^3/s)	Q^2 $(m^3/s)^2$	Pressure Drop (Pa)	Th. Flow (m^3/s)	Point C_d	**Mean C_d**	Variance (%)
0.00	0.00	0.0	0.0	-	-	-	-
1.64	2.04	4.1	25.6	8.2	0.250	**0.247**	1.1
2.00	2.48	6.1	38.4	10.0	0.248	**0.247**	0.6
2.50	3.09	9.6	60.3	12.5	0.247	**0.247**	0.2
3.00	3.72	13.8	88.1	15.1	0.246	**0.247**	-0.4
3.49	4.32	18.6	121.6	17.7	0.243	**0.247**	-1.5

Coefficient of discharge, $C_d = Q / Q_T$ where Q (in m^3/s) is the actual flow at the test.
Tested core area of the louver: 1,120 mm (W) x 1,105 mm (H).
Tested blade spacing: 26.5 mm.

Table 1. Discharge Loss Coefficient Classification

Class	Discharge Loss Coefficient
1	0.4 and above
2	0.3 to 0.399
3	0.2 to 0.299
4	0.199 and below

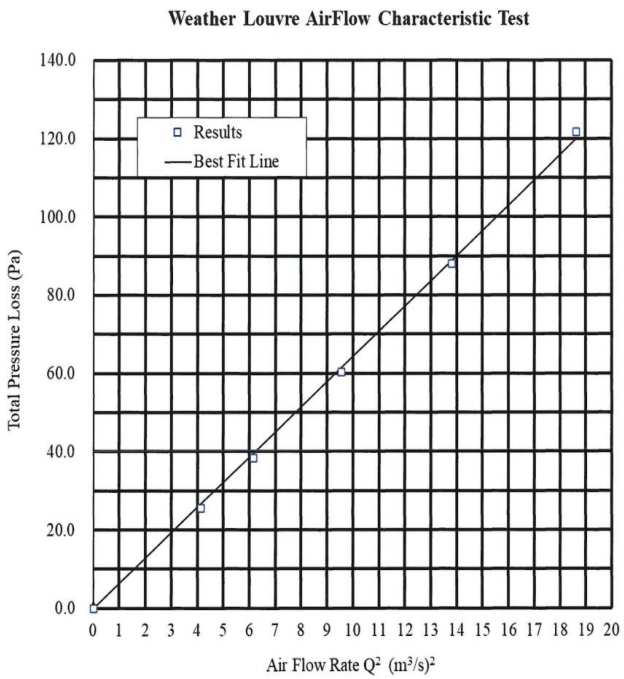


Figure 1- Airflow characteristic test (Inlet)

Wind Driven Rain Test

Table 2. The Wind Driven Rain Test Data for the Louver System

Core Velocity $v_c = q_v / A$ (m/s)	Air Flow Rate q_v (m^3/s)	Water Supply Rate q_s (L/h)	Water Supply Rate $q_{s,nom}$ (L/h)	Water Penetration Rate q_d (L/h)	Water Penetration Rate $q_{d,corr}$ (L/h)	Louvre Effectiveness E (%)
0.00	0.00	111.0	107.5	2.1	2.0	97.8
0.51	0.63	111.0	106.9	4.4	4.2	95.5
1.01	1.25	111.0	106.4	8.7	8.3	91.1
1.51	1.86	111.0	104.6	19.4	18.2	80.3
2.01	2.48	111.0	103.8	37.4	35.0	62.3
2.51	3.10	111.0	103.5	58.1	54.2	41.6
3.01	3.72	111.0	101.9	79.1	72.6	21.8
3.51	4.34	111.0	99.7	91.2	81.9	11.8

Notes:
Core area: 1,120 mm (W) x 1,105 mm (H) nominal, A = 1.24 m^2
Tested blade spacing: 26.5 mm.
Corrected Water Penetration Rate, $q_{d,corr} = (q_{s,nom} \times q_d) / q_s$
Effectiveness $E = [(75 \times A - q_{d,corr}) / (75 \times A)] \times 100$
Wind speed of 13 m/s at 1 m in front of the louver.
Air Temperature = 26 °C
Atmospheric pressure = 1018 hPa

Table 3. Louvre Effectiveness - Penetration Classification

Class	Effectiveness (%)	Maximum allowed penetration of simulated rain ($l/h/m^2$)
A	100 – 99	0.75
B	98.9 – 95	3.75
C	94.9 – 80	15
D	Below 80	Greater than 15

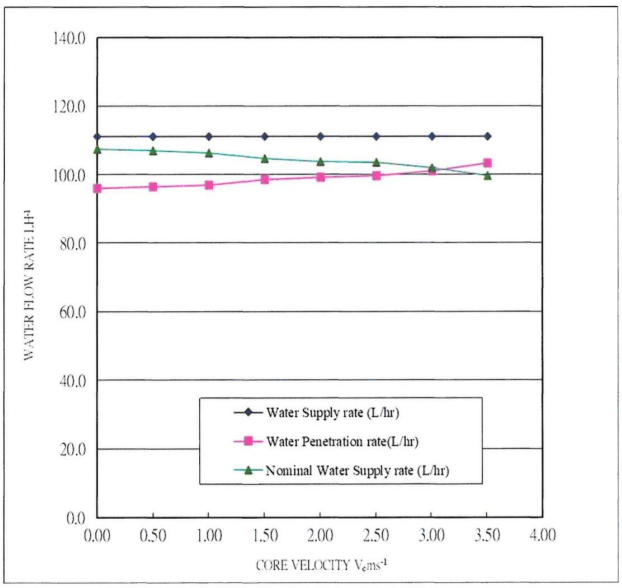


Figure 2. Rain penetration of calibration plate with simulated wind effect

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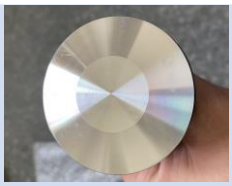
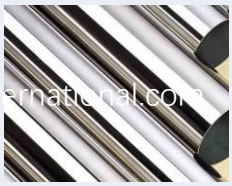
Stainless Steel Products

Alloy for Stainless Steel

Product	Alloy	Standards
Bar/Rod/Shapes	304, 316	ASTM A276
Plate/Sheet	304, 316L	ASTM A666/A240
Tubes	304, 316L	ASTM A269
Casting Parts	CF8, CF8M, CF3, CF3M	ASTM A743

Finish for Stainless Steel

Type	Photo	Type	Photo	Type	Photo
Brushed		Nature		Sand Blast	
Satin		Mirror		Electroplating	

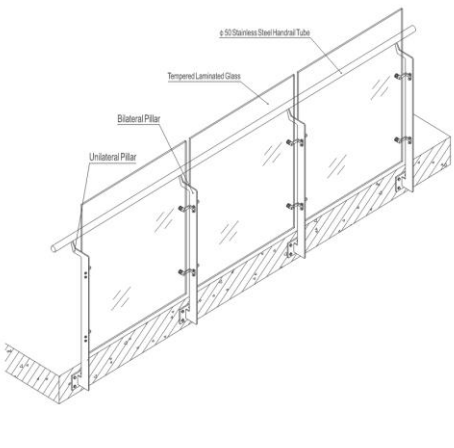
Products We Offer

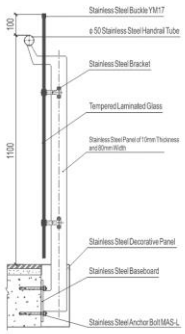
- **Windscreen Posts and Railing Posts**

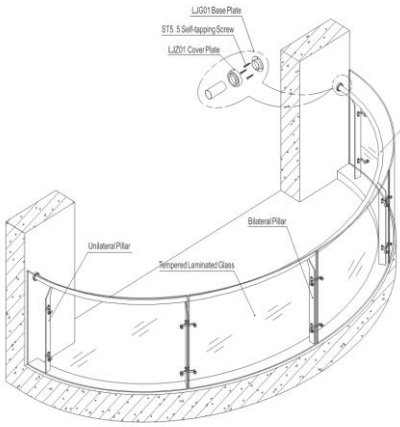
Simply designed post with glass clamps or DPs, all the materials can meet related ASTM standards . High weather proofing performance with 316/316L which is suitable for outdoor usage. Customized luxurious look with good quality.

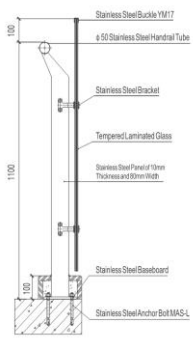
Stainless Steel Products

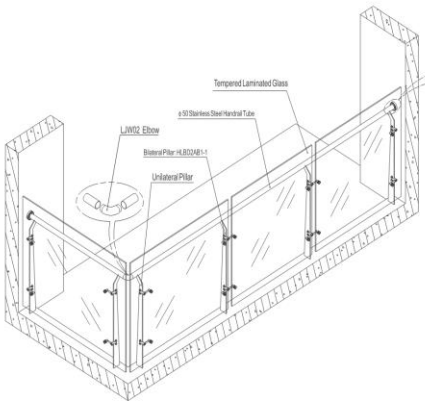
··· Continues

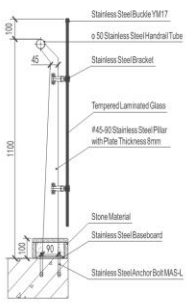


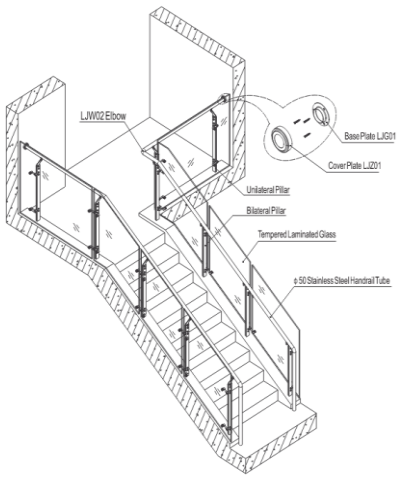


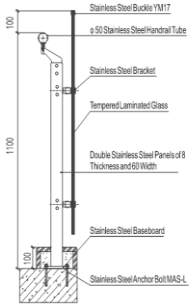


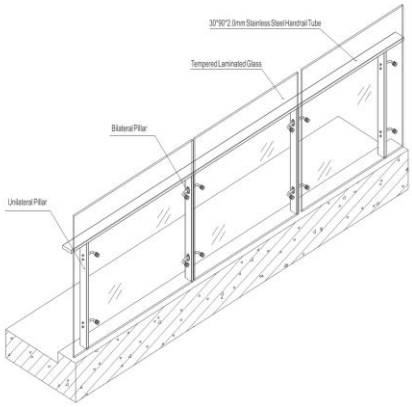


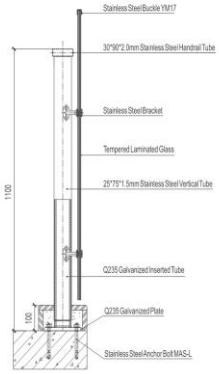


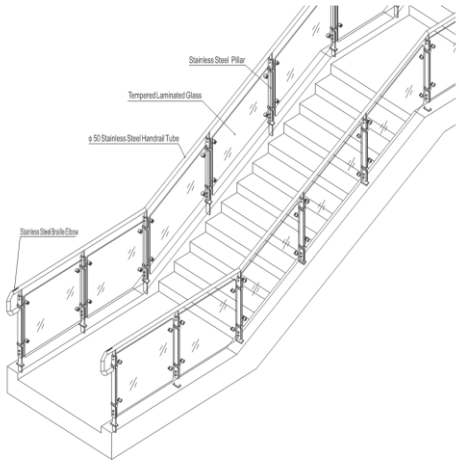


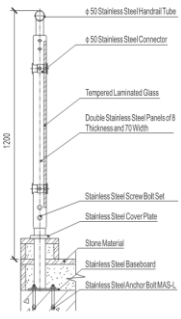












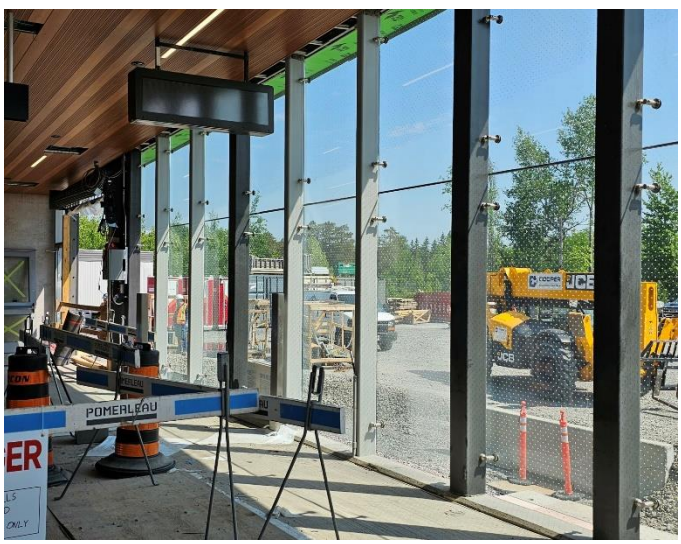
Stainless Steel Products

➢ Glass Clamps and DPs

Varies glass clamps and DPs are designed to suit for the glass thickness, load requirement as well as the look preferred by customer.

Product Name	Materials	Finish	Dimensions	Load Capacity
Glass Clamp	S.S. 316, CF8M, TPR Shim, Nylon Ferrule	Satin	65*60*41.5mm Glass Thickness: 21.52mm	Radial: 1.5KN Axial: 1.5KN

Product Name	Materials	Finish	Dimensions	Load Capacity
Double Doc & Pin	S.S. 316, Nylon Ferrule, Nylon Shim	Satin	Head: 70mm/60mm Length: 132±6mm (Customized per Project) Glass : up to 31.52mm thk.	Radial: 2.0 KN Axial: 2.5 KN



Stainless Steel Products

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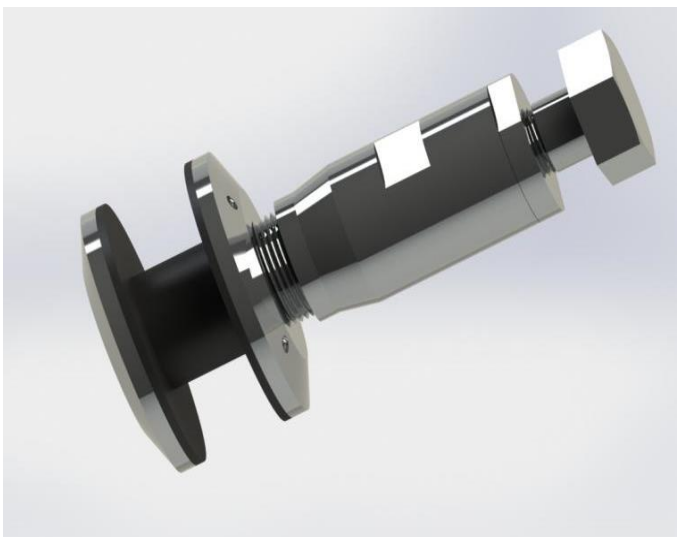
Head diameter and glass thickness varies per requirements of projects, the arm length depends on the distance from glass interior surface to structure where to fix the fittings.

Product Name	Materials	Finish	Dimensions	Load Capacity
Single Doc & Pin	S.S. 316, Nylon Ferrule, Nylon Shim	Satin	Head: 70mm/60mm Length: 132±6mm (Customized per Project) Glass : up to 31.52mm thk.	Radial: 2.0 KN Axial: 2.5 KN

Product Name	Materials	Finish	Dimensions	Load Capacity
Stand Off	S.S. 316, Nylon Ferrule, Nylon Shim	Satin	Head: 60mm Length: 100±5mm Glass Thickness: 21.52mm	Radial: 2.0 KN Axial: 2.5 KN



Stainless Steel Products

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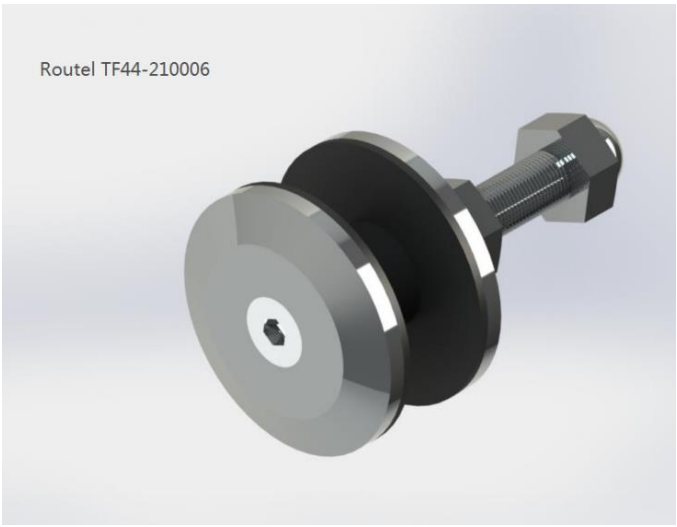
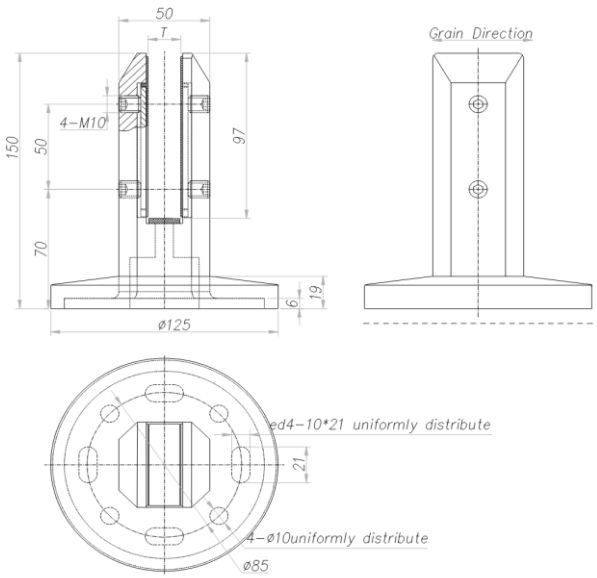
Product Name	Materials	Finish	Dimensions	Load Capacity
Stand Off	S.S. 316, Nylon Ferrule, Nylon Shim	Satin	Head: 59mm Length: 115mm Glass Thickness: 21.52mm	Radial: 2.0 KN Axial: 2.5 KN



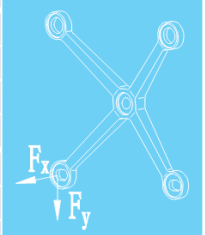
Product Name	Materials	Finish	Dimensions	Load Capacity
Glass Clamp	CF8M, Nylon Ferrule, Nylon Shim	Satin	Base: 85mm Height: 150mm Glass Thickness: 12~13.52mm/16~17.52mm	NA

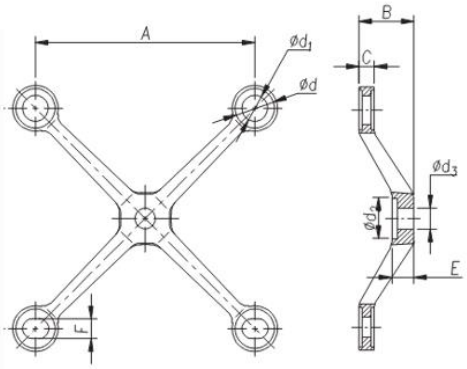


➢ Spiders and Routels

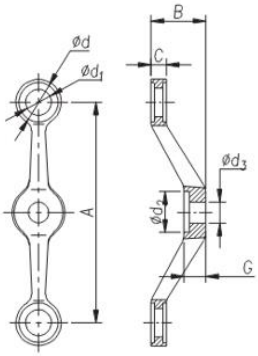
Different series are available to suit the project requirements like glass configuration, distance between glass and structure, load requirements etc. Except for CF8M alloy, CF3M is available for higher load capacity.

Size / Model	A	B	C	d	d_1	d_2	d_3	E	F	G	The Recommended Value of Load Capacity(N)	Material: CF8M、CF8		Material: CD3MN	
												Fx≤	Fy≤	Fx≤	Fy≤
A160A Series	160	40	10	26	16	19	13	16	12.5	16		1500	800	—	—
A200A Series	200	40	12	36	24	37	19	20	18	18		2000	800	—	—
200A Series	200	50	14	36	24	37	19	20	18	20		2000	1000	2600	1300
A220A Series	220	50	12	36	26	37	19	21	18	19		2000	1000	—	—
220A Series	220	50	12	36	26	37	19	23	18	20		2000	1200	2600	1600
C220A Series	220	50	18	36	26	37	19	28	18	26		4000	2500	—	—
D220A Series	220	50	20	36	26	37	21	28	20	28		5000	3500	—	—
A250A Series	250	50	12	40	26	37	19	22	18	20		2000	1200	—	—
250A Series	250	50	14	40	26	37	19	25	18	22		2500	1500	3300	2000
C250A Series	250	50	17	40	26	37	19	27	18	27		4000	2500	—	—
D250A Series	250	50	20	40	26	37	21	30	20	30		5000	3500	—	—
A300A Series	300	50	16	40	26	37	21	28	18	28		2500	1500	—	—
300A Series	300	50	18	40	26	37	21	32	18	26		3000	2000	3900	2600





***A4



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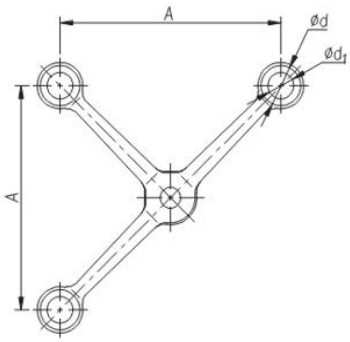

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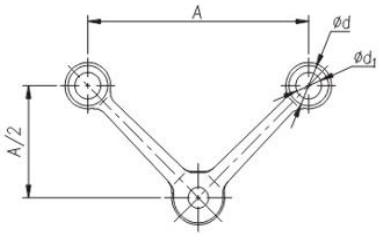

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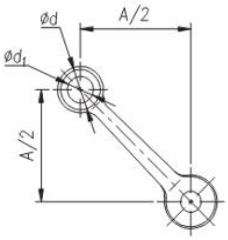

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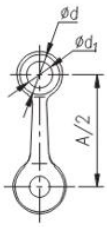

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Stainless Steel Products

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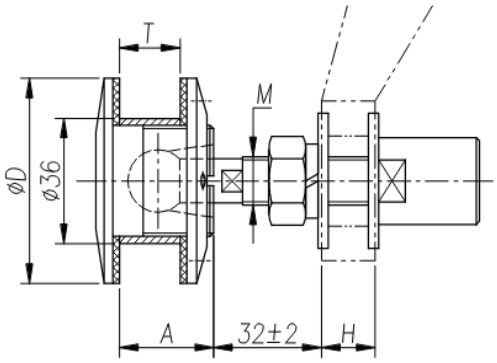
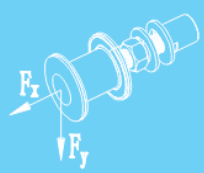
- Standard Routels

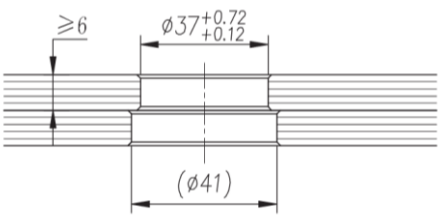


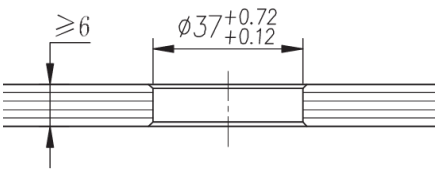
Model \ Size	A	D	M	T	H	The Available Rotation Angle	The Recommended Value of Load Capacity (N)	Main material:316, 304	
								Fx≤	Fy≤
TF11A	28	59	M14	8-18	—	±10°		4500	2000
TF12A	36	59	M14	18-26	—	±10°		4500	2000
TF13(TF13A)	50	59	M16	26-40	—	±5°(±10°)		6000	2500
TF14(TF14A)	56	59	M18	30-46	—	±5°(±10°)		6500	2800
TF21(TF21A)	32	70	M16	8-22	—	±5°(±10°)		6000	2500
TF22(TF22A)	40	70	M16	22-30	—	±5°(±10°)		6000	2500
TF23(TF23A)	50	70	M16	30-40	—	±5°(±10°)		6000	2500
TF24(TF24A)	61	70	M18	30-50	—	±5°(±10°)		6500	2800
TF2E55	66	70	M18	25-55	—	±5°		6500	2800



- Installing Tools

- Holes on Glass for Routels





Stainless Steel Products

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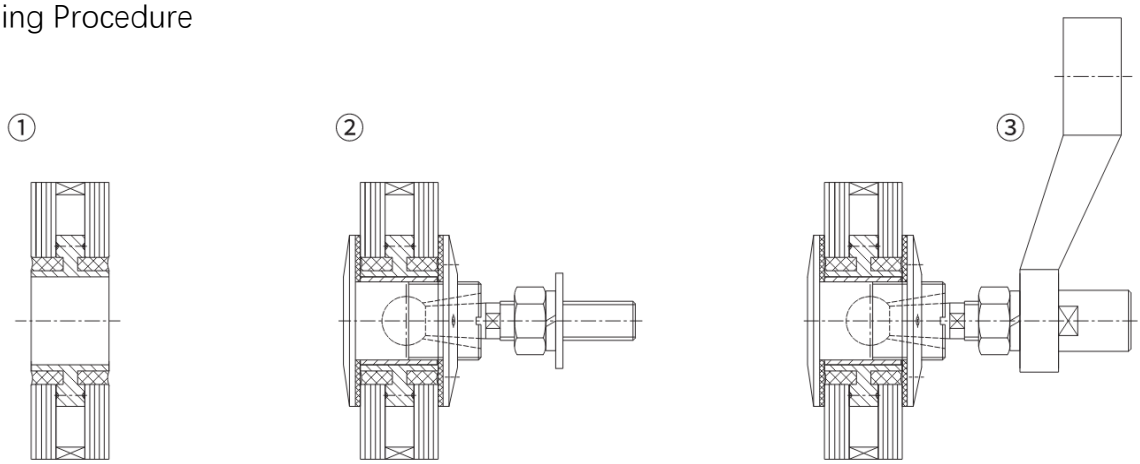
- Explode View

- Installing Procedure



- Site Photos