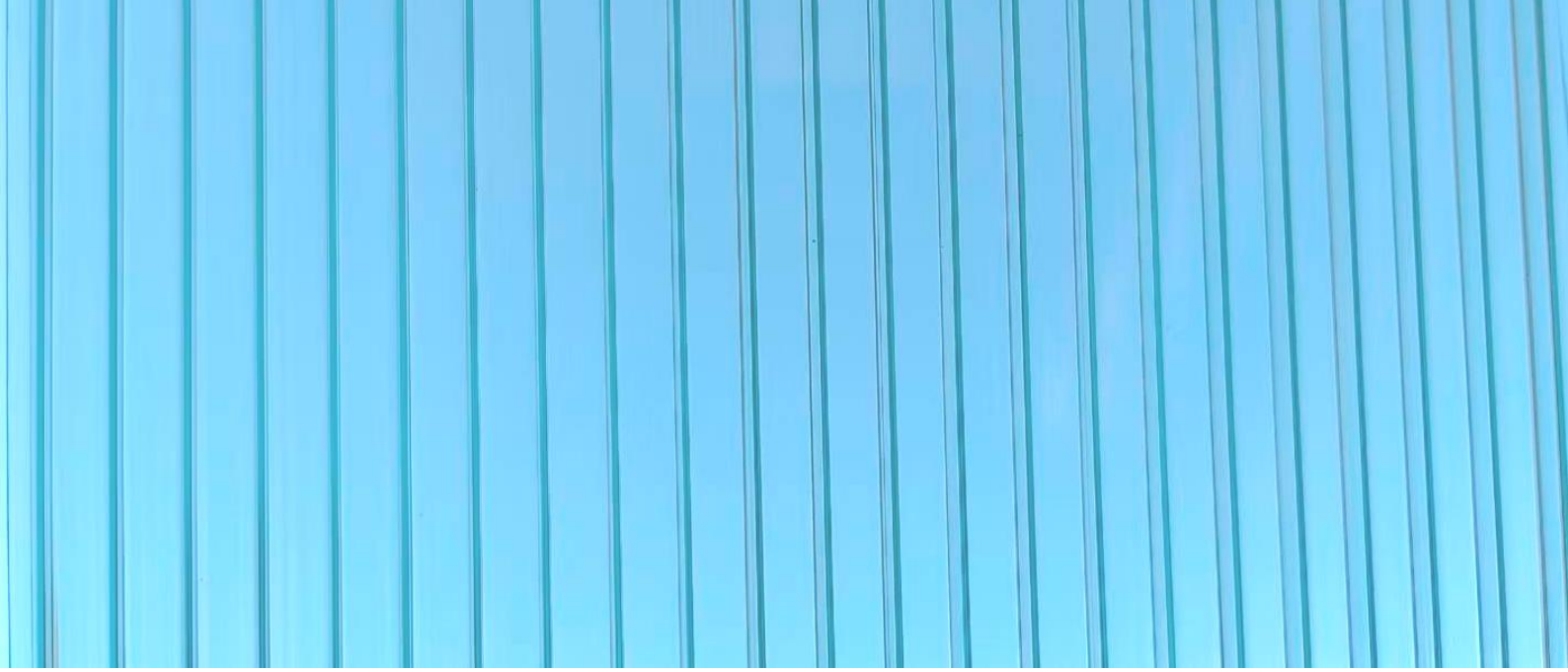


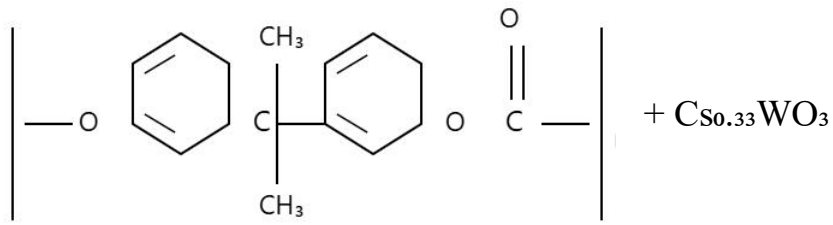

# AoCi® Heat insulation PC sheet



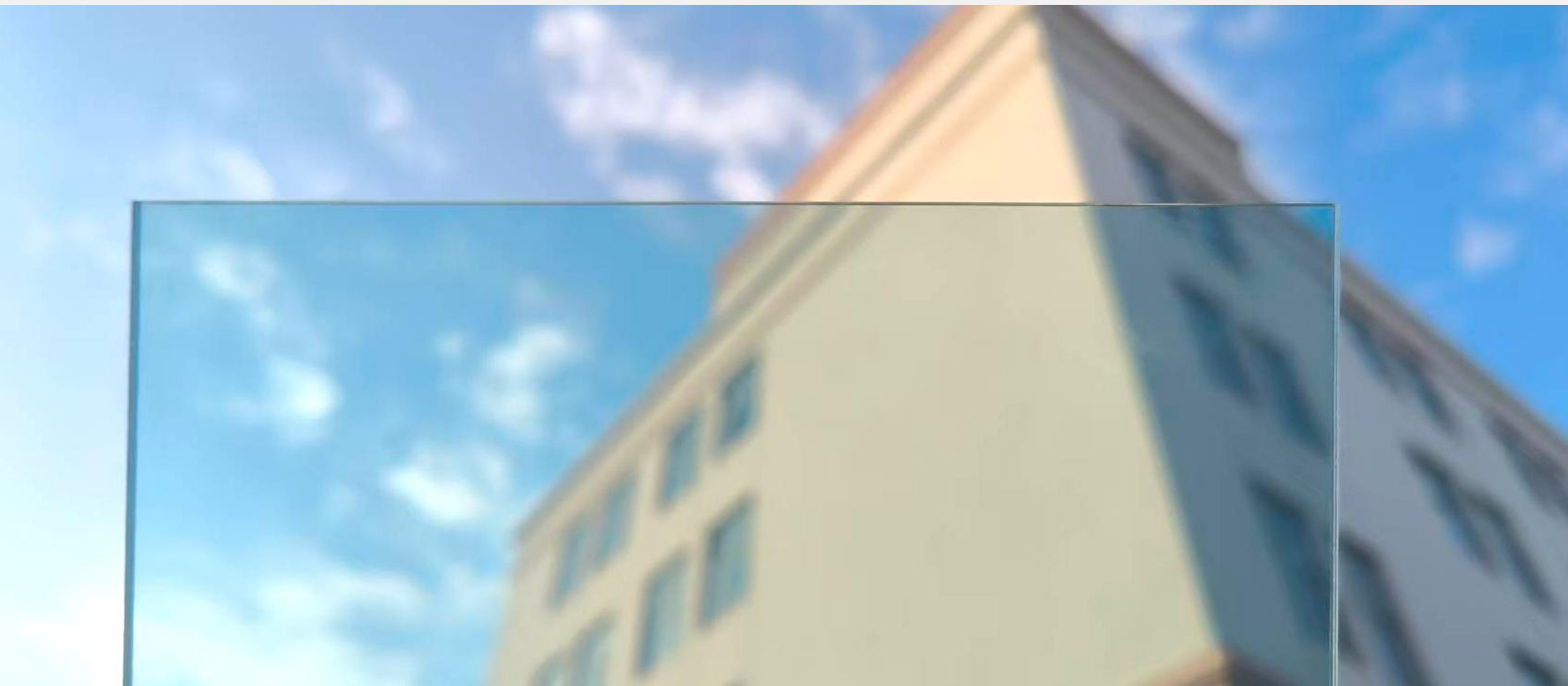
AoCi® Heat insulation PC sheet is a daylighting and thermal heat insulation sheet made from polycarbonate (PC) as the raw material and cesium-tungsten bronze as the inorganic nanocrystalline filler. It is available in two types: Hollow Sheets and Solid Sheets. The surface features a UV-resistant coating, providing light transmission, thermal heat insulation, impact resistance, lightweight properties, and weather resistance; it can also be cold-formed.

☑ Hollow Sheet: With a double-layer/multi-layer hollow structure, enclosed air cavity, and heat and sound insulation, it is an economical lighting and insulation material used for canopies, doors and windows, and skylights.

☑ Solid Sheet: Transparent and more impact-resistant, it is suitable for use in hail-prone areas, car ports, and protective skylights. Used for rain shelters, skylights, sunshades, and windows, it is a high-impact-resistant skylight and thermal insulation material.




$+ Cs_{0.33}WO_3$





## Cesium-tungsten bronze-modified polycarbonate thermal heat insulation Sheets

Matrix: BPA polycarbonate (PC)

$$\begin{array}{c} CH_3 \\ | \\ -[O-\text{benzene ring}-C-\text{benzene ring}-O-C(=O)]_n- \\ | \\ CH_3 \end{array}$$

Filler: $Cs_{0.33}WO_3$(nanocesium tungsten bronze)

Component expression:$[\text{-O-}C_6H_4\text{-}C(CH_3)_2\text{-}C_6H_4\text{-O-CO-}]_n + Cs_{0.33}WO_3$

Note: $Cs_{0.33}WO_3$ is an inorganic nanocrystalline filler that is merely physically dispersed within the PC matrix; no chemical reaction occurs between the two phases, and no new chemical bonds are formed.

Cesium tungsten bronze is currently a mainstream high-performance transparent thermal-insulating inorganic nanopowder. Its key characteristics are: high transmittance for visible light and strong absorption of near-infrared heat, providing a balance between light transmission and thermal heat insulation; it is commonly used to produce transparent thermal-insulating Sheets, films, and thermal-insulating coatings. CAS: 189619-69-0; molecular formula: $Cs_{0.33}WO_3$; appearance: blue-black powder with a hexagonal tungsten bronze crystal structure.

### ✅ Heat heat insulation Principle

Through localized surface plasmon resonance (LSPR) combined with small polariton transitions, it selectively absorbs near-infrared light from the sun (800–1400 nm, the primary wavelength band of Hollow heat), while allowing visible light (380–780 nm) to pass through as much as possible; compared with ATO (antimony-doped tin oxide) and lanthanum hexaboride, it exhibits stronger infrared blocking.

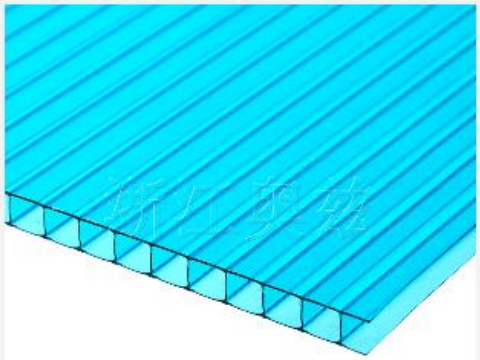
### ✅ Core Performance

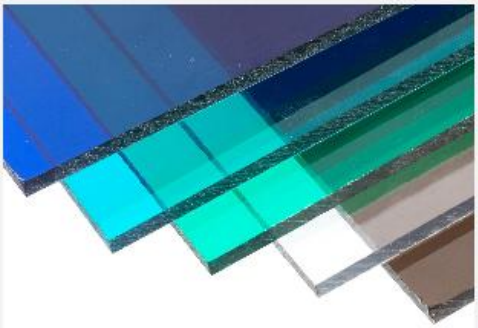
Translucent and heat-insulating: the light transmittance of Hollow Sheets is>50% (4 mm), while that of Solid Sheets is>60% (3 mm); they have low haze and are suitable for high-transparency applications.

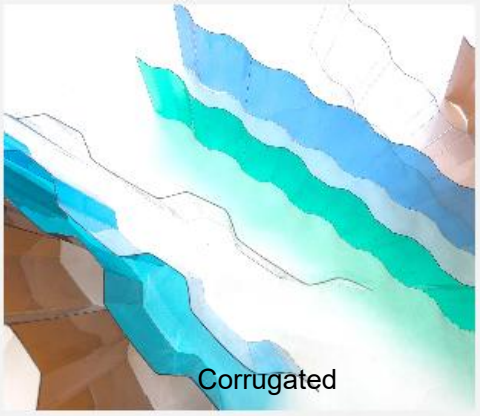
Stability: Inorganic powder; weather-resistant and UV-resistant; RoHS-compliant and free of antimony and indium; the disadvantage is that the raw powder is prone to performance degradation in acidic or alkaline environments and in high-humidity conditions.

Compared with ATO, CWO exhibits an earlier infrared absorption peak and offers a pronounced advantage in blocking thermal radiation in the 800–1200 nm range; ATO, by contrast, exhibits a longer-wavelength infrared absorption peak. The two are typically used in combination to provide broader infrared coverage.

## Scope of Application: Full range of PC Sheets, profiles, and corrugated tiles


Hollow Sheet


Solid Sheet


Corrugated


U-Lock sheet


Embossed sheet


Profiles

**Q: If this thermal heat insulation Hollow Sheet is used as a daylighting roof, and the outdoor temperature reaches 40 °C under direct sunlight, what will the indoor temperature be approximately?**

A: This Sheet provides approximately 69.2% thermal radiation shielding; it blocks only Hollow infrared thermal radiation and cannot completely prevent conductive heat transfer.

✅Good ventilation: indoor temperature approximately 34–37 °C

⚠Airtight and poorly ventilated, with intense western sunlight exposure: indoor temperature approximately 38–40 °C; for comparison, a standard Hollow-Sheet lighting roof under the same conditions can reach 48–53 °C indoors.

Note: This value is a reference estimate and is subject to factors such as orientation, ventilation, and the presence of shading; it does not guarantee precise constant temperature control.

**Q: How was this temperature determined? How was it calculated?**

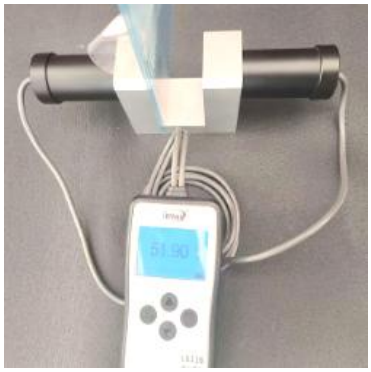
A: This temperature is an empirical estimate and cannot be calculated precisely directly from the thermal heat insulation rate. The 69.2% measured by the instrument represents the infrared radiation heat-blocking rate of the Hollow Sheet; it indicates only its ability to block radiant heat. Once the Sheet is heated, heat will still be transferred indoors through thermal conduction. By comparing this with actual field measurements of Hollow roof Sheets, we found that ordinary Hollow Sheets allow a large amount of radiant heat to enter, causing heat to accumulate and resulting in very high temperatures; heat insulation Hollow Sheets block most of the radiant heat, reducing heat accumulation indoors and resulting in a noticeable temperature drop.

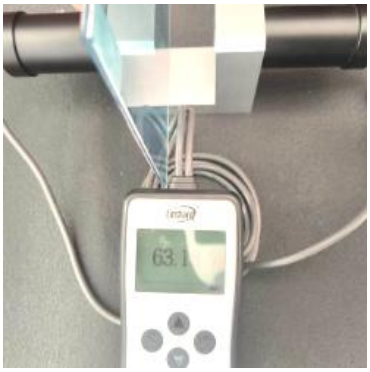
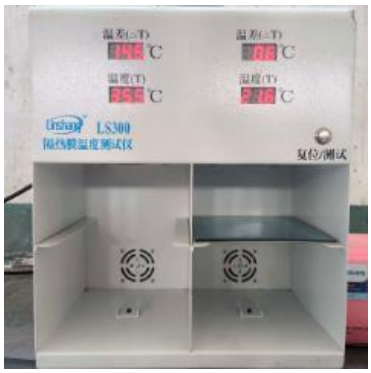
⚠ There is no simple temperature conversion formula; these values are for comparative reference only and should not be regarded as a precise guarantee.

**Q: Does the thickness of the Sheet affect its thermal heat insulation performance?**

A: This example uses a thin 4 mm double-layer heat insulation Hollow Sheet, based on lower-bound test data; given the same material, selecting a thicker Hollow Sheet will provide better thermal heat insulation.

# Sample Testing Record Sheet

| Project | 4 mm heat insulation Hollow Sheet | Standard 4 mm Hollow Sheet |
|---|---|---|
| Transmittance (LS116) | 51.9%  | 62.2%  |
| Heat insulation rate (Estimated for LS300) | ≈69.2%  | ≈22.5%  |

| Project | 3 mm heat insulation Solid Sheet | Standard 3 mm Solid sheet |
|---|---|---|
| Transmittance (LS116) | 63.2%  | 89.2%  |
| Heat insulation rate (Estimated for LS300) | ≈95.9%  | ≈24.3%  |

explain:

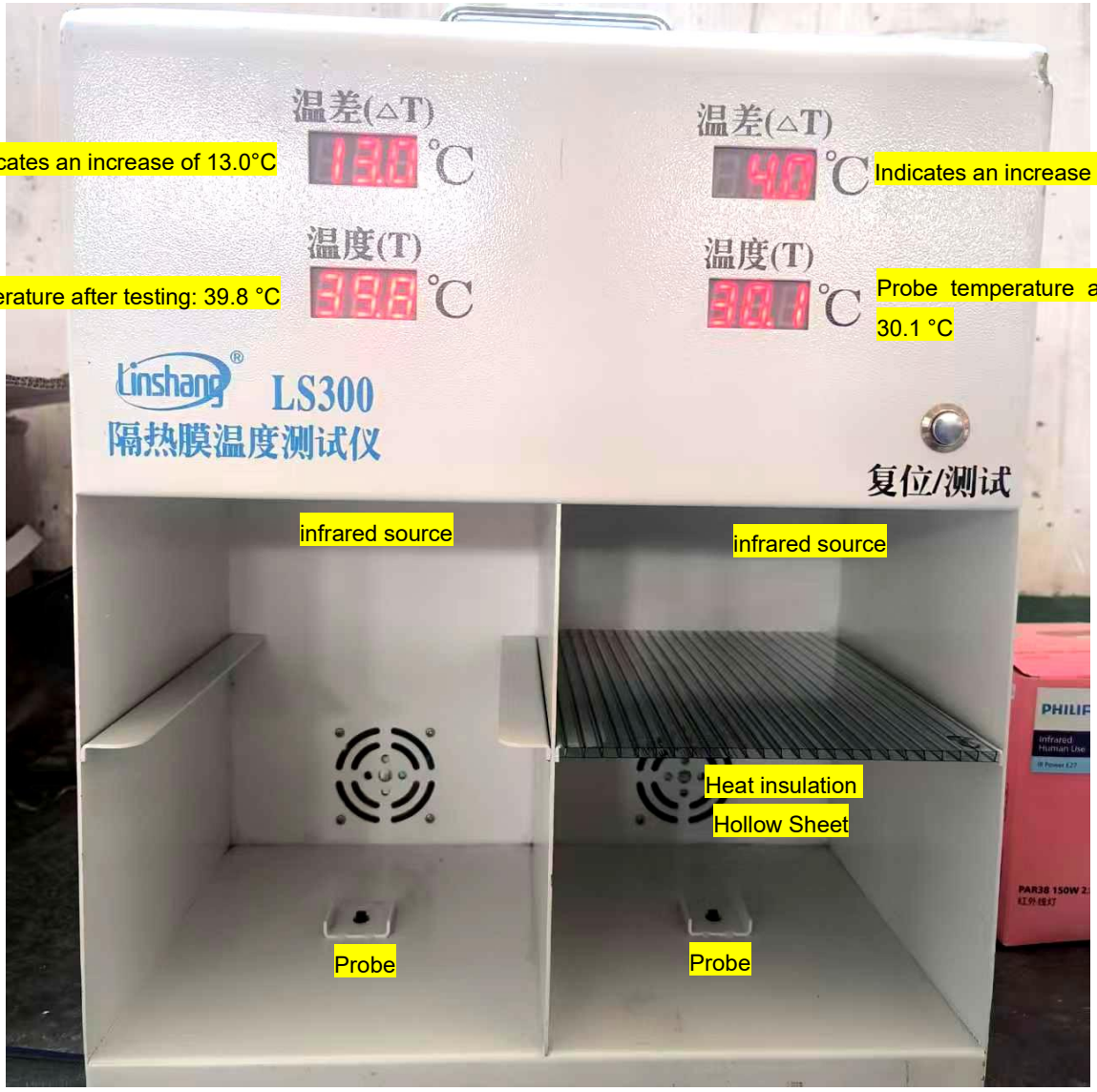
Thermal heat insulation rate: Comparative estimation of thermal resistance for the LS300 infrared light box

Transmittance was measured using the LS116 transmittance meter.

Calculation formula: Thermal barrier index ≈ (blank temperature difference $\Delta T_1$ − sample temperature difference $\Delta T_2$) ÷ $\Delta T_1$ × 100%

Test conditions: LS300 thermal film temperature tester, 150 W Philips infrared lamp

## Illustrative Explanation




### 👉 Left side (blank control group)

- Temperature difference ΔT: 13.0 °C → indicates that after 1 minute of infrared irradiation, the probe temperature increased by a total of 13.0 °C
- Temperature T: 39.8 °C → After the test was completed, the probe's final temperature was 39.8 °C

Meaning: In the absence of Sheet shielding, infrared heat can pass directly through; consequently, the probe experiences a greater temperature rise and more heat penetrates.

### 👉 Right side (Sample group: thermal heat insulation Hollow Sheet)

- Temperature difference ΔT: 4.0 °C → indicates that after the same 1-minute infrared irradiation, the probe rises by only 4.0 °C
- Temperature T: 30.1 °C → After the test was completed, the probe's final temperature was 30.1 °C

Meaning: The thermal heat insulation Hollow Sheet blocks most of the infrared heat; consequently, very little heat is transmitted to the inner sensor, resulting in minimal temperature rise. The smaller the temperature difference ΔT, the better the Sheet's thermal heat insulation performance.

## INSTALLATION GUIDE

**1、STORAGE:** Sheets should be stored in a cool and dry place. Exposure to the sun (the protective film will be difficult to remove), rain, and direct stacking on the concrete floor are strictly prohibited.

**2、SEALANT:** Use neutral silicone sealant,and it is strictly forbidden to replace it with acid-alkaline glass glue. If damage occurs in this situation,warranty is void.

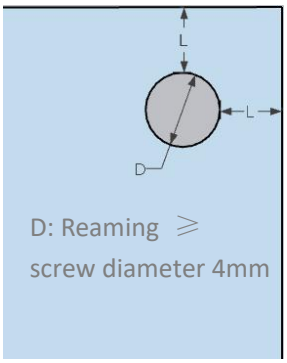
**3、SCREW FIXATION:** When installing the sheets with screws, special waterproof gaskets must be used, and self-tapping screws cannot be directly driven into the sheet surface. Each screw hole position on the sheet needs to be pre-drilled, and the diameter of the drilled hole should be 4mm larger than the screw diameter to allow for thermal expansion, providing enough space to allow for seasonal temperature fluctuation.



The curved project cannot be fixed with screws on the board surface



Waterproof




**4、USE ENVIRONMENT:**

The sheet is afraid of acid and alkali, and can not directly touch the concrete brick wall, and can not be used in acid or alkali materials and gas environments.

**5、Protective film:**

The function of the protective film is to prevent scratching the board surface during transportation and installation, and it should be immediately removed after construction.

**6、slicing：**

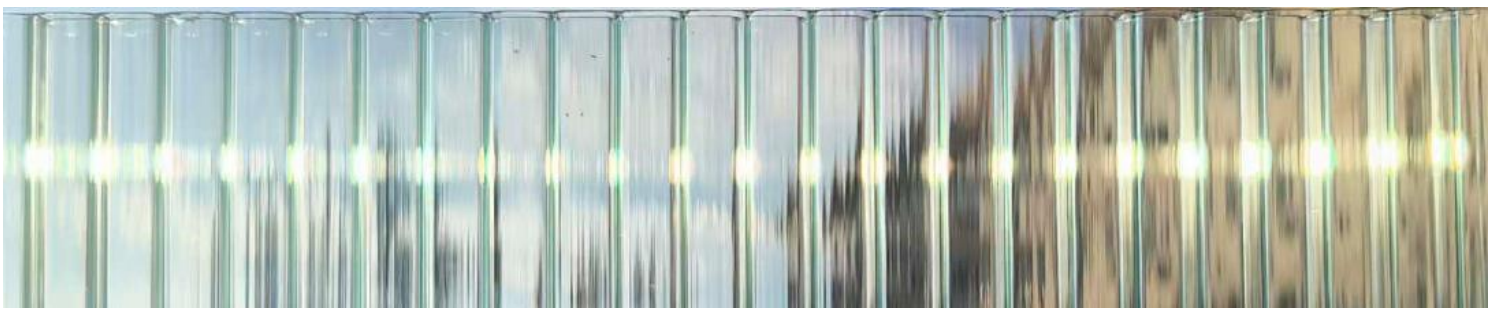
The sheets can be cut with acircular saw, a jig saw or acardboard cutter. Use a vacuumcleaner to remove particlesformed as a result of the cut.

**7、clean：**

Generally speaking, rainwater is sufficient, and diluted household cleaning agents can be used to clean local narrow areas.
Ensure that the cleaning agent does not contain corrosive agents or organic solvents.
Avoid dry cleaning, as adhering dust particles may scratch the surface of the plate.
Large areas can be flushed with a low-pressure water gun.

*If the construction is not carried out as required,there will be no warranty.

Download installation technical documents:https://www.zjaoci.com/jszc







E-Mail:polycarbonatesheet@qq.com