

PALSUN

ARCHITECTURAL GRADE

PRODUCT DESCRIPTION

Being the modern substitute for glass Palsun polycarbonate sheets combine a variety of features, enabling a wide range of uses.

Palsun polycarbonate sheets are for designers and constructors, the answer to virtually all of their glazing needs. Polycarbonate is one of the most advanced polymers in the field of plastics today. It offers an unequalled combination of properties which includes strength, transparency, light weight, flexibility, durability and many more. Palsun polycarbonate sheets are as transparent as glass, 200 times stronger and half its weight. In addition to all of these features, it can be bent both while hot and cold.

Palsun polycarbonate sheets are ideal for use in areas exposed to high impact and vandalism.

Palsun polycarbonate sheets constitute a genuine breakthrough in design concepts and construction methods.

PRODUCT APPLICATIONS

- * Safety glazing
- * Roofing for buildings and halls
- * Glazing of windows
- * Construction of small structure such as telephone booths, bus stops, etc
- * Roofing of stadiums
- * Attic windows

PRODUCT SPECIFICATIONS

SHEET DIMENSIONS:	2440 x 1830 mm (other sizes available on request) 2440 x 1220 mm 2400 x 1250 mm 3000 x 1250 mm 3600 x 1250 mm 6000 x 1250 mm
THICKNESS:	1-10mm
WEIGHT:	1.2 kg/m ²
COLOURS:	Clear, Grey, Bronze, Opal and New Solar Control

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PERFORMANCE CHARACTERISTICS (GENERAL)

MECHANICAL PROPERTIES

Modulus of Elasticity:	24,000 kg/cm ²
Flexural Strength:	890 kg/cm ²
Tensile Strength:	670 kg/cm ²
Yield Strength:	420 kg/cm ²
Elongation:	>80%

THERMAL PROPERTIES

Coefficient of Thermal Expansion:	6.75 x 10 to the power of -5 cm/cm°C	
Long-Term Service Temperature:	-30°C to +120°C	
Thermal Conductivity:	4.6 x 10 to the power of -4 cm/cm°C	
'U' Value:	3.0 & 4.5 mm	5.9 w/m ² K
	6.0 mm	5.8 w/m ² K

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UV PROPERTIES

		Erythemat UV (UVB)	Near UV (UVA)
Clear	4.5mm	< 0.1%	1.8%
	6.0mm	< 0.1%	0.4%
Solar Grey	4.5mm	< 0.1%	0.3%
	6.0mm	< 0.1%	0.2%

SOLAR PROPERTIES

		Shading Coefficient
Clear	1.2mm	.99
	3.0mm	.97
	4.5mm	.94
	6.0mm	.92
	10.0mm	.86
Solar Grey	3.0mm	.88
	4.5mm	.84
	6.0mm	.79
Solar Control	3.0mm	.38 - .49
	4.5mm	.38 - .49
	6.0mm	.59 - .48

LUMINOUS PROPERTIES

		Transmittance
Clear	1.2mm	.89
	3.0mm	.87
	4.5mm	.86
	6.0mm	.84
	10.0mm	.81
Solar Grey	3.0mm	.61
	4.5mm	.51
	6.0mm	.42
Solar Control	3.0mm	.20 - .35
	4.5mm	.20 - .35
	6.0mm	.20 - .35

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EARLY FIRE HAZARD TEST AS1530-3 1989

(AMDT NO.1 APR '92)

TESTING AUTHORITY: AWTA TEXTILE TESTING
TEST NUMBER: 7-45444-CV
DATE: 21 February 1995

SAMPLE DESCRIPTION: Palsun - Tinted polycarbonate sheets
Architectural grade

MATERIAL SPECIFICATION: Nom Composition: Polycarbonate
Nom Thickness: 6.0mm
Nom Mass: 1.2 kg/m²

RESULTS

MEAN

STANDARD ERROR

IGNITION TIME	NIL min	NIL
FLAME PROPAGATION TIME	NI s	NIL
HEAT RELEASE INTEGRAL	NIL kJ/m ²	NIL
SMOKE RELEASE, LOG D	-1.3341	0.0406
OPTICAL DENSITY, D	0.0473 m	

NUMBER OF SPECIMENS IGNITED:	0
NUMBER OF SPECIMENS TESTED:	6

REGULATORY INDICES:

IGNITABILITY INDEX	0	RANGE 0-20
SPREAD OF FLAME INDEX	0	RANGE 0-10
HEAT EVOLVED INDEX	0	RANGE 0-10
SMOKE DEVELOPED INDEX	3	RANGE 0-10

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DIFFUSE, ULTRAVIOLET & VISIBLE TRANSMISSION TESTS

TESTING AUTHORITY: UNISEARCH LIMITED
School of Opportunity
University of New South Wales

DATE: 8 February, 1991

METHOD 1

The luminous transmittance, erythema and near ultraviolet transmittance for the uniformly transparent single lay (non Opaque) samples was determined using a Pye Unicam PU8800 03 spectrophotometer with double monochromator, double beam and end on photomultiplier. A wavelength accuracy of within 0.3 nm was verified using a Mercury and Neon discharge lamps.

Stray light PU 8800 03 < 0.0005% at 220nm (NaI) Deuterium ar.
Stray light PU 8800 03 < 0.0001% at 340 nm (NaNO₂) Tungsten filament
Bandwidth for each measurement was 2 nm.

METHOD 2

The diffuse transmittance, erythema and near ultraviolet transmittance of the semi-opaque (diffusely transmitting) samples was determined using an Hitachi U-3410 double beam, double monochromator with a photomultiplier detector in the ultraviolet/visible and a lead sulphide detector in the infra-red. To determine diffuse transmittance an Hitachi 151-0030 60mm diameter integrating sphere fitted. A wavelength accuracy of within 0.3nm was verified using a Mercury and Neon discharge lamps.

Considerable variation in transmittance of diffusely transmitting samples is possible with differences in orientation and the distance of the diffusely transmitting components relative to the integrating sphere entrance port.

Bandwidth for each measurement was 2 nm.

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FORMING

Forming Paltough sheet should always be done when the formed zone is at a temperature above the "Gas Transition Temperature" (T.G.) which is approximately 150°C. Any failure to do so will result in high internal stresses that might greatly decrease impact resistance and increase chemical sensitivity. Unlike other plastics, these internal stresses cannot be seen by the naked eye and can only be detected with the use of a light polariser. Annealing can solve this problem in certain cases, however, the problems encountered in annealing make it complicated and inefficient.

THERMOFORMING

When thermoforming is done, it is always recommended to pre-dry the sheet. A pre-dried sheet can be safely heated up 180 - 190°C. At this temperature, the sheet will lend itself to deep-drawing and tight curve forming.

PRE-DRYING CONDITIONS

Paltough and Palsun sheets should be pre-dried at 120°C. The duration of pre-drying is dependent upon the amount of humidity absorbed by the sheet and by its thickness. Therefore, the best method to determine the pre-drying time is as follows:

- Cut 2-3 small pieces from a sheet in the sample batch.
- Place these pieces in an oven at the pre-drying temperature (110-120°C)
- At pre-determined intervals of 2-3 hours, take out a piece and heat it to the forming temperature (170 - 180°C).
- Check for the appearance of bubbles in the piece. If no bubbles appear after 10 minutes, the sheet is dry. If bubbles do appear, additional pre-drying is necessary.
- After determining the pre-drying time, proceed to pre-dry the production items.

THERMOFORMING WITH P.E. MASKING

This is sometimes desirable and possible, since Paltough sheets are masked by a P.E. foil that is designed to tolerate thermoforming. However, if lengthy pre-drying is necessary, the P.E. may leave marks on the surface which might be unacceptable in circumstances where high optical quality is required. In these cases, it is necessary to remove the masking foil before pre-drying.

1. **Vacuum Forming** is simple to accomplish with a pre-dried sheet on any good vacuum machine. It is preferable to use automatic machines that grip the sheet from all sides during the entire process. This is especially important when working with thin sheets of 1-2.0 mm. Such sheets might exhibit shrinkage of up to 5% and must be attached firmly to a frame.

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THERMOFORMING WITH P.E. MASKING

Vacuum forming without pre-drying should be done very carefully. Sheet temperature should not exceed 160°C. Uneven heating, resulting in local heating above 160 - 165°C will cause bubbles to appear in the overheated area.

2. **Pressure Forming** is a process like vacuum forming. Free blowing of domes or caps is easily done. This method is also possible without pre-drying, since the draw ratio is not high and the shape is very simple (spherical or near-spherical).
3. **Drape Forming** can be done without pre-drying, but the P.E. masking foil must be removed because it requires long heating times at high temperatures. If the sheet is not pre-dried, only accurately controlled air circulation ovens should be used in order to prevent local overheating. It is necessary to examine the sheet and its shrinkage, since, in this method, the sheet is not attached to a frame that prevents shrinkage.
4. **Hot Line Bending** can be done without pre-drying, but this also requires accurate control of the temperature. Initial, overheating will be detected at the edges of the bending line where the sheets heat more rapidly. Extreme care should be taken not to force the bend at a temperature below 155°C. Failure to do so will induce internal stress that will cause the sheet to lose most of its impact resistance. It is highly recommended to experiment with small pieces, checking them for impact resistance by hitting the bend line with a heavy hammer while the piece is lying on the floor or work table, with the bend line up. Breakage of the piece indicates that the bending temperature was too low.
5. **Cold Forming** can be performed based on a minimum curve diameter of 200 x thickness for Palsun.

PALSUN

10 YEAR WARRANTY

1. SCOPE OF WARRANTY

It is hereby warranted by Paltough Ltd (hereinafter the "Manufacturer"), subject to any other terms contained herein that for a period of 10 years from the commencement date as defined below, PALSUN or PALSUN PLUS POLYCARBONATE FLAT SOLID SHEETS, (hereinafter the "Product"), shall not lose more than 8% of its light transmission as a direct and exclusive result of the impact of solar radiation (as measured pursuant to the procedures specified in ASTM D-1003-77).

(Loss of above light transmission in excess of 8% shall be hereinafter referred to as a "Decrease").

2. COMMENCEMENT DATE

The commencement date shall be the date of the Product's manufacturer or - if such does not appear on the Product - the date upon which the Product was purchased from the Manufacturer.

3. LIMITATIONS

This warranty shall be valid only:

- a. if the Product is installed and maintained in accordance with the Manufacturer's written instructions, and is not used in any non-customary fashion: and
- b. if the Product is not adversely effected by connecting, fastening or sealing, and
- c. where Decrease is not due or accelerated by the product alteration or damage directly or indirectly caused by fire, vandalism, structural defects at the site of installation, negligence (including, but not limited to, storage or installation with non-UV protected side exposed) and negligence (including, but not limited to negligently transporting and/or installing the Product), chemicals. Further, this Warranty shall not apply to a Decrease caused by the accumulation of dirt, lack of proper maintenance, scratches, chemicals, paint, glue or any other similar or incompatible factors and elements.

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10 YEAR WARRANTY (CONT.)

4. NOTIFICATION

A warranty claim will be honoured:

- a. if Manufacturer is notified of such claim within 30 days of Decrease and provided with written proof or purchase and this Warranty: and
- b. if the claimant allows inspection by the Manufacturer at the installation site, if so requested.

5. JURISDICTION

This Warranty is governed by and shall be construed according to the laws of the Australia. Any claim or dispute relating to the Product and/or this Warranty shall be exclusively brought before the appropriate court in Sydney, Australia, which shall have the exclusive jurisdiction in any such claim or dispute.

6. COMPENSATION

- a. In the event the Manufacturer is duly notified of Decrease within 5 (five) years of the commencement date, and a claim upon such Decrease is properly made and approved, Manufacturer will provide free substitute Product or, at its sole option, refund the original purchase price.
- b. In the event the Manufacturer is duly notified of Decrease after more than 5 (five) years from the commencement date, and claim upon such Decrease is properly made and approved, prior to the expiration of 10 years from the commencement date, the Manufacturer will provide substitute Product at reduced price. The reduced price to be paid by the purchaser will be calculated by multiplying $1/120^{\text{th}}$ of the then effective Manufacturer's price of the Product, by the number of months which have passed from the commencement date until the date of the claim.

The Manufacturer, at its sole option may, instead of replacement sheets, refund the purchaser by an amount equal to $1/120^{\text{th}}$ of the original purchase price multiplied by the number of months which remain between the date of the claim and the end of 120 months of the warranty period.

PALSUN

10 YEAR WARRANTY (CONT.)

THE REMEDIES SET FORTH IN THIS WARRANTY CONSTITUTE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE TO PURCHASER AND SAVE AS SET FORTH HEREIN, MANUFACTURER SHALL BE UNDER NO LIABILITY WITH RESPECT TO THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY COSTS AND/OR EXPENSE EXCEEDING ITS LIMITED OBLIGATIONS SET FORTH HEREIN.

THE WARRANTIES SET FORTH HEREIN ARE EXPRESSLY IN LIEU OF OTHER WARRANTIES, EXPRESS OR IMPLIED WHETHER STATUTORY OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL THE MANUFACTURER BE RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.