



VIRA GROUP

Polycarbonate Sheets

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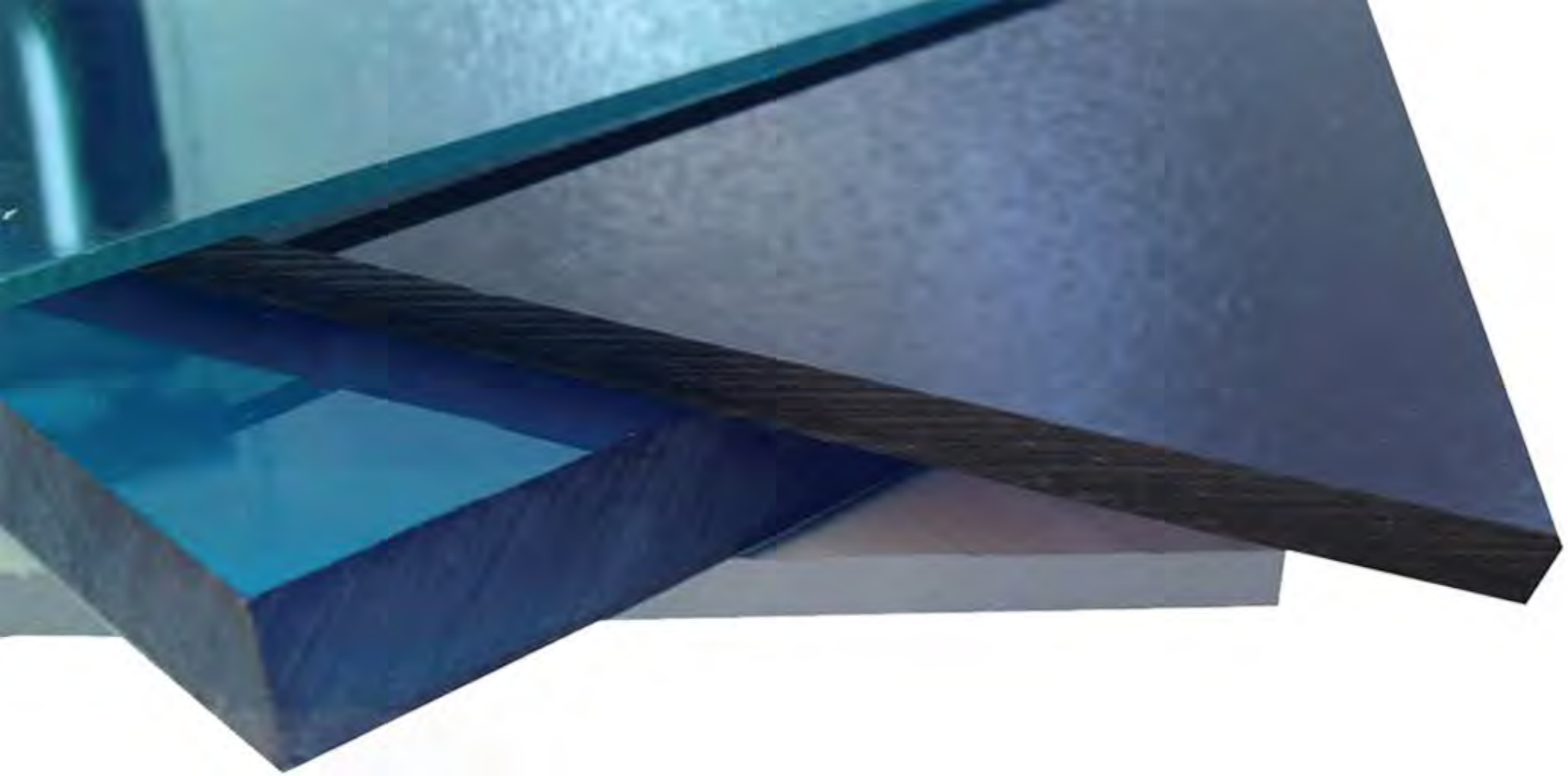


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Polycarbonate sheets

- Multiwall polycarbonate sheets
- RFX polycarbonate sheets
- Security sheets
- Sound barrier sheets



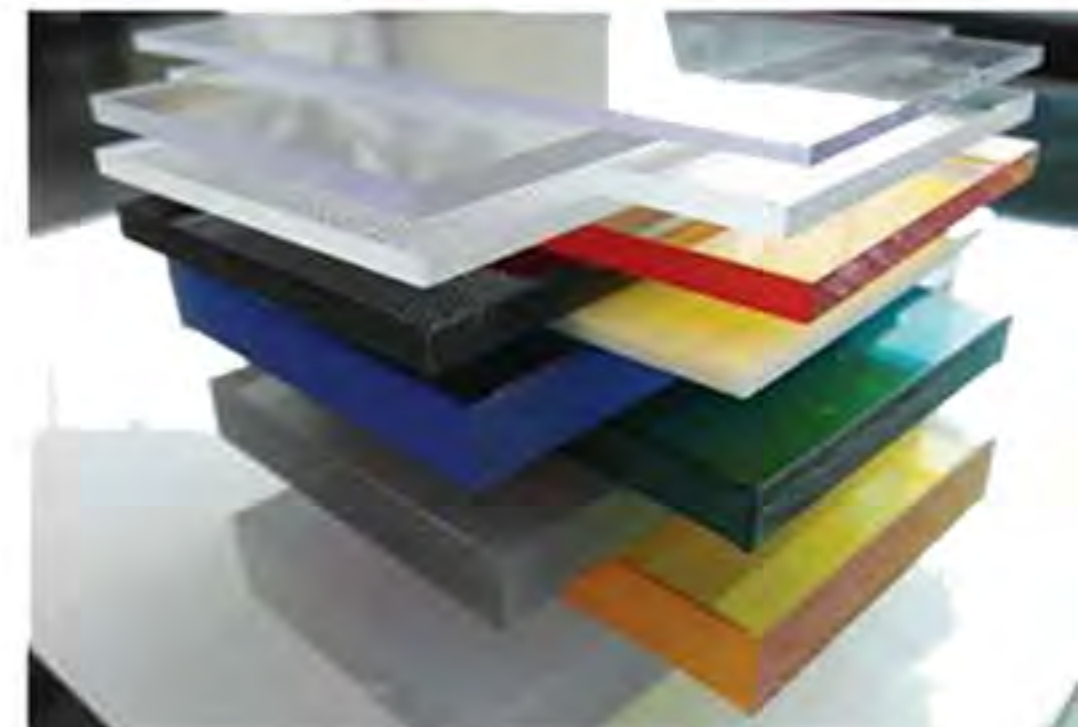
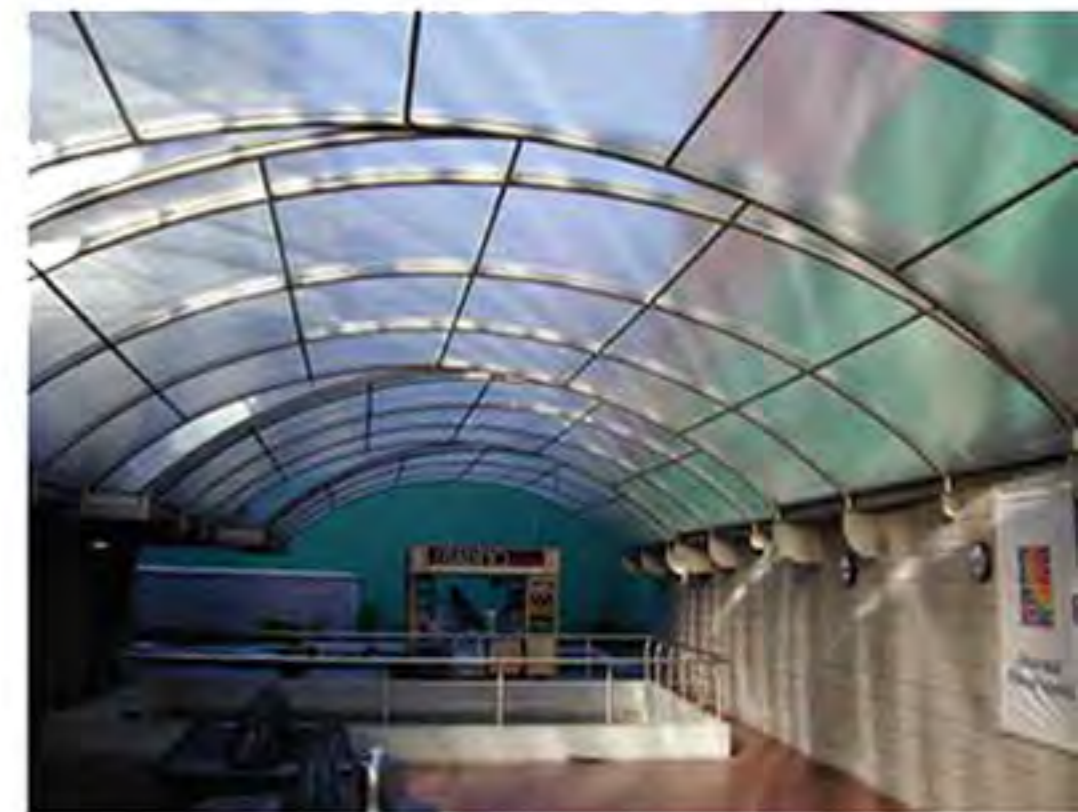


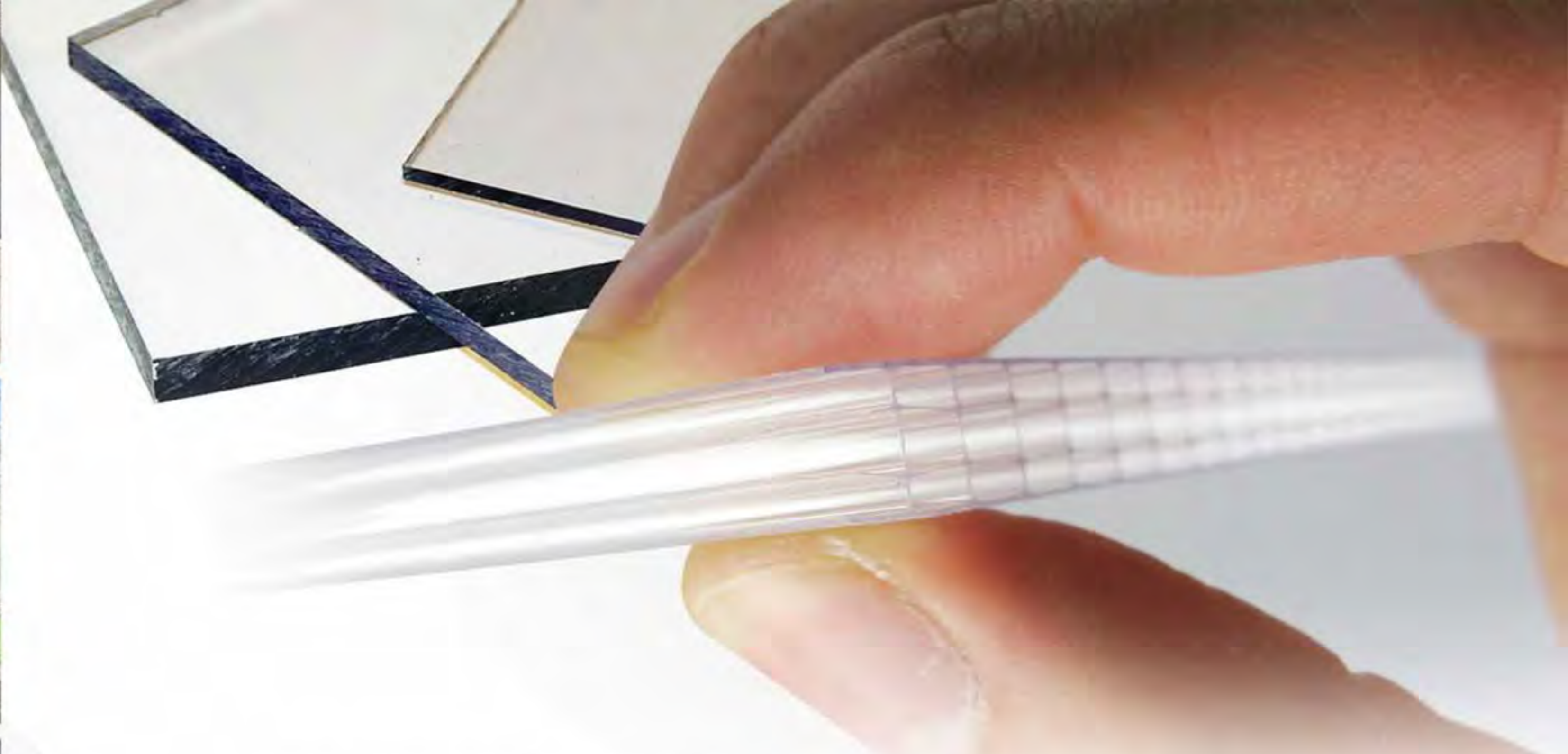
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Flat polycarbonate sheets

Polycarbonate flat sheets, unique products with exceptionally high standards of security toward physical impact are considered as viable alternatives for glass applications. Due to high strength and exceptional transparency, these sheets have been known as transparent steel. It is worth noting that flat sheets of polycarbonate are the hardest and toughest transparent material ever known. Flat polycarbonate sheets manufactured by Polymer

Vira Group possess excellent light transmission properties with surfaces shining bright as diamond. facile shapeability under vacuum, exceptional thermal resistance in the temperature range from -20 to 120 Centigrade, ease of recycling, high impact resistance (250 times stronger than glass and almost unbreakable), safe bending radius (175 times more than thickness of sheet), ease of installation, heat and cold insulation, electrical insulation, light weight (1/2 in compare to glass), and color constancy are among notable features of these products which make them suitable for wide applications.





Transparent Steel, Bullet Proof, Constancy and Variety in Color

Unbreakable and fire proof polycarbonate flat sheets eliminate the risks of glass breakage and fire spread.

Applications:

Flat polycarbonate sheets manufactured by **Vira Group** according to safety guidelines are suitable for application in open or closed environments. These products have found applications such as alternative choice for ordinary or securite windows in houses, schools, industries, rooflights, footbridges, bust stops, commercial panels, stands, kiosks, modern urbanization, sound barriers, machinery shields, greenhouses, ceiling lights cover, and also security and protection. In overall, these products are suitable for any application requiring transparent glass with excellent toughness.



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Technical specification of Flat polycarbonate sheets

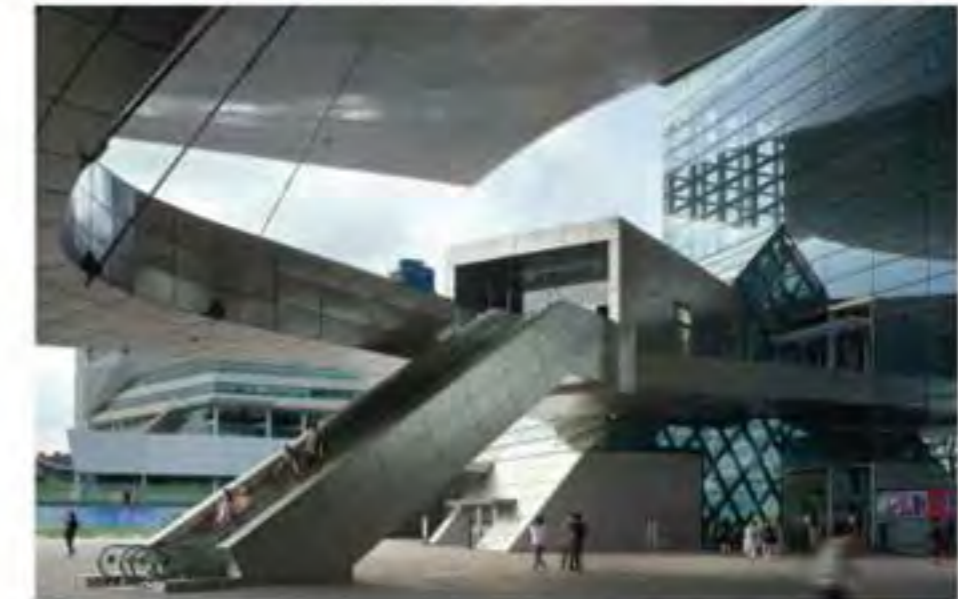
Dimension:

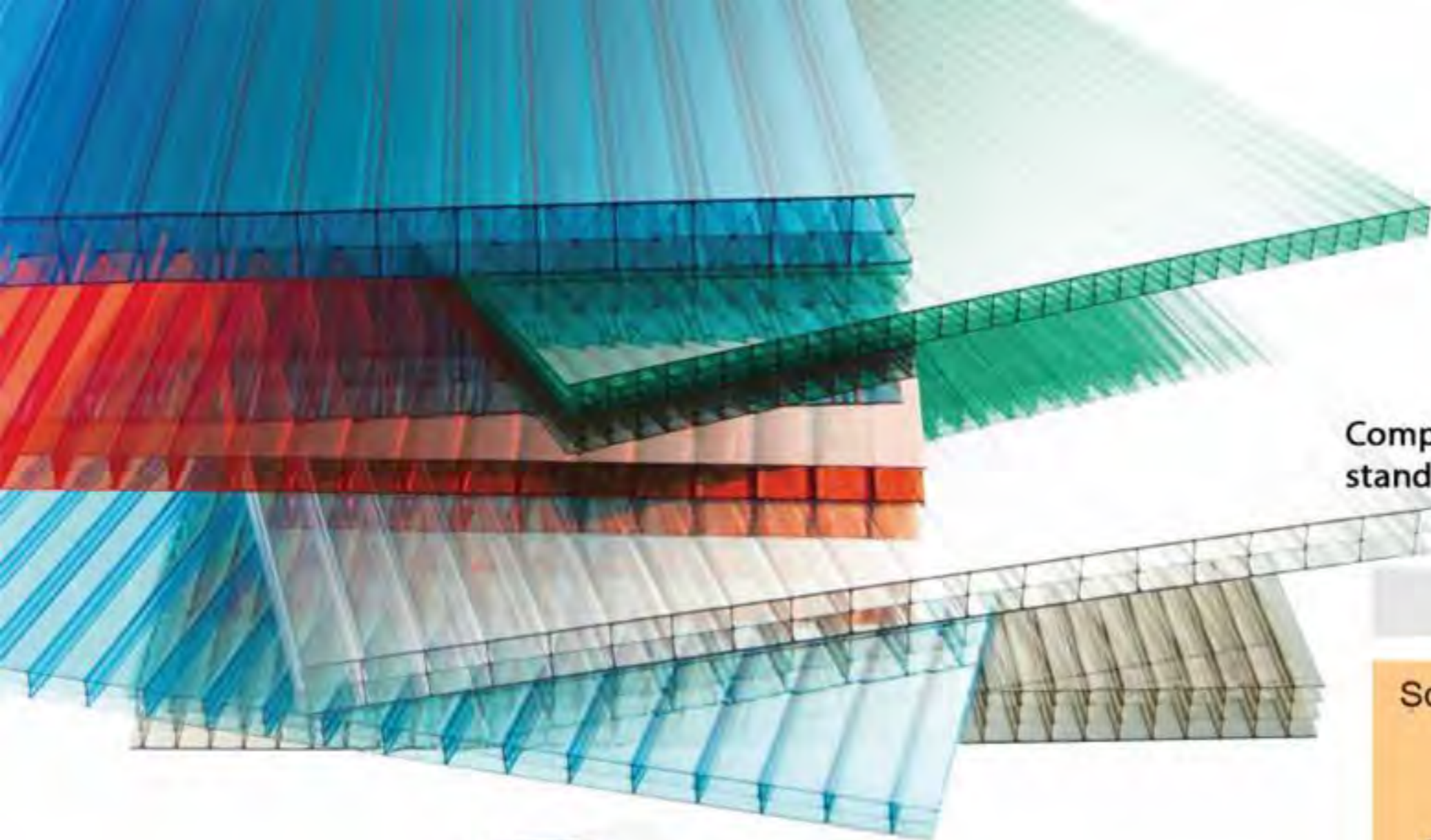
Flat polycarbonate sheets manufactured by **Vira Group** are produced with a thickness of 2 to 12 millimeters. Standard width and length for these sheets are:

2050 mm × 3050 mm

Variety in color:

These sheets are manufactured and distributed by **Vira Group** Co. with a wide variety of standard colors. In addition, in the cases where different dimensions or colors are required, sheets are produced custom-made upon customer request.





Comparison of heat transfer from flat polycarbonate sheets and glass, according to ASTM C1363 standard is presented in table below.

		Thickness (mm)	2	3	4	5	6	8	10	12
Solid pc	U-Value (w/m.k)		5.56	5.41	5.26	5.13	5.00	4.76	4.55	4.35
	Area Weight (kg/m)		2.4	3.6	4.8	6	7.2	9.6	12	14.4
Glass	U-Value (w/m.k)		5.83	5.80	5.78	5.75	5.73	5.68	5.63	5.58
	Area Weight (kg/m)		5	7.5	10	12	15	20	24.9	29.9

U-Value is overall heat transfer coefficient and it is worth noting that larger heat transfer coefficient leads to larger amount of transferred heat per unit surface area.



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Multiwall polycarbonate sheets

This category of products distributed by **Vira Group** are manufactured according to up-to-date quality standards by using high quality raw materials acquired from most credible German companies. Due to co-extrusion of cover layer, these products possess excellent resistance towards destructive solar rays. Multiwall polycarbonate sheets manufactured by **Vira Group** are light in weight, transparent, resistant toward harsh atmospheric conditions such as storm and hail, and completely safe in case of fire spread. Bending radius of these sheets is 175 times more than their thickness which makes them a suitable choice for construction of domical and embowed structures. Other prominent features of these products are facile installation, high impact resistance (200 times stronger than ordinary glass), prevention of harmful ultraviolet light, easy maintenance and transport due to light weight, and suitable light transmission in the range of 48-84 percent according to respective color and application.



Moreover, as a result of light weight, installation of these sheets requires less support (purlins and rafters) along with exceptional durability. These features have led to consideration of multiwall polycarbonate sheets as an economic and efficient alternative.

Profile	Thickness (mm)	Area weight (kg/m ²)	U-value (w/m ² k)
	4	0.8	4
	5	1	3.9
	6	1.3	3.6
	8	1.5	2.9
	10	1.7	2.5
	16	2.7	2.09
	20	3.0	2.09

Applications:

Multiwall polycarbonate sheets manufactured by **Vira Group** found numerous fields of application such as: greenhouses roof and walls, footbridges, industrial niches, sloping roofs for villas and etc.



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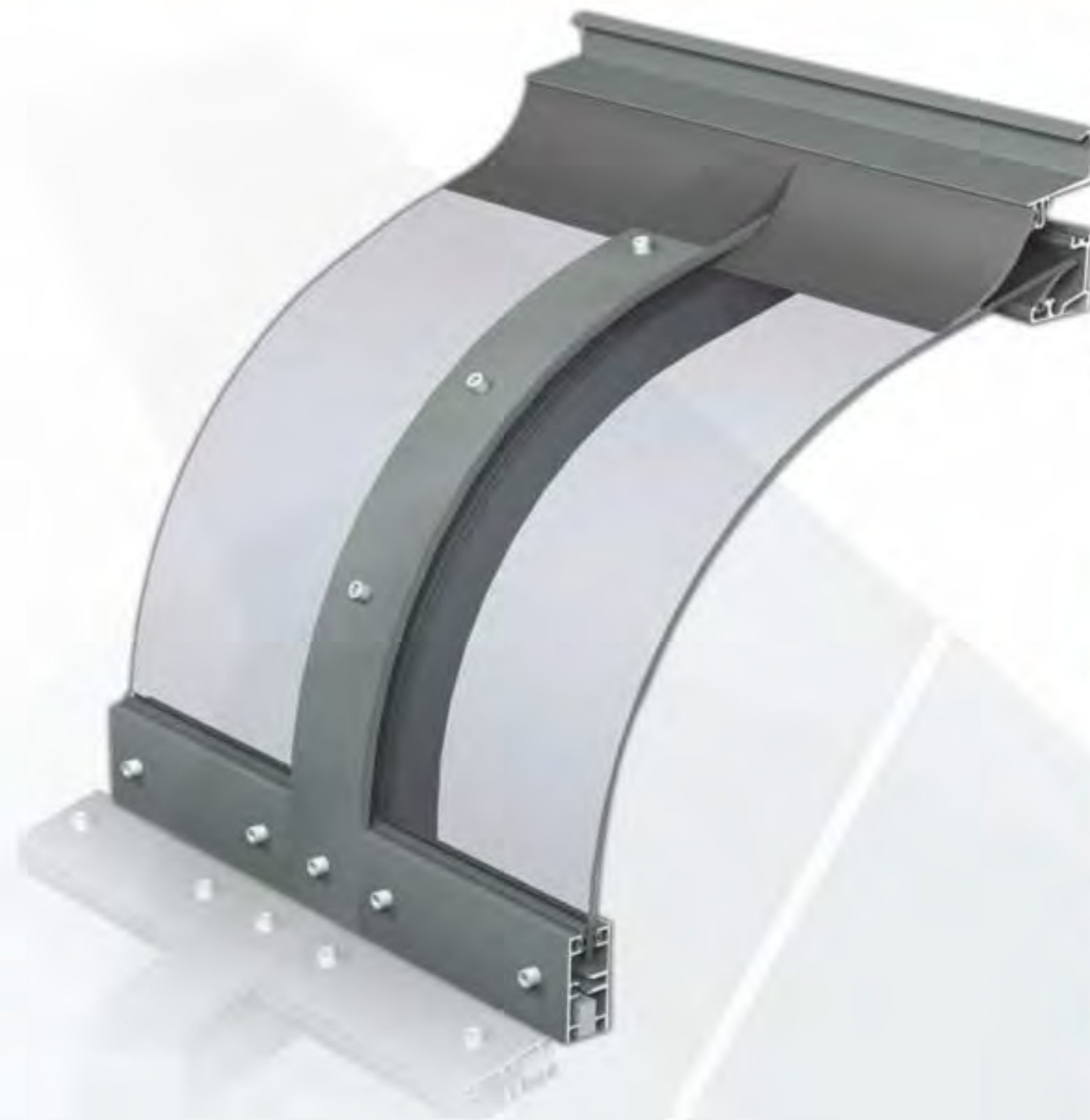


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Technical information

Dimensions:

Standard length and width of these sheets are: 6000mm × 2100mm



These sheets are manufactured and distributed by **Vira Group** with a wide variety of standard colors. In addition, in the cases where different dimensions or colors are required, sheets are produced custom-made upon customer request. Comparison of heat transfer between multiwall polycarbonate sheets and glass is presented in below tables according to ASTM C1363

Hollow PC							
Profile	2-Walls			3-Walls		4-Walls	
Thickness (mm)	4	4.5	6	8	10	16	20
U-Value (w/m ² . K)	4	3.9	3.6	2.9	2.5	2.1	2.09

Glass								
Thickness (mm)	2	3	4	5	6	8	10	12
U-Value (w/m ² . K)	5.83	5.80	5.78	5.75	5.73	5.68	5.63	5.58
Area weight (kg/m ²)	5	7.5	10	12	15	20	24.9	29.9








Security sheets

The need for public and military security equipment is increasing as a result of increase in rate of felony. In order to meet specific needs of public in this regard, **Vira Group** as a pioneer company, feels a sense of responsibility and benefiting from modern technology and experience in manufacturing of polycarbonate sheets, has launched its own production of flat sheets suitable for safety and security applications. **Vira Group** ensures unaffected constancy of color toward sunlight and transparency of sheets, and compliance of manufactured products with safety and security standards.

Manufactured sheets are resistant toward physical impact, projectiles fired from a handgun, breakage, and delamination, Due to unique multi layered structure. Accordingly, these sheets have found numerous applications in the safety and security applications. It is worth noting that, different grades of flat polycarbonate sheets manufactured by **Vira Group** are laminated with special adhesives such as polyurethane.

Suggested applications:

Security bars/shields and related equipment, windows, schools and government buildings, detention centers and prisons, commercial or military kiosks, psychiatric hospitals, cash transportation, jewelries, banks, anti-riot equipment, bulletproof shields and in overall, applications subject to physical impact.

Profile	Name	Function	Thickness in mm	Weight in kg/m ²	Light Trans Mission in %	Test results*
	CG 375	Protection against Forced entry	10	12	86	. EN 356-P7B . Astm F1233 Class II Step 15 . Hpw Level Step 15 . ASTM F1915-03 Grade 3
	CG 500	Protection against Forced entry	13.5	16.2	83	. EN 356-P8B . HPW TP 0500.202 Level A . Ballistics (.38 special) . ASTM F1915-03 Grade 2
	BR 750	Protection against ballistic impact	20	24	88	. PM 2000. Level pm1-NS . EN 1063,Level BR1-Ns . UL Level 1 Ballistic
	BR 1250	Protection against ballistic impact	33	39.6	67	. EN 1063, Level BR2-NS . UL Level 3 Ballistic . ASTM F1915-03 Grade 1
	MS 1250	Protection against ballistic impact	33	39.6	75	. PM 2000. Level pm2-NS . EN 1063,Level BR1-Ns . UL Level 6 Ballistic



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Sadr elevated expressway

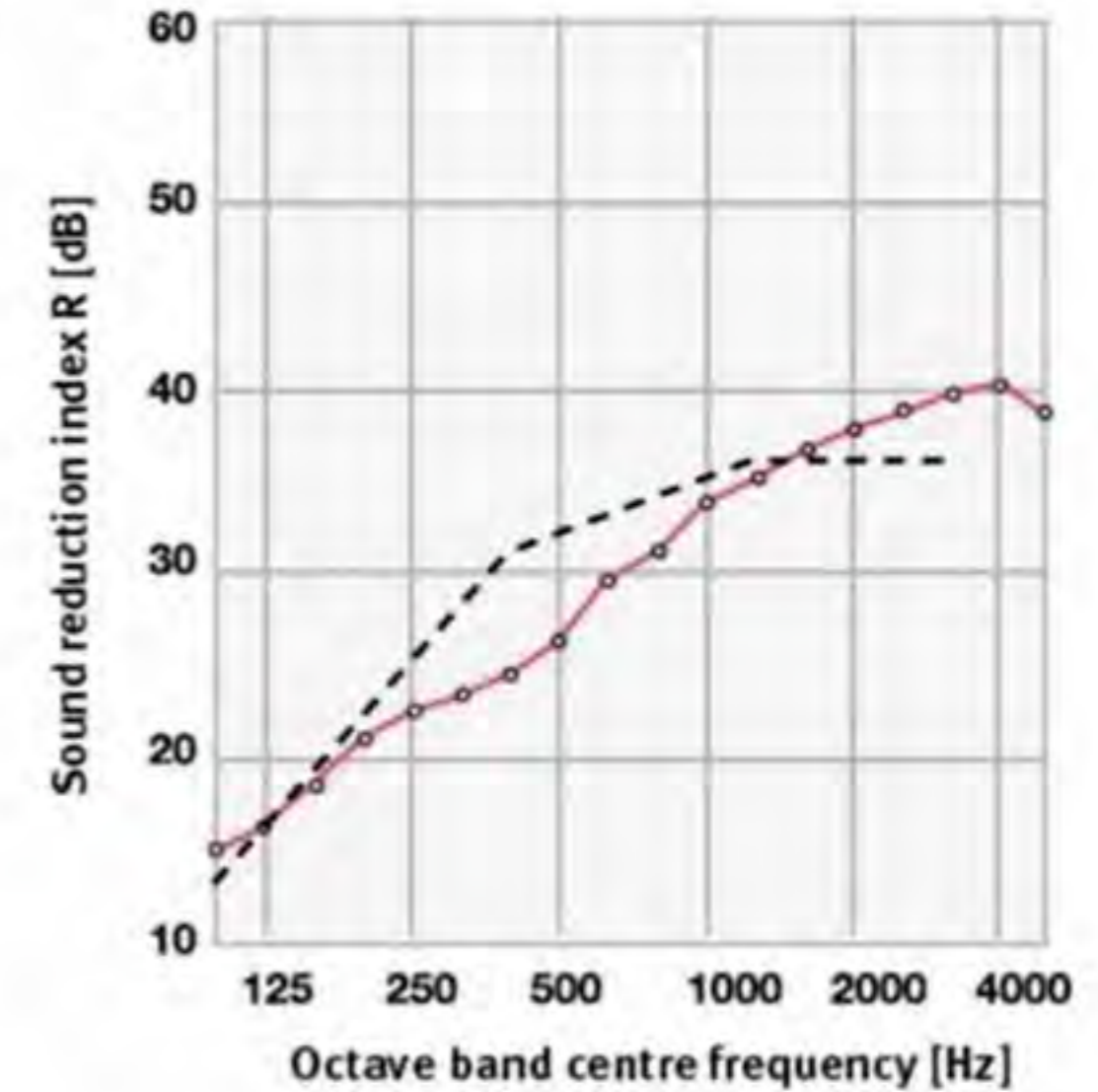


Hakim highway

Acoustics properties of 8 and 16 millimeters thick flat polycarbonate sheets are presented in below tables and figures:

Results db (En Iso 140-3)		
sum of deviation		28.5
Average deviation		1.78
displacement desiganted curve		-18
Sound reduction index Rw		32
SPECTRUM ADAPTATION TERMS		
	c	C _{tr}
100-3,150 hz	-1	-5
100-5,000 hz	-1	-5
100-3,150 hz	-1	-5
100-3,5000 hz	-1	-5

European Certificates:	
resistance to brushwood fire according to (*)	
Din en 1794-2 annex a: Class 2 ztv-lsw 06, section 2.5.4	
Impact of stones according to:	
Din en 1794 - 1 annex c:Passed	
Danger of falling debris according to:	
Din en 1794 - 2 , annex b: Class 3	



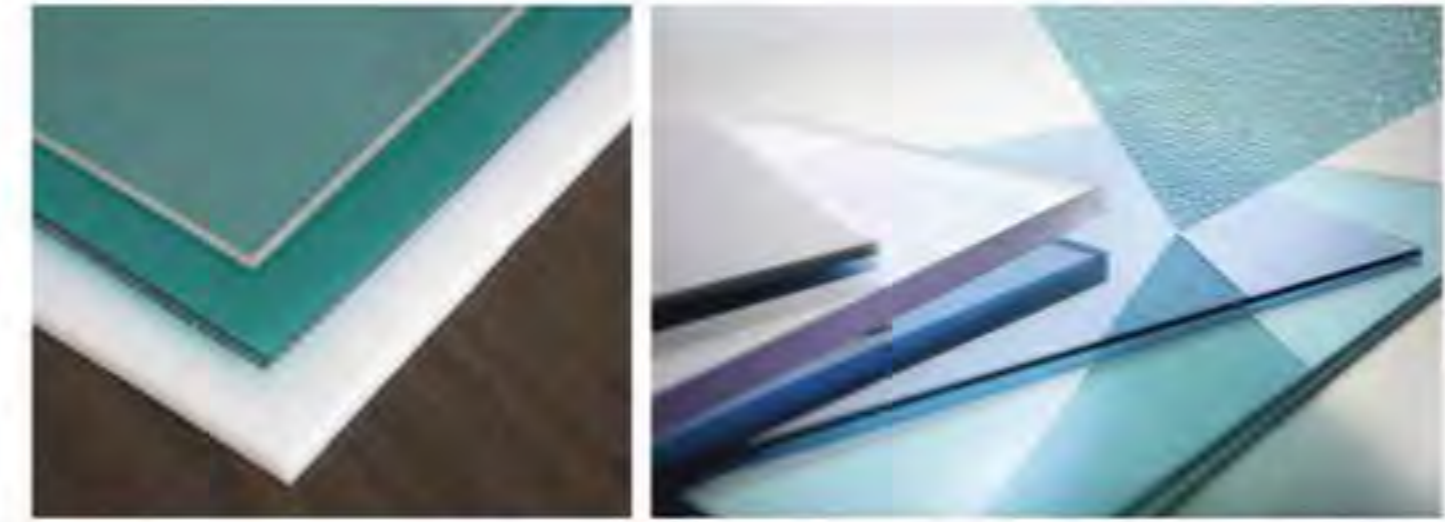
Sound barriers:

Noise pollution is a common problem nowadays. Large urban territories are considered major sources of noise pollution generation as a result of streets and highways activities. In addition, increase in traffic rate, growth of economies, high population density, and higher levels of expectation in life have led to increased severity of noise pollution issue in the development process of urban highways. As a result, application of sound barriers is proposed as a viable option.

It is worth noting that in the design procedure of sound barriers, negative impact of these barriers on urban appearances and beauty must be considered. Harmony of sound barriers with surroundings such as highways, line of sight prevention and light transmission to nearly stationed residents must be accounted for during design and material selection of sound barriers. Nowadays, novel materials such as polycarbonate are utilized for realization of transparency and efficiency features of suitable sound barriers.



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Acrylic sheets

Flat poly methyl methacrylate sheets are among well-known polymers with wide applications such as alternative materials for glass. These sheets are made from the hardest polymers with similar transparency to glass and smooth and clear surfaces which are resistant toward impact, atmospheric conditions, and destructive solar rays. Benefiting from modern technology and machinery, **Vira Group** have launched production of these sheets with compliance with DINEN ISO 7823-2 standards. Colorless flat poly methyl methacrylate sheets are 92% transparent while common glass materials are only 90% transparent. In addition, these sheets are highly resistant toward UltraViolet light and also color change due to solar rays. Flat poly methyl methacrylate sheets manufactured by **Vira Group** Possess suitable mechanical strength toward atmospheric conditions such as wind, rain, and hail. Moreover these sheets demonstrate low humidity absorbance. In addition, aging leads to no change in shape and dimension of these sheets and no wrinkle or pucker occurs.

In case of identical dimension and thickness, poly methyl methacrylate sheets weigh twice as low as glass and approximately 43% of aluminum sheets. In addition, flat poly methyl methacrylate sheets possess better insulation properties in compare to glass and respective overall heat transfer coefficient is 10% less than that of glass. Due to increasing energy prices and importance of energy usage optimization, flat poly methyl methacrylate sheets are considered as viable alternatives to glass materials.

Moreover, these sheets demonstrate better resistance toward stress or thermal shocks as a result of high temperature difference conditions.

It is worth noting cutting, perforation, shaping, painting and attachment are easily performed on flat poly methyl methacrylate sheets manufactured by **Vira Group**



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C1 technical information weight of flat surface sheets of polymethyl methacrylate

THICKNESS(MM)	2	3	4	5	6	8	10	12
AREA WEIGHT (KG/M2)	2/38	3/57	4/76	5/95	7/14	9/52	11/90	14/28

Characteristics	Unit	Typical values
Light Transmission	%	92
Specific Gravity	g/cm ³	1.19
Coefficient of Thermal Expansion	m/m C	8*10 E-5
Maximum Recommended Continuous Service temperature	C	71
Thermal Conductivity	W/m k	0.2
Tensile modulus	Mpa	3200
Stress at break	Mpa	76
Strain at break	%	5.5
Charpy impact strength	Ki/m ²	20
Elongation at break	%	4
Specific Heat	j/g.k	1.47
Glass transition temperature	C	112
Vic at Softening Temperature	C	103
Degradation temperature	C	>280
Moulding shrinkage	%	0.5 -0.8
Refractive Index	N D 20	1.49

C2 technical information of flat poly methyl methacrylate sheets.



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Applications:

These sheets have found numerous applications such as households, commercial, industrial, and professional fields including: light domes and roof lights, partitioning, windows, roof materials, skylights, unbreakable safety glass, offices, indoor lighting components, light controlling lenses, optical glasses, lamp covers, kiosks and machinery shielding, transparent pipes and containers, store stands, decoration and statute manufacturing, graphical illustration boards, vitrines, plastic ware, tanning kiosks made of glass, airplane glass manufacturing, and etc.

Dimensions:

Flat poly methyl methacrylate sheets are produced by **Vira Group** in 2 to 12 millimeters thickness. Standard length and width for these sheets are:

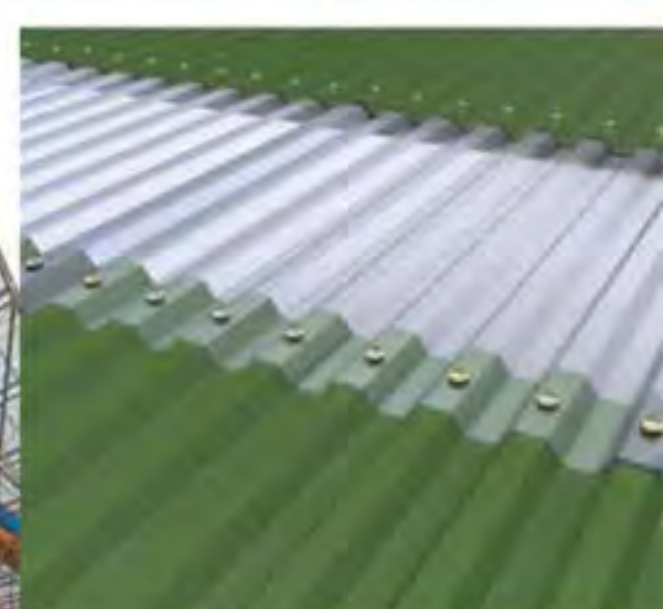
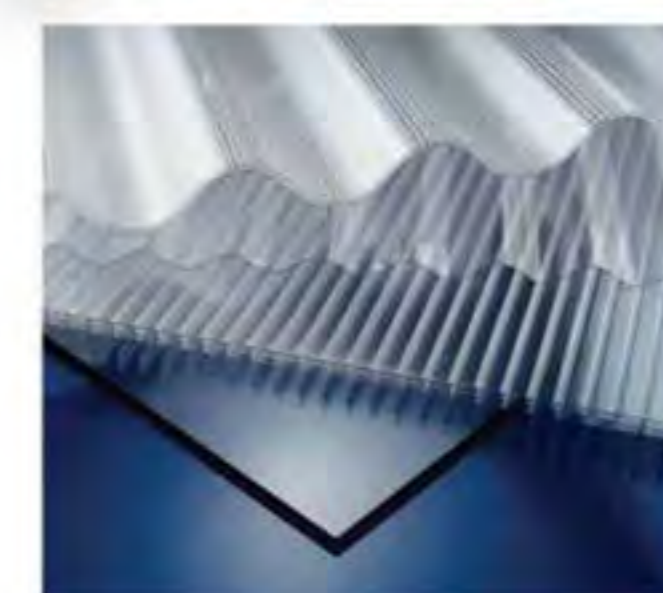
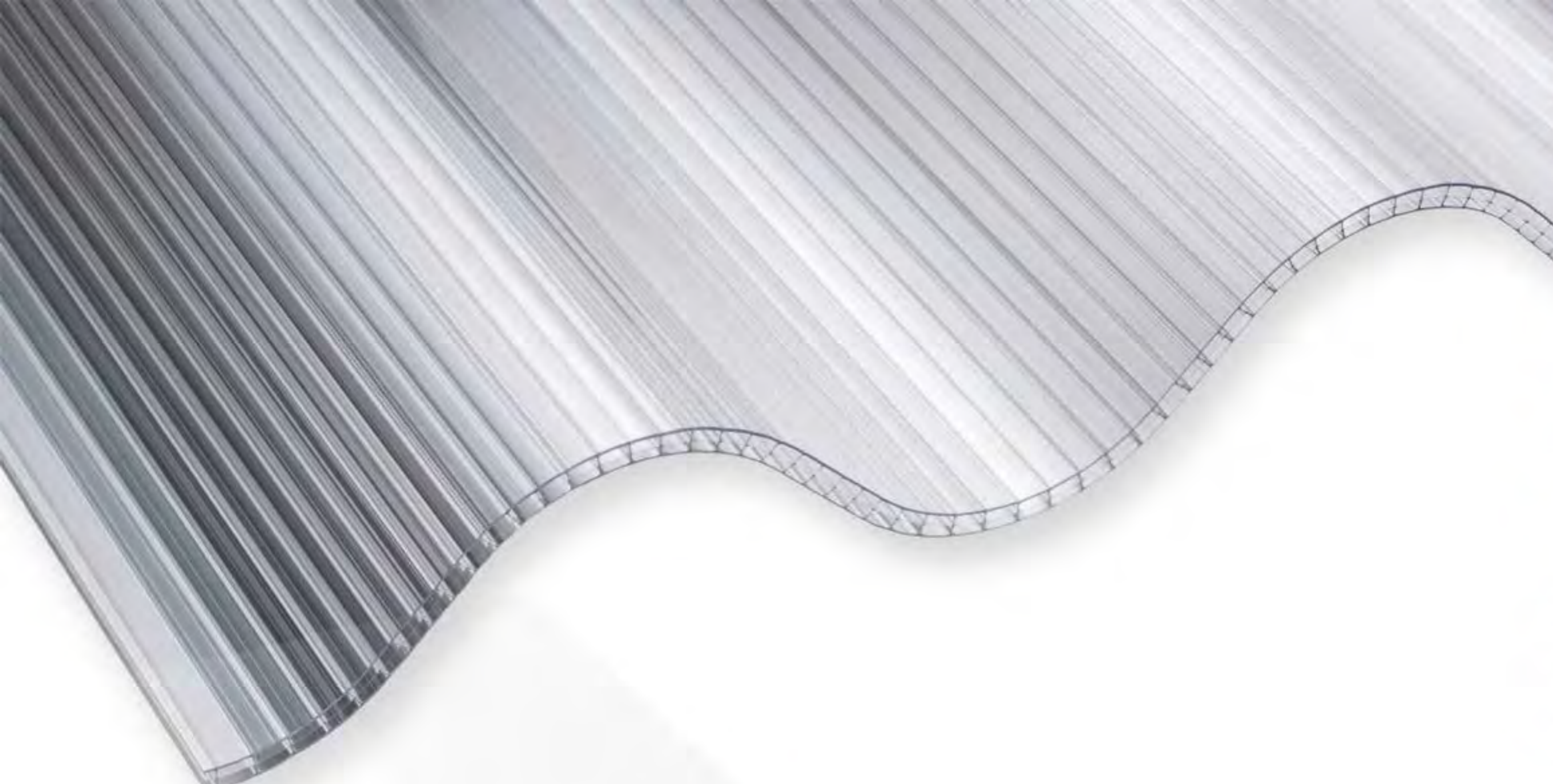
2050mm × 1250mm / 3050mm × 2050mm

Color variety:

These sheets are manufactured and distributed by **Vira Group** with a wide variety of standard colors. In addition, in the cases where different dimensions or colors are required, sheets are produced custom-made upon customer request.

Thickness(mm)		2	3	4	5	6	8	10	12
PMMA	U-Value(w/m ² .k)	5.52	5.36	5.20	5.06	4.92	4.66	4.43	4.23
	Area Weight(kg/m ²)	2.38	3.57	4.76	5.95	7.14	9.52	11.90	14.28
Glass	U-Value(w/m ² .k)	5.83	5.80	5.78	5.75	5.73	5.68	5.63	5.58
	Area weight(kg/m ²)	5	7.5	10	12	15	20	24.9	29.9

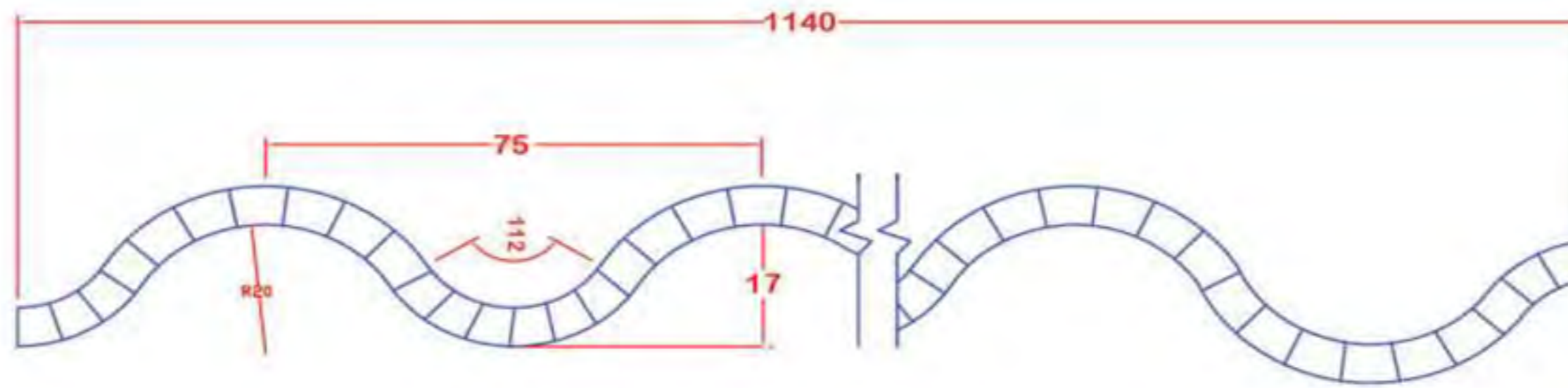
C3 C3 heat transfer comparison from poly methyl methacrylate and glass sheets according to ASTM 1363 standards.



Notable advantages of polywave (sinusoidal) and polyan (trapezoidal) sheets are Easy and cost effective installation in combination with galvanized sheets which leads to elimination of need for installation fittings such as H, convex fittings, cold waterproofing, aquarium safe glue and etc. and eventually reduced cost and effective waterproofing.



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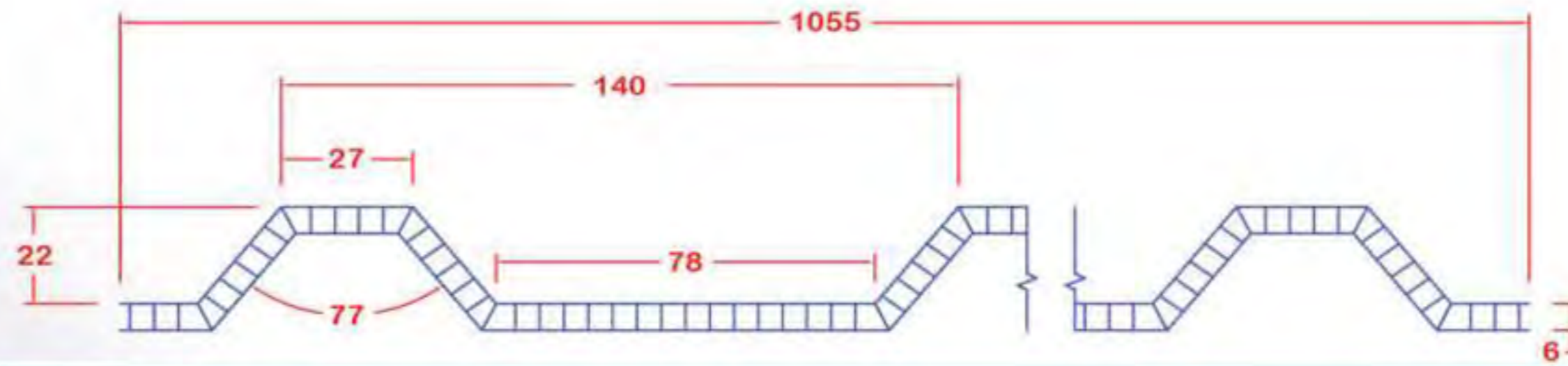


Technical specifications of double-layer sinusoidal sheets

Thickness (mm)	4-6		
Sheet width (mm)	1140±5		
Useful width (mm)	1040		
Sheet length (mm)	3 and 6, dimensions up to 12 meters		
Step height (mm)	17 (mm)		
Distance between steps	75 (mm)		
Light Passage	75 (mm)		
U-VALUE (W/M ² K)	Thickness	4 mm	4/1
		6 mm	3/5
UV	50 μ on one side of the sheet		
Variety of colors	Standard colors		
Impact resistance	200 times the glass		
Coefficient of linear expansion (mm/m°C)	0/065		
Ambient operating temperature	-40c°	+120 c°	



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Technical specifications of double-layer trapezoidal sheets (corrugated)

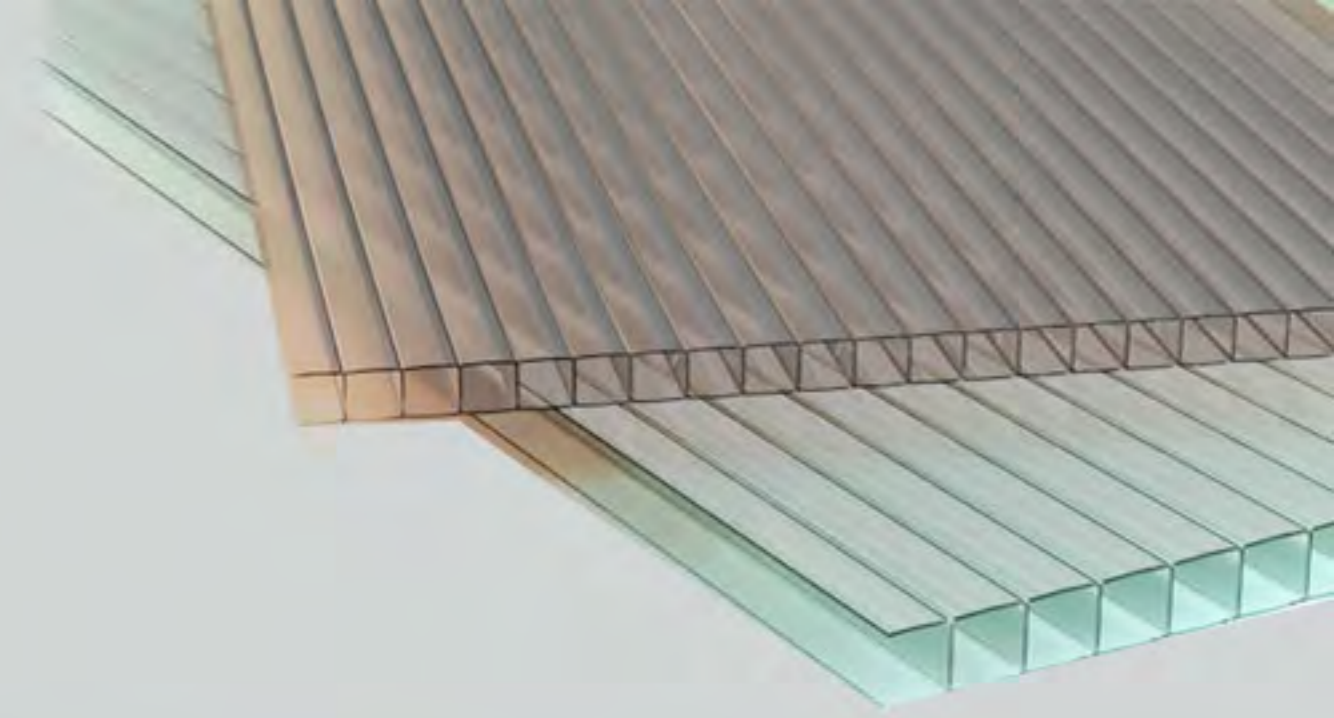
Thickness (mm)	4-6	
Sheet width (mm)	1055±5	
Useful width (mm)	955	
Sheet length (mm)	3 and 6, dimensions up to 12 meters	
Step height (mm)	22 (mm)	
Step width	27 (mm)	
Distance between steps	78 (mm)	
Light Passage	%85±3 transparent light, %70 lactescent	
U-VALUE (W/M ² K)	Thickness	4 mm 4/1
		6 mm 3/5
UV	50 μ on one side of the sheet	
Variety of colors	Standard colors	
Impact resistance	200 times the glass	
Coefficient of linear expansion (mm/m°C)	0/065	
Ambient operating temperature	-40c°	+120 c



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