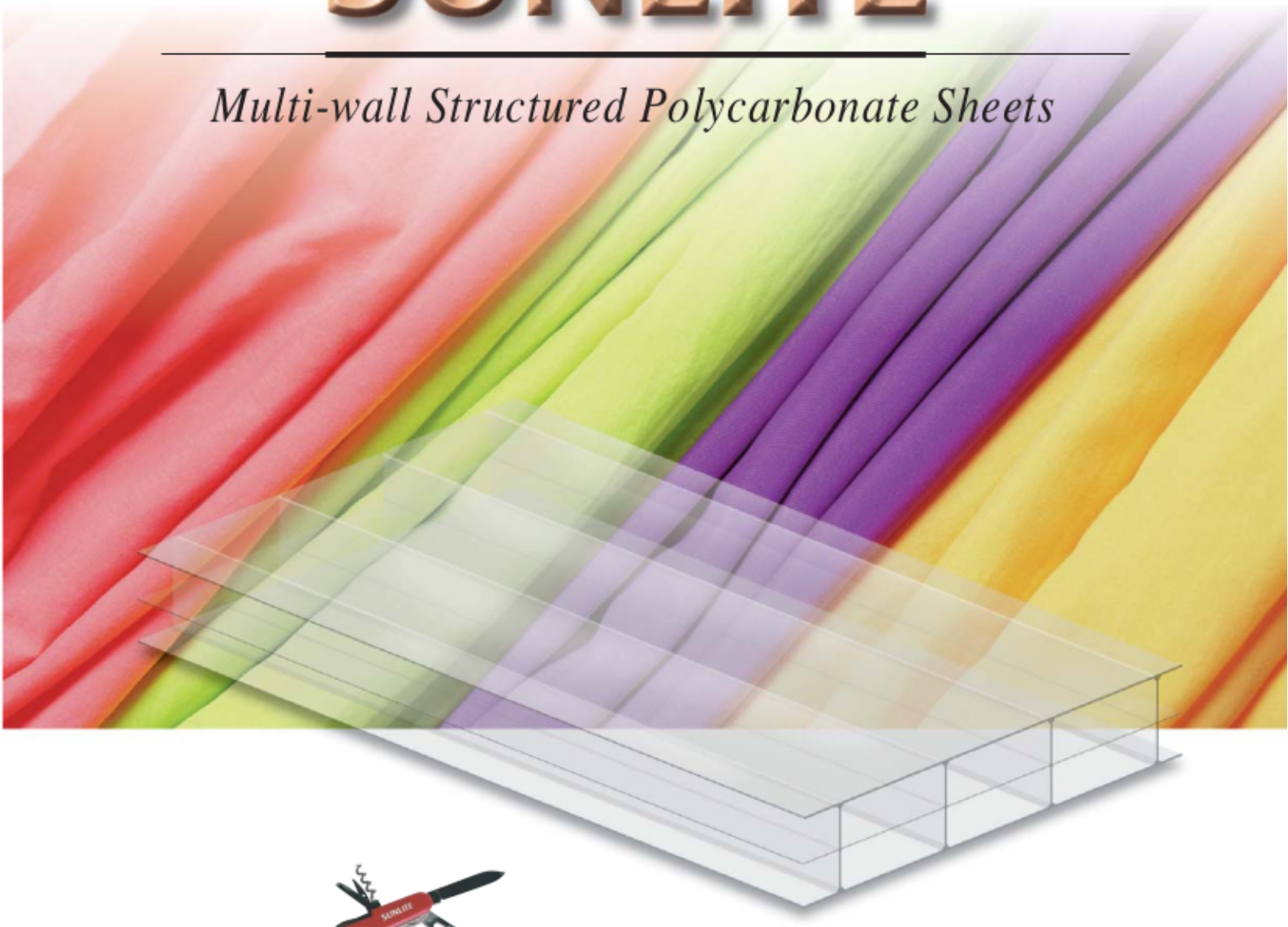
Uniclass	EPIC
L522:P*	E321:X*
CI/SfB	
(47) Rn6	

BBA BRITISH BOARD OF AGRÉMENT
CERTIFICATE No 01/3837

SUNLITE®

Multi-wall Structured Polycarbonate Sheets



The multi-wall that has it all

PALRAM

Additional Products Manufactured by Palram Industries

PALSUN®

Flat rigid polycarbonate sheets with the following options: standard, one or two side co-extruded UV protection, mirror, solar control, FR, embossed (E102, prismatic, hair cell), abrasion and scratch resistant, new PALSUN Foam flat foamed polycarbonate sheet.

SUNTUF®

Corrugated rigid polycarbonate sheets with the following options: co-extruded UV protection on one or two sides, anti-condensation treatment, embossed, solar control, standard or tailor-made profiles.

SUNTOP®

Corrugated foam polycarbonate sheets in rounded profiles with co-extruded UV protection on one side.

COMPAX™

Flat rigid matte opaque modified polycarbonate sheets for thermoforming without pre-drying.

PAL-G®

Flat rigid standard or UV protected (one side) co-polyester sheets.

PALGLAS®

Flat rigid extruded solid acrylic sheet.

PALRUF®

Corrugated rigid PVC sheets with the following options: clear, translucent or opaque, with or without additional UV protection, HI (High Impact), standard or tailor-made profiles.

PALCLEAR®

Flat rigid clear PVC sheets with the following options: standard, HI (High Impact), UV protection on one side, UV protection on one side for thermoforming, embossed (prismatic 12).

PALOPAQUE®

Flat rigid opaque PVC sheets with the following options: glossy, matte, UV protection, UV protection for thermoforming.

PALDOOR®

Flat rigid matte or wood grain PVC sheets for thermoforming door panels.

PALIGHT®

Flat foamed PVC sheets with the following options: matte, glossy (one side or two), UV protected.

Company Profile

Palram Industries, founded over 40 years ago, is a leading multinational manufacturer of extruded thermoplastic sheets from polycarbonate, PVC and other materials. Palram thermoplastic sheets are designed to suit a diverse range of applications in the advertising, agricultural, construction, DIY, glazing, and thermoforming markets. Worldwide sales totaled $ 140 million in 2003.

Palram - a Global Company

Palram operates production sites, warehouses and sales offices arround the globe.

Production Sites:

Israel	- polycarbonate and PVC sheets
UK	- polycarbonate in Doncaster and PVC in Durham
USA	- polycarbonate in Allentown, PA
China	- polycarbonate in Shanghai

Warehouses: Israel, France, UK, USA (5)

Marketing Offices: Israel, USA, France, Germany, Italy and Scandinavia Singapore, Japan and Australia

Quality Assurance

- Maintaining Palram's dedication to the highest internationally recognized quality standards
- All Palram plants have achieved ISO 9001: 2000 Quality Assurance accredidation

Research and Development

- Creating unique, high performance products
- Maintaining Palram's leadership in adapting, changing and modifying existing products to meet thedemands of an ever growing and evolving market

Main Features and Applications

SUNLITE is a multi-wall structured polycarbonate sheet, UV protected (co-extrusion) on one side which combines the following outstanding features:

- High impact resistance
- 10 Year limited warranty
- Remarkable insulation
- Excellent structural properties
- Excellent light transmission (up to 82%)
- Solar Control option
- Wide service temperature range (-40 °C to +120 °C)
- Good fire resistance with no emission of toxic gases
- High architectural versatility

Main Applications

- Conservatories
- Civil engineering and industrial skylights
- Greenhouses
- D.I.Y. (verandas, carports, patios, etc.)
- Swimming pool covers
- Covered walkways
- Illuminated signs
- False ceilings, partitions, cladding

Standard SUNLITE Products

Structures		Sheet Weights kg/m²	[c]Thickness mm	[a,b]Standard Sheet Width in mm						
				[b]980	[b]1050	1220	1250	1800	1830	2100
Twin Wall		0.8	4	x	x	[c]x	[c]x		[c]x	x
		1.0	4.5	x	x				[c]x	x
		1.3	6	x	x	[c]x	[c]x		[c]x	x
		1.5	8	x	x	[c]x	[c]x		[c]x	x
		1.7	10	x	x	[c]x	[c]x		[c]x	x
Triple Wall		1.7	[c]8						[c]x	[c]x
		2.0	[c]10						[c]x	[c]x
		2.7	16	x	x	[c]x	[c]x	x		x
Structured		3.5	25	x	x	x	x	x		x
		3.8	32	x	x	x	x	x		x
		4.0	35	x	x	x	x	x		x

Standard Colors: Clear, Bronze, Opal, Solar Gray, Sky Blue[b] (transparent), Sea Green[b] (transparent)

Specialty Products: Solar Control, available in Solar Metallic Gray and Solar Ice; SUNLITE UV2 (UV protection on two sides); SUNLITE Plus (With anti-condensation treatment on one side)

[c]Designates that product is manufactured at Suntuf 2000 in the USA.

[b]Non-standard products (lengths, widths and colors) are available subject to a minimum order quantity.

Properties

Physical Properties of SUNLITE

Service Temperature Range	-40 to +120 °C
H.D.T.	135 °C
Thermal Expansion (Delta T @ 40°C)	2.5 mm/m for Clear & Opal 3.5 mm/m for Bronze
Refractive Index	1.59

Flammability

SUNLITE sheets are self-extinguishing and comply with the most demanding of international fire resistance standards defined in the field of plastics, as indicated by representative results in the table below.

Method	Classification[a]
BS 476/7	Class 1
DIN 4102	B-1
NSP 92501	M-1, M-2
ASTM D-635	CC-1 (SUNLITE SL)
ASTM E-84	Class A

[a] For additional information please consult your SUNLITE distributor.

		% Light Transmission						
Thickness mm	Structure	Clear	Bronze	Solar Grey	White Opal	Opal (WD)	Solar Metallic	Solar Ice
4	Twin Wall	82%	35%	35%	30%		-	-
4.5	Twin Wall	82%	35%	35%	30%		-	-
6	Twin Wall	80%	35%	35%	20%		-	-
8	Twin Wall	80%	35%	35%	35%		-	20%
10	Twin Wall	79%	35%	35%	30%		25%	20%
8	Triple Wall	76%	35%	35%	45%		25%	20%
10	Triple Wall	76%	35%	35%	45%		25%	20%
16	Triple Wall	76%	35%	35%		48%	25%	20%
25	Structured	55%	20%	20%		20%	25%	20%
32	Structured	50%	20%	20%		20%	25%	20%
35	Structured	50%	20%	20%		20%	25%	20%

Properties

Thermal Insulation Properties

The excellent thermal insulation of SUNLITE results from the air cells inside the hollow structure of the sheet. It has a much higher insulating ability than single walled, corrugated or solid flat sheets. It offers lower heat loss (or gain), and therefore - higher energy efficiency. This saves fuel, electricity and money by reducing the need for heating or air-conditioning, a top priority for homes, businesses, or public buildings, making SUNLITE an environmentally friendly choice.

The K-value (or U-value) is a number, which measures the quality of thermal insulation. Lower values for a material mean superior thermal insulation. Typical values for SUNLITE sheet appear in the table below.

Typical K-values (U-values) for SUNLITE Sheet

SUNLITE Profile	Thickness mm	K-value (W/m² K)
Twin wall	4	3.8
	4.5	3.7
	6	3.5
	8	3.3
	10	3.0
Triple wall	8	2.9
	10	2.7
	16	2.3
Structured	25	1.5
	32	1.3
	35	1.25

Cold or Hot "Radiation"

During cold weather, in a relatively warm interior, when standing near the window, or a glazed exterior wall, one can feel the cold "radiated" inside from the glazed area. The windows (or glazed areas) are the least insulating elements of the structure's exterior envelope. The cold radiated inside reduces the ambient temperature of the heated interior, impairing the well being and comfort level near the windows.

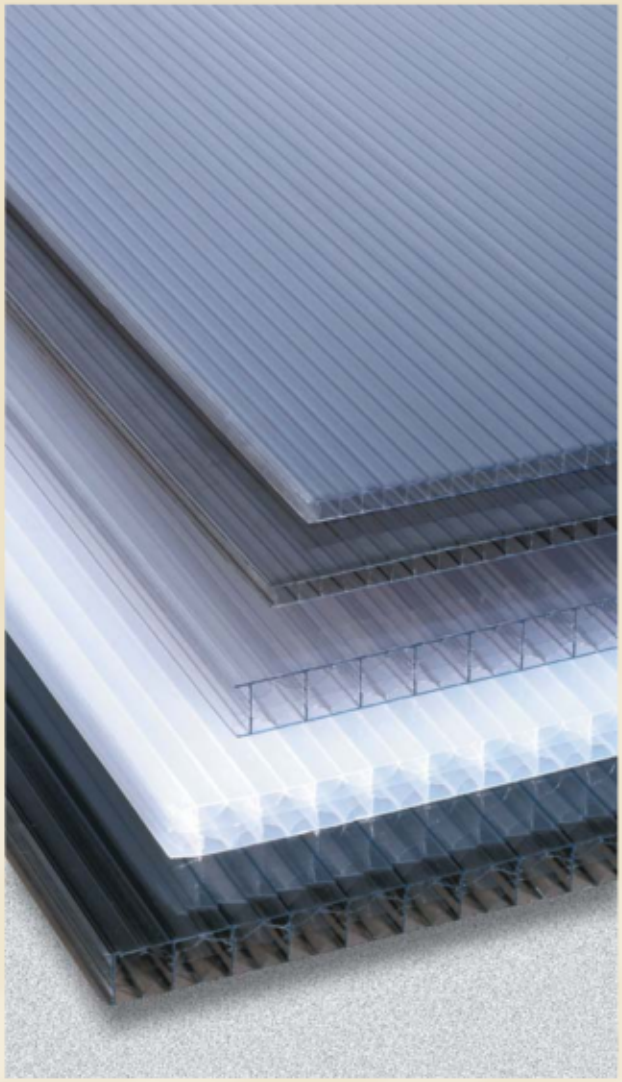
A reversed experience can be felt in hot climates. The interior is air-conditioned, but the glazing is warm, or even hot, radiating heat inside, reducing the comfort level near the windows, subjectively asking for stronger air-conditioning than really required.

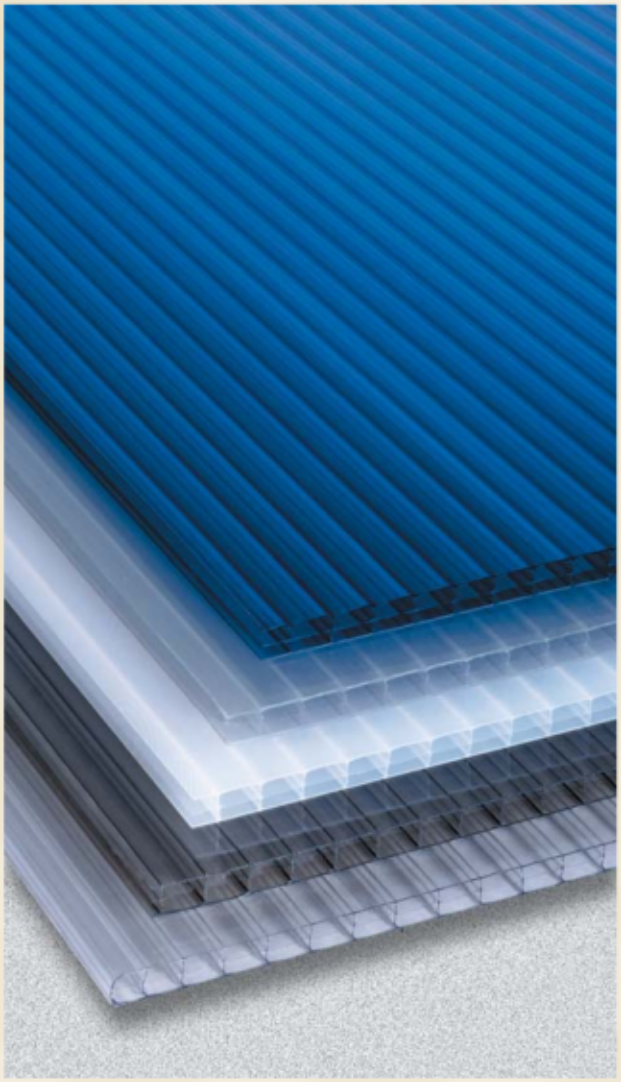
The improved insulating qualities of SUNLITE counteract this effect and make the inhabitants experience comfortable internal surroundings, even when staying closer to the glazing. Better-insulated exterior glazing offers both energy savings and better all-around well being of the occupants.

Weather Resistance

SUNLITE with its co-extruded UV protective layer will resist the affects of solar UV radiation. The measured changes in optical properties of a typical 16 mm SUNLITE sheet under accelerated UV exposure (QUV) for 2000 hours are not detectable by the human eye. Note that 100 hours of QUV exposure is roughly equivalent to 1 year of actual outdoor exposure in Israel or Phoenix, Arizona in the USA.

A limited **10 Year Warranty** covering loss of light transmission and loss of strength due to weathering is available upon request. See the warranty for the exact details.





SUNLITE Solar Control

Palram introduces the latest innovation from its R&D Department, SUNLITE Multi-wall Polycarbonate sheets with integrated solar control. There is no extra laminated reflective layer to peel off or be scratched. Palram Solar Control polycarbonate sheets are designed to give the qualities of reflective glass plus the known advantages of polycarbonate as a glazing material.

SUNLITE Solar Control sheets have a considerable advantage over regular colored sheets. The latter reflect only a small amount of solar radiation, and absorb most of the light energy, which is not transmitted through the sheets. This leads to the heat build-up in the sheet itself, followed by heat accumulation within the covered area. SUNLITE Solar Control sheets transmit a controlled amount of visible light and reflect the largest part of the solar heat radiation at the same time, resulting in "cool lighting" within the covered area.

The effect of solar heat penetration prevention during the summer may reduce or cancel the need for blinds in summer. Conversely, in winter, the far infrared radiation blocking of any type of polycarbonate glazing greatly reduces the heat loss from within the structure, thereby reducing heating costs.

SUNLITE Solar Control sheets offer an additional aesthetic property with either a state-of-the-art rich metallic, Hi-Tech look or a pearl-like finish. This can contribute to many modern structures.

Unique Features

- Colors: Solar Metallic Gray (25% LT) and Solar Ice (20% LT)
- Translucent (Semi-Transparent)
- Up to 50% reduction in Solar Heat Gain
- May eliminate the Need for Sun Blinds

SUNLITE Solar Control

THERMAL AND OPTICAL PROPERTIES of SOLAR CONTROL SHEETS

SUNLITE - Solar Light and Radiation Transmission Properties

Product	% LT	%LR	%ST	%SR	%SA	$\%SR_t$	$\%ST_t$	SC
	ASTM D-1003	ASTM E424-71	ASTM E424-71	ASTM E424-71	ASTM E424-71	ASTM E424-71	ASTM E424-71	ASTM E424-71
Clear[a]	73[b]	23	71	23	6	27	73	0.84
Bronze[a]	40[b]	15	48	16	36	45	55	0.63
Opal[a]	45[b]	21	49	20	31	43	57	0.66
Solar Metallic Gray	25	29	24	29	47	63	37	0.43
Solar Ice	20	52	32	44	34	62	38	0.44

[a] 16 mm sheet
[b] Values differ slightly from standard SUNLITE products depicted on page 5.

Definitions

Visible Light Radiation
The portion of the light spectrum whose wavelength ranges from 400 nm to 700 nm.

% Light Transmission (%LT)
Percentage of incident visible light that passes through an object .

% Light Reflection (%LR)
Percentage of incident visible light that strikes an object and returns in the form of visible light.

% Light Absorption (%LA)
Percentage of incident visible light that strikes an object and is absorbed by it.

%LT + %LR + %LA = 100%

Solar Radiation
The solar spectrum ranging from 300 nm to 2400 nm. Included are UV, visible and NIR radiation.

% Direct Solar Transmission (%ST)
Percentage of incident solar radiation that passes directly through an object.

% Solar Reflection (%SR)
Percentage of incident solar radiation that strikes an object and is reflected.

% Solar Absorption (%SA)
Percentage of incident solar radiation that strikes an object and is absorbed by it.

%ST + %SR + %SA = 100%

Total Solar Transmission ($\%ST_t$)
The percentage of incident solar radiation transmitted by an object which includes the direct solar transmission plus the part of the solar absorption reradiated inward.

Total Solar Reflection ($\%SR_t$)
The percent of incident solar radiation rejected by an object, which includes the solar reflectance plus the part of the solar absorption, reradiated outward.

$\%ST_t + \%SR_t = 100\%$

Shading Coefficient (SC)
The ratio of the total solar radiation transmitted by a given material to that transmitted by normal glass, whose light transmission is 87%. It can be approximately calculated by:

$SC = 1.15 \times (\%ST + (0.27 \times \%SA))/100$
$\%ST + (0.27 \times \%SA) = \%ST_t$
$SC = (1.15 \times ST_t)/100$

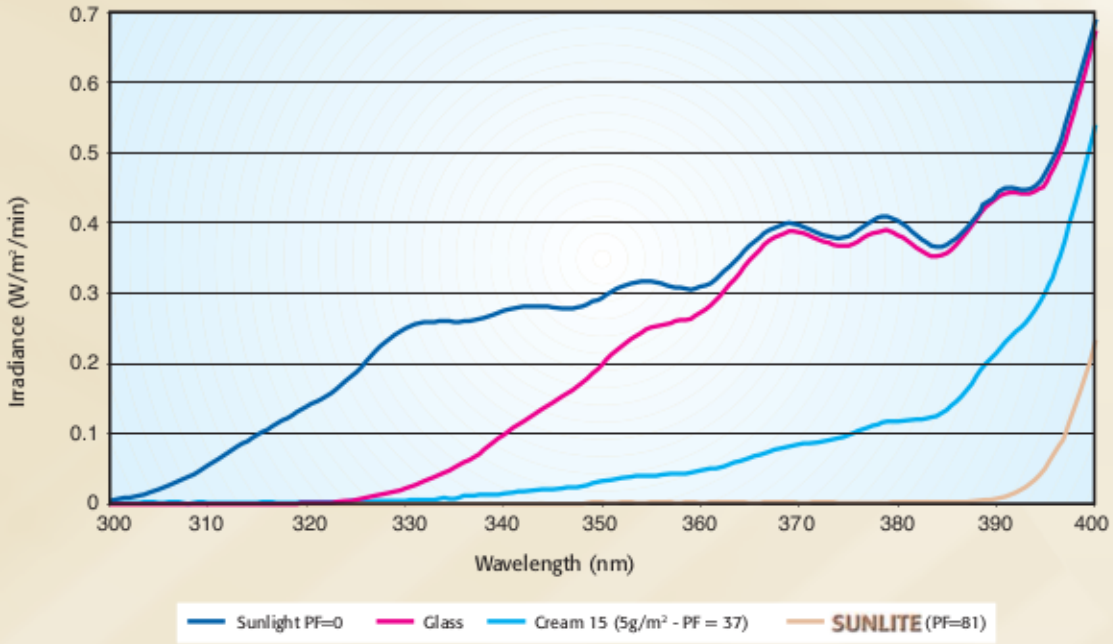
First note that all SUNLITE sheets transmit practically 0% UV radiation and offer 100% protection to anyone sitting or playing under the sheets. Data is available indicating that tinted sheets absorb more solar energy over the entire spectrum. This energy is partially converted into heat which can be radiated inward, heating the area below the sheets. The Solar Control sheet avoids this by reflecting a much larger percentage of energy over the entire spectrum. Tinted sheets reflect must less energy. SUNLITE Solar Control sheets transmit a uniform 20% to 25% of light energy over a wide portion of the energy spectrum. The result is that the much lower shading coefficients obtained for the Solar Control product result in a temperature reduction of up to 5 °C on a hot summer day.

Protection against UV

SUNLITE Polycarbonate Sheet Protects against the Harmful Affects of UV Radiation

Exposure to solar ultraviolet (UV) radiation is becoming a major health concern. The adverse affects were once thought to be associated with solar UV radiation in the 270 to 320 nm (UV-B) range. However, in recent years it has become apparent that exposure to UV-A (320-400 nm) is also detrimental. Both ranges in addition to the UV-C range (200-290 nm) were included in the 10th Report on Carcinogens issued by a US government agency. In addition to skin cancer, premature aging has been associated with exposure to UV-A. SUNLITE sheets totally block out UV radiation in this portion of the spectrum. Almost all the UV-A radiation is also blocked out. This almost total blockage of UV radiation can be observed in the figure below.

Comparison of Irradiance of Solar UV Radiation through Various Protective Barriers



A comparison of the UV protection offered by SUNLITE and that offered by sunscreen Cream 15 is depicted in the graph above. Note that no barrier is as effective as SUNLITE sheet. Activity below SUNLITE will be more protected than that offered by proper application of sunscreen, though the latter is sufficient in almost all cases. The key word in the previous sentence is proper. Improperly applied sunscreen or forgetting to apply sun screen will result in undesirable levels of exposure. In addition, note that protection factors are computed on the basis of UV-B exposure. There is as yet no way to compute protection to UV-A exposure. It should also be noted that formulations are still being marketed which only block out UV-B. When playing or swimming below SUNLITE, protection is always complete. When swimming, there is no danger that the protection will be washed away.

In the last ten years, it also has been documented that UV exposure can also damage the eyes, specifically the cornea. Wearing sunglasses manufactured from polycarbonate protects the eyes. However, most people remove their glasses when entering the pool. This is a factor for both public and private pools to consider when contemplating a choice of covering.

General Recommendations

Edge sealing
To avoid dirt and internal condensation, install sheets in such a way as to permit gravity drainage. Seal the open ends after cutting and before installation with compatible impermeable anti-dust tape and an anti-dust venting tape. Palram recommends Anti Dust Venting Tapes ADT16 and ADT25 and Anti Dust Impermeable Tape RA1025 produced by Pal Adhesives Products Ltd., West Midlands, UK.
For additional information, please refer to "Adhesives and Sealants Compatible with Polycarbonate Sheets".

The polyethylene masking protective film must be removed immediately after installation.

Cleaning
First rinse with lukewarm water in order to remove dust particles. Then use a mild compatible soap or detergent and a cotton (not synthetic) cloth. Rinse again with water and dry with a soft cloth to avoid spotting.

Chemical Resistance
Please refer to, "Palram Industries Chemical Resistance of Polycarbonate Sheets".

Storage
Store horizontally on a flat pallet in a dry shaded place.
Avoid unsupported overhangs.
Avoid humidity, dust and direct sun radiation.

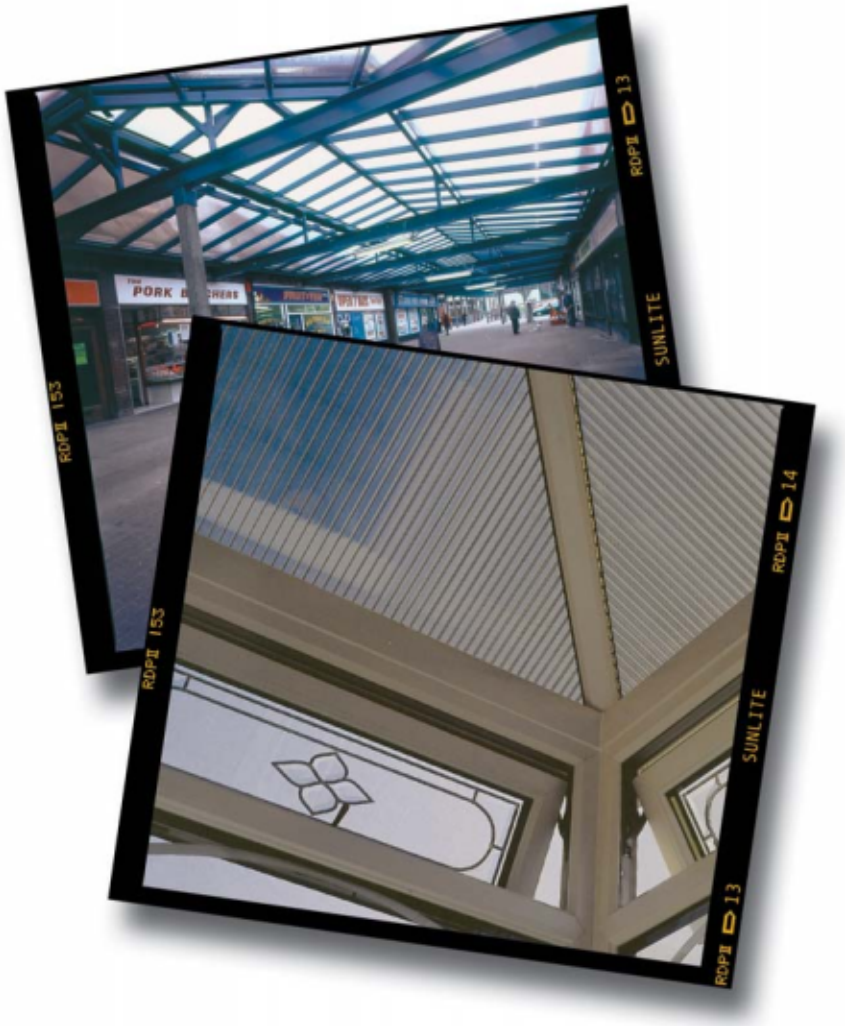
Handling
Handle with care to avoid scratches, edge damage and puncturing. Retain in the original packaging. Unpack just prior to use.

Sawing and drilling
Use standard workshop equipment like a circular saw or jigsaw.
Blow dust from the channels immediately after sawing and seal with appropriate tape. (Professional clean cut-to-size service is offered by the factory.)
Drill with a power drill using a metal drill bit.

Site safety
Do not stand or walk on sheets without temporary or fixed crawling boards or ladders.

Installation
Verify that the UV protected side of the sheet is facing out to the sun.
Never use accessories or hardware manufactured from soft PVC in contact with polycarbonate products.

Detailed installation instructions ("Installing SUNLITE") are available from your Palram distributor.



Distributor

Inasmuch as PALRAM Idustries has no control over the use to which others may put the material, it does not guarantee that the same results as those described herein will be obtained. Each user of the material should make his own tests to determine the material's suitability for his own particular use. Statements concerning possible or suggested uses of the materials described herein are not to be construed as constituting a license under any PALRAM Idustries patent covering such use or as recommendations for use of such materials in the infringement of any patent. PALRAM Idustries or its distributors cannot be held responsible for any losses incurred through incorrect installation of the material. In accordance with our company policy of continual product development you are advised to check with your local PALRAM Idustries supplier to ensure that you have obtained the most up to date information.

61321 8.04

Europe
UK
Israel
USA
Australia
Far East

PALRAM

EUROPE
PALRAM EUROPE LTD.
Tel ▸ (44) 1302 380 777
Fax ▸ (44) 1302 380 788
sales.europe@palram.com

PALRAM UK
Tel ▸ (44) 1302 380 738
Fax ▸ (44) 1302 380 739
sales.uk@palram.com

ISRAEL
PALRAM ISRAEL LTD.
Tel ▸ (972) 4 8459 900
Fax ▸ (972) 4 8459 980
palram@palram.com

USA
PALRAM AMERICAS
Tel ▸ 610 285 9918
Fax ▸ 610 285 9928
suntuf@suntuf.com

www.palram.com

SUNLITE® ML

Multi-layered Multi-wall Structured Polycarbonate Sheet

Glazing Construction DIY

Introduction

SUNLITE ML allows combinations of diffferent colours in one sheet, and adds a multi-layer technological edge to the already wide range of SUNLITE products. SUNLITE multi-layered products provide the benefits of solar energy treatment, delivering cool natural light without sacrificing the interior. SUNLITE ML adds new attractive dimension to any conservatory, and may also appeal to architects, who would appreciate this creative element when designing structures.

Features and Benefits

- *New:* X-Lite structure for improved overall mechanical performance
- Reduced heat buildup
- White interior blends with any decor
- Range of thicknesses available
- Supplied in standard SUNLITE widths
- Compliments all fabricated roof structures and glazing systems
- Bronze/Opal and Solar Guard color combinations
- Softer lighting effect created when using opal

SUNLITE® Colours & Light Transmissions

Structure	% Light Transmission by Colours										
	Standard Colours							Multi-Layer		New DC	
	Clear	Bronze	Solar Grey	White Opal	Opal WD	Solar Metallic Grey	Solar Ice	Bronze/ Opal	Solar Guard	CL	AG
Twin Wall 4 mm	82%	35%	25%	30%		30%					
Twin Wall 4.5 mm	82%	35%	25%	30%		30%					
Twin Wall 6 mm	80%	35%	25%	20%		30%					
Twin Wall 8 mm	80%	35%	25%	35%		25%				45%	45%
Twin Wall 10 mm	79%	35%	25%	30%		25%				45%	45%
Triple Wall 8 mm	76%	35%		48%		25%					
Triple Wall 10 mm	76%	35%		48%		25%					
Triple Wall 16 mm	76%	35%	25%		48%	25%		20%	10%		
NEW X-Lite 10 mm	63%										
X-Lite 16 mm	60%	25%			38%	18%	15%				30%
X-Lite 25 mm	60%	25%			20%	20%	15%	10%	5%		20%
X-Lite 32 mm	58%	20%			20%	20%	15%	10%	5%		20%
X-Lite 35 mm	57%	20%			20%	20%	15%	10%	5%		20%

Typical Properties Table

Property	(Method)	Conditions	Units	Value
Density	(D-792)		g/cm^3	1.2
Heat Deflection Temperature	(D-648)	Load: 1.82 MP	°C	130
Short Term Service Temperature Range			°C	-50 to + 120
Long Term Service Temperature Range			°C	-50 to + 100
Coefficient of Linear Thermal Expansion	(D-696)		10^{-5}/°C	6.5
Tensile Strength at Yield	(D-638)	10 mm/min	MPa	62
Elongation at Break	(D-638)	10 mm/min	%	>80
Impact Falling Dart	(ISO 6603/1)		J	40 - 400
Thermal Expansion / Contracion Range			mm/m	3

Flammability

SUNLITE complies with international fire resistance standards as represented by results in the following table.

Method	Classification*
BS 476/7	Class 1
DIN 4102	B-1
NSP 92501	M-1, M-2
ASTM D-635	CC-1 (SUNLITE SL)
ASTM E-84	Class A

* *Results depend on thickness and profile.*
For additional information consult your SUNLITE distributor.

Standard Dimensions

Profile	Thickness mm	(In.)	Width (mm)				
			980	1050	1600	1800	2100
Triple Wall	16	(5/8)	x	x	x	x	x
X-Lite	25	(1)	x	x	x	x	x
X-Lite	32	(11/4)	x	x	x	x	x
X-Lite	35	(13/8)	x	x	x	x	x

Additional SUNLITE® Products

Solar Control™ *For breaking the penetrating heat/light ratio*
SUNLITE® UV2 *Co-extruded UV protection on both sides*
SUNLITE® Plus *Clear SUNLITE with anti-condensation treatment*
SUNLITE® CL *With advanced heat filtering for architectural applications*
SUNLITE® AG *With special coloring and anti-condensation*

61.273 - 08.05

Europe
UK
Israel
USA
Australia
Far East

EUROPE
PALRAM EUROPE LTD.
Tel ▸ (44) 1302 380 777
Fax ▸ (44) 1302 380 788
sales.europe@palram.com

PALRAM UK
Tel ▸ (44) 1302 380 738
Fax ▸ (44) 1302 380 739
sales.uk@palram.com

ISRAEL
PALRAM ISRAEL LTD.
Tel ▸ (972) 4 8459 900
Fax ▸ (972) 4 8459 980
palram@palram.com

USA
PALRAM AMERICAS
Tel ▸ 610 285 9918
Fax ▸ 610 285 9928
palramamericas@palram.com

www.palram.com