



SUNTUF[®]

Corrugated Polycarbonate Sheets



The way to enjoy the sun



Additional Products Manufactured by Palram Industries

PALSUN[®]

Flat rigid polycarbonate sheets with the following options: standard, one or two sided co-extruded UV protection, mirror, solar control, FR, embossed (E102, prismatic, haircell), abrasion and scratch resistant.

PALSUN FOAMED - flat foamed polycarbonate 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.

SUNTOP[®]

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

SUNLITE[®]

Multi-wall (structured) sheets co-extruded with UV protection on one or two sides available with anti-condensation treatment.

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.

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

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Company Profile

Palram Industries is a multinational manufacturer of a broad range of flat and corrugated thermoplastic sheets for varied applications in industry, agriculture, construction, advertising, and D.I.Y. PALRAM has five state-of-the-art production plants in Israel, North America, Europe and Asia and a global network of sales representatives. In 2000 products were sold in 120 countries with sales reaching over \$100 million. An ongoing Research and Development program leads to continual technological innovation that is reflected in the high, ever improving quality and increasing diversity of PALRAM products.

In 1993 PALRAM received ISO 9002 accreditation recognizing its long-standing commitment to the highest international quality codes and standards for manufacturing procedures and facilities. Featuring product integrity, color consistency, long-term retention of physical properties and attractive appearance, PALRAM thermoplastic sheets meet the individual product performance for the applications for which they were designed. In addition, PALRAM specializes in custom manufactured sheets to satisfy specific color, thickness, corrugation and length requirements of each customer.



Product Group

SUNTUF is a segment of the extensive line of polycarbonate sheets manufactured by PALRAM Industries. Light weight SUNTUF corrugated sheets are manufactured from polycarbonate which combines clarity with strength and incorporates a coextruded UV protective layer that will not peel or separate. SUNTUF exhibits outstanding resistance to impact (hail or wind) and physical abuse, the most extreme of weather conditions (SUNTUF will not distort or become brittle at any temperature naturally encountered), a large number of chemicals, while remaining corrosion free. Due to these exceptional properties, SUNTUF sheets are the ideal solution for greenhouse or swimming pool coverings in addition to roofing, siding or cladding in industry, construction and agriculture. SUNTUF can also be used to create skylights or to cover light fixtures. Do-It-Yourself (D.I.Y.) enthusiasts have found SUNTUF useful in a wide variety of applications. This brochure contains detailed information to assist you with selecting the color, dimensions and profile that suit a particular application and location.

SUNTUF[®] - Corrugated polycarbonate sheet with co-extruded UV protective layer on one side.

SUNTUF[®] Plus* - Corrugated polycarbonate sheet with co-extruded UV protective layer on the exterior side and anti-condensation treatment applied to the interior side.

SUNTUF[®] UV2 - Corrugated polycarbonate sheet with co-extruded UV protective layer on both sides.

SUNTUF[®] SOLAR CONTROL* - NEW - Corrugated polycarbonate sheet that transmits selected percentages (20%, 35%, or 50%) of the light energy while keeping the undesired components of the energy spectrum (heat) out. The solar control feature is an integral part of the sheet and will not peel away.

* Also available with co-extruded UV protective layer on both sides.

Applications

As a roofing, siding or cladding material or skylights, SUNTUF sheets are unmatched in their vast variety of uses due to their features, performance and aesthetic appearance.



Construction and Industry

Roofing or cladding for structures, industrial facilities, public buildings, etc.

SUNTUF combines resistance to corrosion and high impact strength, with the ability to withstand the most extremely cold to the most extremely hot temperatures that occur in nature. No other material offers this.

Skylights

SUNTUF can be used in conjunction with other corrugated roofing or cladding materials to facilitate daytime natural light transmission, resulting in reduced lighting costs.

Skylight walkways

Swimming pool covering

SUNTUF Plus can be used to prevent condensation build-up. SUNTUF's UV protective shield will protect the bathers below.

Partitions

Other



Agriculture

Commercial Greenhouses - SUNTUF Plus with its unique anti-condensation treatment is the ideal greenhouse covering

Various other uses, taking advantage of the material and its properties



Applications

Do-It-Yourself (D.I.Y.)

SUNTUF sheets are an outstanding D.I.Y. material particularly for their appearance, versatility, durability and ease of handling. The extent of possible D.I.Y applications is virtually unlimited.

- Skylights to provide natural lighting in your house
- Canopies, Overhangs and Awnings
- Greenhouses
- Carports and Garages
- Partitions
- Patio Enclosures
- Sundecks/Verandahs
- Pool Enclosures
- Gazebos and Pergolas
- Sunhouses



Features at a Glance

Strength

SUNTUF sheets, manufactured from polycarbonate - the plastic steel - are unbreakable. SUNTUF is extremely resistant to impact either from a falling tool during installation or hailstones that may strike during a long lifetime of service.

Clarity

Natural, clear SUNTUF exhibits the clarity of glass, transmitting over 90% of light over the entire visible light spectrum.

UV Resistance

A co-extruded UV protective layer, which is an integral component of the sheet, enables SUNTUF to retain its transparency without yellowing over the course of a long lifetime of service.

Weather Resistance

SUNTUF resists wind, hail, and the most extreme of temperatures, from -40°C to $+120^{\circ}\text{C}$. It will not become brittle at low temperatures or distort at high temperatures.

UV Protective Shield

SUNTUF will not allow harmful UV radiation to penetrate and harm either crops or children playing below.

Thermal Insulation

SUNTUF is a better insulator than fiberglass or glass resulting in less heat loss

Corrosion Resistance

SUNTUF matches the performance of metal roofs at any temperature, but will not corrode and will yield a much longer lifetime of service.

Chemical Resistance

SUNTUF resists a wide variety of chemical substances. However, certain substances are not compatible with polycarbonate.

Flexibility

SUNTUF can be curved parallel or perpendicular to their corrugation. Arched roofs and curved walls are easily constructed.

Flammability

SUNTUF sheets have a low flammability rating and do not emit toxic gases when burning. They are less flammable than fiberglass or acrylic. SUNTUF meets many international fire standards, some of which appear on page 19.

Ease in Handling and Installation

Light in weight, SUNTUF sheets are easy to handle and install. SUNTUF is easily cut and drilled using standard ordinary tools.

Appearance and Minimum Maintenance

SUNTUF retains its attractive appearance over its long lifetime and is easily cleaned with soap and water.

Limited Lifetime Warranty

SUNTUF retains its integrity and properties over an extended lifetime of service. A limited lifetime warranty is available upon request.

Characteristics

SUNTUF Typical Properties

SUNTUF corrugated sheets possess electrical, mechanical, physical, optical and thermal properties, presented in the table below, that provide comprehensive solutions for the

wide variety of applications depicted previously. The combination of these characteristics qualifies SUNTUF sheets as a first class material.

Typical Properties of SUNTUF Sheet (0.8 mm.)

	Property	Conditions	ASTM Method ^a	Units - SI	Value
Physical	Density		D-1505	g/cm ³	1.2
	Water Absorption	24 hr. @ 23°C	D-570	%	0.15
Mechanical	Tensile strength at yield	10 mm/min	D-638	MPa	62
	Tensile strength at break	10 mm/min	D-638	MPa	65
	Elongation at yield	10 mm/min	D-638	%	7
	Elongation at break	10 mm/min	D-638	%	>80
	Tensile Modulus of Elasticity	10 mm/min	D-638	MPa	2,300
	Flexural Modulus	1.3 mm/min	D-790	MPa	1,890
	Flexural Strength at Yield	1.3 mm/min	D-790	MPa	93
	Notch Impact Strength Izod	23°C	D-256	J/m	800
	Notch Impact Strength Charpy	23°C	D-256	J/m	800
	Impact Falling Weight		ISO-6603/1 ^a	J	50
	Rockwell Hardness		D-785	R scale	118
Thermal	Long Term Service Temperature			°C	-75 to +100
	Short Term Service Temperature			°C	-75 to +120
	Heat Deflection Temperature	Load: 1.82 MPa	D-648	°C	135
	Vicat Softening Temperature	Load: 1 kg	D-1525	°C	150
	Coefficient of Linear Thermal Expansion		D-696	10 ⁻⁵ cm/ cm °C	6.5
	Thermal Conductivity		C-177	W/m K	0.21
	Specific Heat Capacity		C-351	kJ/kg K	1.3
Optical	Haze		D-1003	%	<0.5
	Light Transmission		D-1003	%	90
	Refractive Index		D-542		1.57
	Yellowness Index		D-1925		<1
Electrical	Dielectric Constant	1 kHz	D-150		2.6
		1 MHz	D-150		2.4
	Dissipation Factor	1 kHz	D-150		0.005
		1 MHz	D-150		0.02
	Dielectric Strength Short Time	500 V/s	D-149	kV/mm	20
	Surface Resistance	Ketley	D-257	Ohm	4.1x10 ¹⁵
	Volume Resistance	Ketley	D-257	Ohm-cm	1.7x10 ¹⁷

a. All the results depicted in this table were obtained by following the indicated ASTM method except where another method is indicated by the appearance of this symbol (a).

UV and Weather Resistance

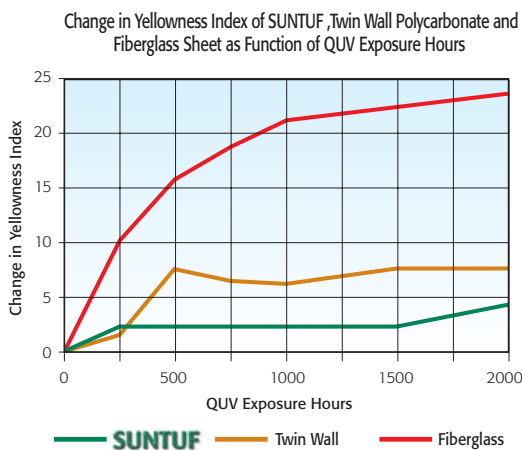
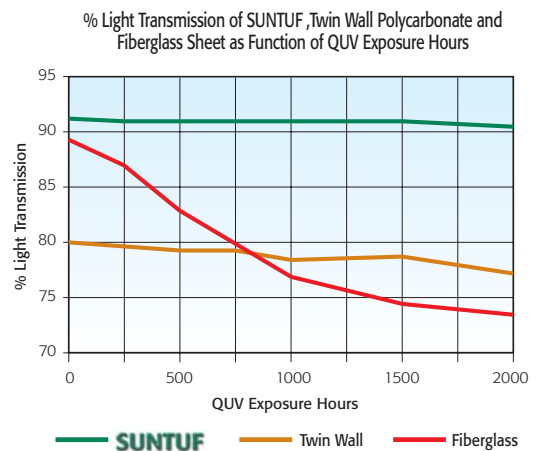
Weather Resistance

SUNTUF will resist all that nature has to offer. Wind will not buckle it. SUNTUF meets the standards of Dade County Florida for resisting hurricane force winds. Hail bounces off. Extremely cold temperatures will not render it brittle and leave it vulnerable to breakage. Even the hottest of days in the middle of the desert will not distort SUNTUF.

UV Protection

SUNTUF is manufactured with a co-extruded UV resistant layer that will not separate or peel over time. The graph to the right, which depicts the results of laboratory QUV testing, which simulates actual UV exposure, indicates that there is only a negligible decrease in light transmission over the 20 year lifetime of the sheet. The small increase in yellowness index depicted in the graph below is not visible to the human eye. For comparison, the results of representative twin wall and fiberglass sheets are also depicted.

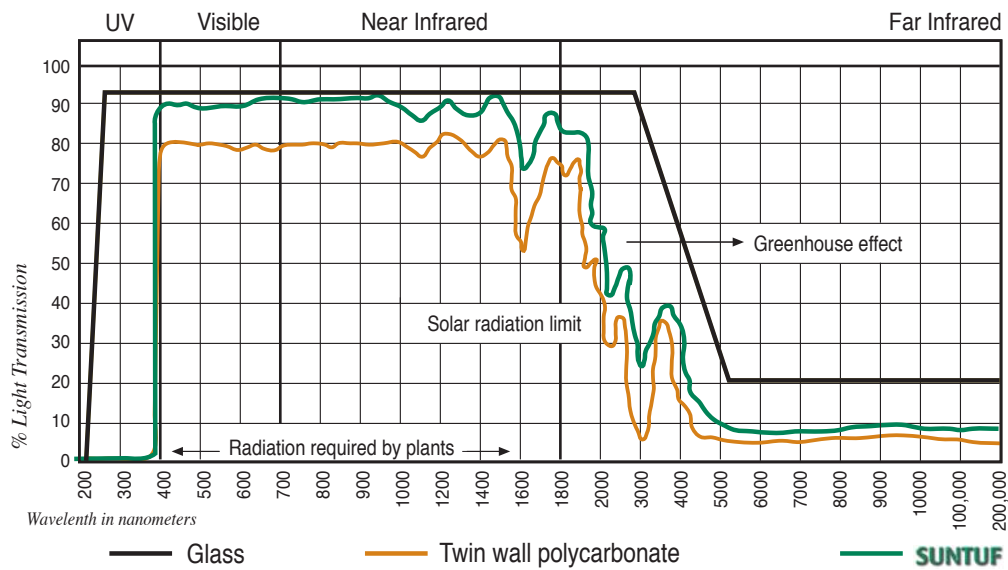
Note that QUV testing consists of 20 hours of intense UV radiation followed by 4 hours exposure to high humidity. A constant temperature of 48 °C is maintained. Testing is carried out for up to 2000 hours. 100 hours of QUV exposure is equivalent to approximately one year of exposure to solar UV radiation in the USA's Southwest, Australia and the Middle East.



Radiation Filtering

The graph below depicts the transmission of electromagnetic radiation from 200 to 200,000 nm by SUNTUF. It can be observed that SUNTUF transmits selectively. The beneficial blocking of potentially harmful UV radiation (200 to 400 nm) will be discussed in detail on page 14. On average, clear SUNTUF will transmit 90% of incident visible radiation (400 to 700 nm). This makes clear SUNTUF an ideal material for creating skylights integrated into opaque roofing or cladding of the identical profile. It also makes SUNTUF a requested material for covering public or residential structures where the maximum entry of light is required. This same property has played a significant role in SUNTUF's dramatic penetration into the greenhouse covering market over the last ten years. No other synthetic covering transmits a greater percentage of P.A.R. Also contributing to the attractiveness of SUNTUF as a greenhouse cover is the reduced transmission of far infrared radiation (2000 – 3000 nm). Visible light and near infrared radiation (780 -1400 nm) heat both the air they pass through and solid objects inside which they strike. These warmed objects, in turn, radiate energy in the far infrared region, which is only partially transmitted by SUNTUF. This untransmitted radiation raises the temperature within the structure, an example of the "greenhouse effect". Regulating the ambient temperature created by this phenomenon can be done by controlled ventilation. Choosing tinted SUNTUF glazing with suitable light transmission can also assist in controlling the internal temperature (refer to page 15).

Transparency versus other products



SUNTUF® Polycarbonate Corrugated Profiles

No.	Standard Available Profiles with Configuration and Support Distances ^a for Selected Thicknesses ^a and Widths ^b										Theoretical Weight (kg per sq. meter ^e) kg/m ²	Maximum Support Spacing ^{fg,h}			
	Units	Profile	Thickness	Pitch	Depth	No. of ^d	Width ^{c,d}	Net Coverage	No. of	%		Design Load ^{ij}	Slope ^k 10-20%	Slope >20%	Wall
	Name		mm	mm	mm	Corrugations	mm	mm	Overlap ^d	Overlap ^d					
	A	B	C	D	E	F	G	H	I	J		K	L	M	N
1	Mini 32		0.8	32	8	32 1/2	1040	992	1 1/2	4.6	-				
2	Iron 76		0.8	76	16	17	1260	1216	1	3.5	1.06	50	850	1000	1200
												80	700	780	1100
												110	600	650	950
3	Greca 76		0.8	76	16	17	1260	1216	1	3.5	1.20	50	1100	1200	1300
												80	1000	1100	1200
												110	900	1000	1100
4	Greca 70		0.8	70	16	15	1095	1050	1	4.1	1.25	50	1100	1200	1300
												80	1000	1100	1200
												110	900	1000	1100
5	Omega 76		0.8	76	15	24	1870	1824	1	2.5	1.12	50	1050	1100	1300
												80	950	1050	1200
												110	850	950	1100
6	Asbestos 177		1.0	177	50	5 1/4	920	885	1/4	3.8	1.44	50	1250	1300	1450
												80	1150	1200	1350
												110	1100	1150	1250
7	Asbestos 177		1.0	177	50	6 1/4	1100	1062	1/4	3.4	1.44	50	1250	1300	1450
												80	1150	1200	1350
												110	1100	1150	1250
8	American 4.2"		1.0	107	27	10	1070	963	1	10	1.37	50	1250	1300	1400
												80	1100	1150	1300
												110	1050	1100	1200
9	American 4.2"		1.5	107	27	10	1070	963	1	10	2.05	50	1300	1350	1500
												80	1200	1250	1400
												110	1100	1150	1300
10	Trimdek		0.8	190	27	5	820	760	1	7.3	1.11	50	1100	1200	1300
												80	1050	1100	1250
												110	950	1000	1200
11	Trimdek		1.2	190	27	7	1200	1140	1	5	1.65	50	1350	1400	1550
												80	1250	1300	1500
												110	1100	1200	1300
12	Spandek 87.5		1.0	87.5	24	9	754	700	1	6.7	1.56	50	1100	1200	1350
												80	1000	1100	1250
												110	900	1000	1200
13	Spandek 87.5		1.2	87.5	24	9	754	700	1	6.7	1.87	50	1300	1350	1500
												80	1200	1250	1400
												110	1100	1150	1300
14	SunSky 9"		0.8	228.6	19	5	956	914	1	4.3	1.02	50	750	850	1020
												80	600	730	930
												110	500	600	850
15	SunSky 12"		0.8	304.8	32	4	965	914.4	1	5.2	1.05	50	930	1050	1250
												80	800	930	1100
												110	650	800	980
16	SunSky 12"		1.5	304.8	32	4	965	914.4	1	5.2	1.98	50	1350	1400	1550
												80	1250	1300	1500
												110	1100	1200	1400
17	Astoria		1.5	304.8	38	4	1033	914.4	1	10.5	2.32	50	1400	1450	1650
												80	1350	1400	1550
												110	1260	1350	1500
18	Industrial 0100		1.0	250	40	5	1063	1000	1	5.9	1.46	50	1300	1350	1550
												80	1250	1300	1450
												110	1200	1250	1350
19	Industrial 0100		1.2	250	40	5	1063	1000	1	5.9	1.69	50	1350	1400	1600
												80	1300	1350	1500
												110	1250	1300	1400

^a Support distance is characteristic of profile identity and sheet thickness and is not related to profile configuration (width and overlap). The profile configurations depicted above are the most common.

^b Detailed information on all profile configurations (including dimensions in inches) appears in the PALRUF and SUNTUF Profiles Catalogue. Spacing for configurations not shown or spacing in inches will be supplied upon request.

^c Other thicknesses and widths are available. See page 20. Thickness and configuration are independent parameters. The configuration information is valid for all thicknesses of a given profile.

^d The values shown are for the configuration depicted. Computation of % overlap differs from that appearing in PALRUF and SUNTUF Profiles Catalogue. % Overlap = ((width - Net Coverage)/width) x 100%

^e Values depend on thickness. Those listed are for the values appearing under thickness in the same row. The theoretical gross weight per sqm. Depicts the value for the sheeting in itself, without taking into account the overlapping percentage.

^f The supports spacing depicted here are based on the assumption that the installation instructions are carefully followed, including the use of the Sheet-to-Sheet stitching fasteners (or screws) along the overlapping corrugations.

^g Supports spacing values shown, are based partly on actual load tests performed, and partly on empirical experience gained out of field use, theoretical calculations, educated estimates, extrapolations and evaluations made according to similar, or parallel products. Actual values may be updated later on, due to further testing and evaluations

^h Max. Suggested Supports Span shown for the Asbestos profiles (of both widths and gages), are really theoretical. These profiles are meant as a replacement for the obsolete previous Asbestos panels, which are now banned from use, and are practically installed on the same structure and existing smaller spans as dictated by the previous cladding. There is usually no use of this type of profile in new structures.

ⁱ Deflection at max. load depicted-(useful wind/uplift or snow workloads) is up to 1/20 (5%) of the proposed purlins span.

^j Relationship between wind velocity and wind load: 100 km/hr is equivalent to a wind load of 50 kg/m², 130 km/hr is equivalent to 80 kg/m² and 150 km/hr is equivalent to 100 kg/m²

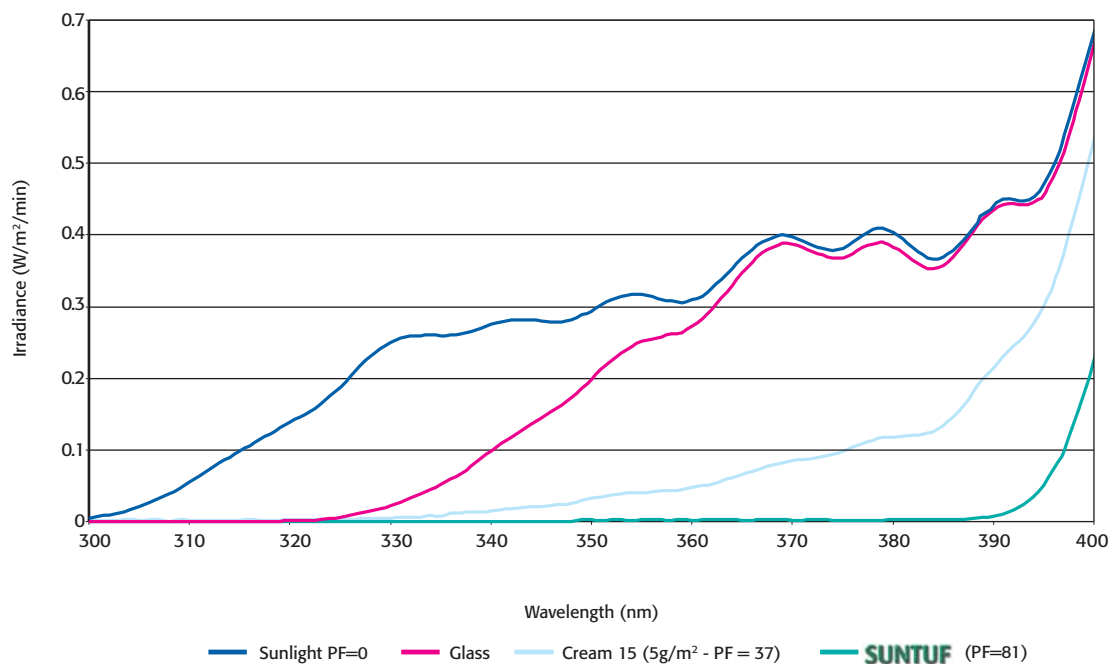
^k Slopes of less than 10% are not recommended. If chosen, the support spacing needs to be reduced by up to 60% (depending on the actual slope chosen), due to the reduced possibility of self-cleaning and lower rate of rainwater evacuation, necessitating much smaller deflection.

SUNTUF 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. In addition to skin cancer, premature aging has been associated with exposure to UV-A. SUNTUF 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 SUNTUF and that offered by sunscreen Cream 15 is depicted in the graph above. Note that no barrier is as effective as SUNTUF sheet. Activity below SUNTUF 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 SUNTUF, 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 to 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.

Thermal and Optical Properties

Thermal insulation is an important factor to consider when choosing a glazing material due to its impact on energy expenditure for heating in the winter and air conditioning in the summer. Textured, tinted, opal, diffuser and the new SUNTUF Solar Control sheets possess energy saving properties that complement those resulting from the low thermal conductivity of SUNTUF. (SUNTUF's thermal conductivity is lower than that of fiberglass (FRP) sheets and glass.) The light transmission is reduced from the very high value available with clear SUNTUF. However, the resulting lowered light transmission still delivers excellent lighting within, while providing a shading coefficient (SC) which provides significant cooling for structures located in hot sunny climates, or in cases where large glazing areas face direct sun exposure for many hours a day.

The range of SUNTUF clear, tinted, opal, diffuser or Solar Control sheets, depicted on the next page, offers a wide range of light transmission and shading coefficient grades to suit the application. They diminish solar energy buildup and glare created by direct sunlight, prevent dazzle and reduce air-conditioning costs. The diffused light transmitted through translucent or textured SUNTUF sheets, or the special shade of light delivered by other tinted SUNTUF sheets, help to maintain a comfortable and pleasing ambience to the users of the structure.

SUNTUF textured, diffuser and opal sheets are also suitable for incorporation into light fixtures. They enable designers to deliver the exact quantity and quality of light desired.

On the following page, a series of definitions appear to assist you in understanding the thermal and optical properties of SUNTUF sheets, followed by a table depicting these properties.



Thermal and Optical Properties

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 as 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 percent 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 reflected 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:

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

$$\%ST + (0.27 \times \%SA) = \%ST_t$$

$$SC = 1.15 \times ST_t / 100$$

SUNTUF - Solar Light and Radiation Transmission Properties (Thickness 0.8 mm to 1.5 mm)

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	90	10	86	10	4	14	86	1.00
Clear Textured	87-89	10-12	83-85	10-12	3 to 7	14	86	1.00
Bronze 50%	50	7	54	7	39	35	65	0.75
Bronze 35%	35	6	42	6	52	44	56	0.64
Bronze 20%	20	6	28	6	66	54	46	0.52
Solar Gray 50%	50	7	54	7	39	35	65	0.75
Solar Gray 35%	35	6	42	6	52	44	56	0.64
Solar Gray 20%	20	6	27	6	67	55	45	0.51
White Opal (0.8 mm)	45	51	46	43	11	51	49	0.56
White Opal (1.0 mm)	35	55	40	47	13	57	43	0.50
Mist Green 20%	20	25	33	24	43	55	45	0.51
Smooth Cream 35%	35	17	45	17	38	50	50	0.64
Solar Metallic 20%	20	30	21	30	49	66	34	0.38
Solar Metallic 35%	35	28	32	28	40	57	43	0.49
Solar Metallic 50%	50	24	48	24	28	44	56	0.64
Solar Ice 20% ¹	20	59	29	52	19	66	39	0.39
White Opaque	<2	N.A. ²	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Green Opaque	<2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Blue Opaque	<2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Red Brick	<2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Black	<2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

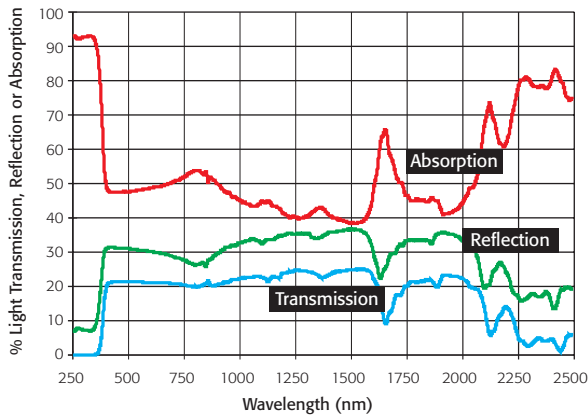
¹Additional Solar Ice % LT are available.

²N.A. Not applicable

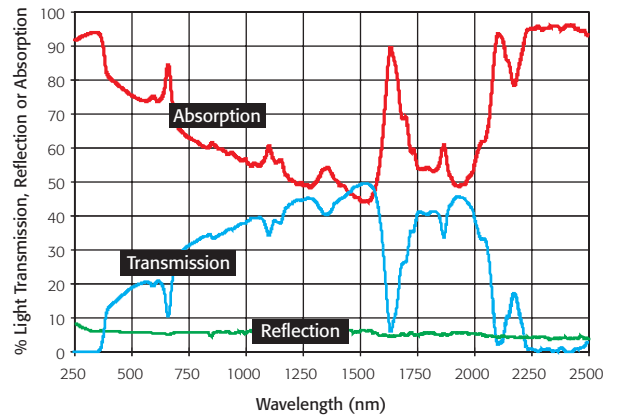
Suntuf Solar Control

As can be seen in the table on page 16, the **new** SUNTUF Solar Control sheet possesses the lowest shading coefficient and conversely the coolest temperatures at a given level of light transmission. The solar control is integrated. **There is no chance of a laminated layer peeling away.** To illustrate the advantage of solar control in fighting heat buildup, the figures below compare a 20% Light Transmission Solar Gray sheet with a 20% Light Transmission Solar Control Sheet. **First note that both sheets transmit practically 0% UV radiation and offer 100% protection to anyone sitting or playing under the sheets.** Comparing the absorption spectrum, it becomes apparent that the Solar Gray sheet absorbs 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. Compare this with the small percentage of reflection by Solar Gray. Also note that the Solar Control transmits a uniform 20% of light energy over a wide portion of the energy spectrum. Similar comparisons can be made for sheets transmitting 35% and 50% of incident light.

Optical Properties of Solar Control Sheet with 20% Light Transmission



Optical Properties of Solar Gray Sheet with 20% Light Transmission



Chemical Resistance

The mechanism of chemical attack on SUNTUF polycarbonate sheets differs significantly from the mechanism of corrosion of metals. Corrosion of metals results in a gradual loss of surface material as a result of electrolytic action by the relevant chemicals. In the cases where chemical attack on polycarbonate sheet occurs, all or a portion of a range of effects can be observed. Ethylene chloride, chloroform, tetrachloroethane, m-cresol, pyridine and other chemicals can cause partial dissolution of polycarbonate. Swelling agents include benzene, chlorobenzene, tetralin, acetone, ethyl acetate, acetonitrile and carbontetrachloride. Additional effects include color change and/or whitening. These effects may not always lead to product failure, especially for non-loaded sheets. Nevertheless, the level of measured mechanical properties will be reduced. The most critical effect of chemical attack is stress cracking or crazing, which may range in size from being visible to the naked eye to being only observable under a microscope. Stress cracks will always result in sheet failure which will emanate from areas of greatest stress (screws, fixings, bends, etc.)

SUNTUF polycarbonate sheets are generally not recommended for use with acetone, ketones, ethers, and aromatic and chlorinated hydrocarbons in addition to aqueous or alcoholic alkaline solutions, ammonia gas and its solutions and amines.

SUNTUF polycarbonate sheets are resistant to mineral acids, many organic acids, oxidizing and reducing agents, neutral and acid salt solutions, many greases, waxes and oils, saturated, aliphatic and cycloaliphatic hydrocarbons and alcohols, with the exception of methyl alcohol. The resistance of polycarbonate to water may be described as good up to approximately 60 °C. At higher temperatures, degradation occurs, the extent of which depends on time and temperature. Polycarbonate should therefore not be exposed for long periods of time to hot water. However, brief contact with hot water has no effect. For example, polycarbonate tableware can be washed over 1000 times in a dishwashing machine with no adverse effects being observed.

A table, which lists the resistance of polycarbonate sheet to many commonly encountered chemicals and other corrosive media at room temperature, appears in the pamphlet, "Palram Industries Chemical Resistance of Polycarbonate Sheets".

Adhesives and Sealants

Adhesives and sealants are often required when installing SUNTUF. Detailed information on compatible adhesives and sealants can be found in the leaflet, "Adhesives and Sealants Compatible with Polycarbonate Sheets".

Flammability, Building and Construction Standards

The value and quality of a construction material is indicated by the standards, which it meets. The table below lists the stringent international building and construction standards, which SUNTUF meets.

Standard	Country	SUNTUF Thickness	Method	Designation or Rating
Flammability	France	0.8 - 1.0 mm	NFP 92501, NFP 92504, NFP 92505	M-1
Flammability	Germany	0.8 - 1.0 mm	DIN 4102	B-1
Flammability	Israel	0.8 mm	I.S. 755	V 2 2
Flammability	Israel	1.5 mm	I.S. 755	IV 2 1
Flammability	Dade County FL- USA	0.8 mm	ASTM D-1929	Meeting the South- Florida building code 806° F
			D- 1929	1004° F
			D- 635	45 Sec
			D- 635	1.77 in
			E- 84	6
			E- 84	78
			D- 638	(Weathering)
Flammability	USA	0.8 mm	<u>UL</u> : UL 723	4.7 47.0
			ASTM D- 1929	490°c @ 4:3 min 530°c @ 2:15 min
			ASTM D- 635	3.0 cm/ min 100 (AEB) 30 (Burning rate)
Flammability	USA Los Angeles	0.8 mm	Los Angeles Building Code	CC2 (Section 2603)
Hurricane Code	Dade County, Florida, USA		AS2376-1980	Passed
Wind Load	Australia			Complies
Cyclonic Wind Load	Australia		AS 2424	Passed
Sandbag Impact Testing	Australia		AS2424, AS 1562-3	Passed
TNO Hail Test	Netherlands		1999-CON- LBC/B7139/JNE	Passed
TNO Load Test (Pressure)	Netherlands		1999-CON- LBC/B7157/JNE	Passed

SUNTUF Standard Corrugated Profiles

Standard Suntuf Profiles and dimensions appear in the table below (a graphical depiction of the profiles appears in the table on pages 12-13). Nonstandard products are available for a guaranteed minimum order. These include the following:

- 1-Products with nonstandard widths or thicknesses.
- 2-Additional available profiles not in the list below. ("The Palruf and Suntuf Profiles Catalogue" will be supplied upon request.)
- 3-Tailor or custom made profiles which can be developed to meet any existing or future design requirement.

Standard Available Dimensions

Profile Units	Thickness mm	Width mm	Length m
Mini 32	0.8	480, 660, 1008, 1040	1.5 - 6.0
Iron 76	0.8 - 1.0	660, 860, 900, 1140, 1260	1.5 - 11.6
Greca 76	0.8 - 1.2	660, 810, 1040, 10641, 1260, 1870	1.5 - 11.6
Greca 70	0.8	1090	1.5 - 11.6
Greca 78	0.8	1020	1.5 - 11.6
Omega 76	0.8	810, 1260, 1870	1.5 - 11.6
Asbestos 177	1.0 - 2.0	920, 1100	1.5 - 6.0
SunSky 9	0.8 - 1.5	956	2.5 - 4.9
SunSky 12	0.8 - 1.5	965	2.5 - 4.9
American 4.2"	1.0 - 1.5	1070	1.5 - 11.6
Trimdek 190	0.8 - 1.5	820, 1200	1.5 - 11.6
Astoria	1.0 - 2.0	1033	1.5 - 11.6
Industrial 0100	1.0 - 1.5	1063	1.5 - 11.6
Spandek 87.5	0.8 - 1.5	754	1.5 - 11.6

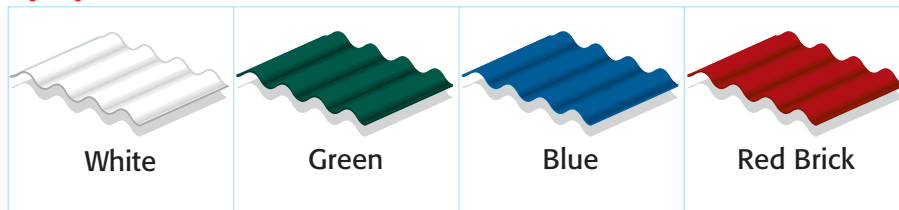
- Sizes in inches are available.

Colors

SUNTUF sheet is available in a wide variety of transparent, translucent, and opal colors. Opaque colors do not transmit light. Transparent colors transmit light and images (and are clear or tinted). Clear and opaque sheets may have a glossy or embossed surface on one side. Opal or translucent sheets have 20% to 40% light transmission, depending on the thickness of the sheet. SUNTUF Solar Control transmits fixed amounts of light (20, 35 or 50%) and will allow images to be viewed. The heat transmission is also reduced. Please refer to the table on page 16 for more detail.

A list of standard colors appears below. The colors depicted on this page are the closest reproduction of the actual color that is technically possible. Only sample chips* accurately characterize the colors in question.

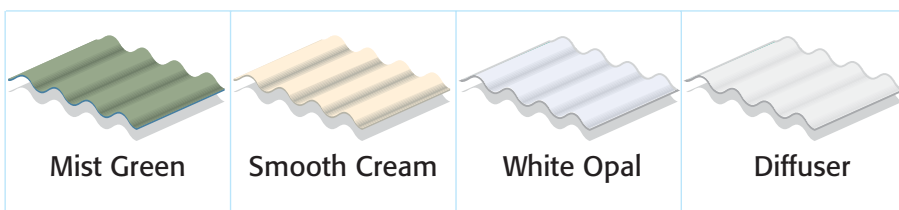
Opaque



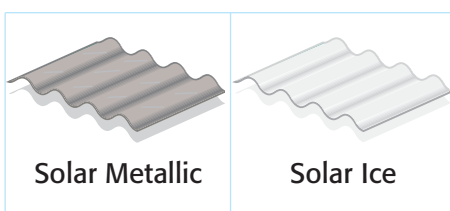
Transparent



Translucent



Solar Control Translucent



* Please consult with your local PALRAM distributor to:

- Receive a sample color chip.
- Order custom colors and/or light transmissions (subject to certain minimum quantities).

Consulting with your Distributor

Worldwide Distribution Network

PALRAM has a global distribution network with local representatives in most countries. Please refer to the list on the back page for information. PALRAM's representatives can supply you with the required know-how and accessories for integrating SUNTUF sheets with construction designs employed in your region.

As there are many factors involved in selecting a roofing, siding or cladding material, we strongly advise you to consult with your PALRAM distributor to assist with your profile selection before placing an order.

Consult with your local distributor for:

- Alternative PALRAM products that may be more suitable for your application (PALRUF corrugated PVC sheet, SUNLITE multi-wall polycarbonate sheet or PALSUN flat rigid polycarbonate sheet).
- Advice on the final selection of a profile.
- Accessories
- Adhesives and Sealants required for installation
- Requests for PALRAM's Technical Support Department to test materials for compatibility or use of SUNTUF sheets for a new application.
- Additional Literature related to SUNTUF is available upon request.

Greenhouse

SUNTUF Plus
SUNTUF Plus Technical Guide
SUNTUF Plus Installation Instructions

Technical Literature

Catalogue of Finishing Accessories
PALRUF (PVC) and SUNTUF (Polycarbonate) Profiles Catalogue
Palram Industries Chemical Resistance of Polycarbonate Sheets
Adhesives and Sealants Compatible with Polycarbonate Sheets

Installation Instructions

SUNTUF Industrial 0100 Profile
SUNTUF Iron 76 Profile
SUNTUF Greca 76 Profile
SUNTUF Omega 76 Profile
SUNTUF Asbestos 177 Profile
SUNTUF American 4.2 Profile

Distributor

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

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