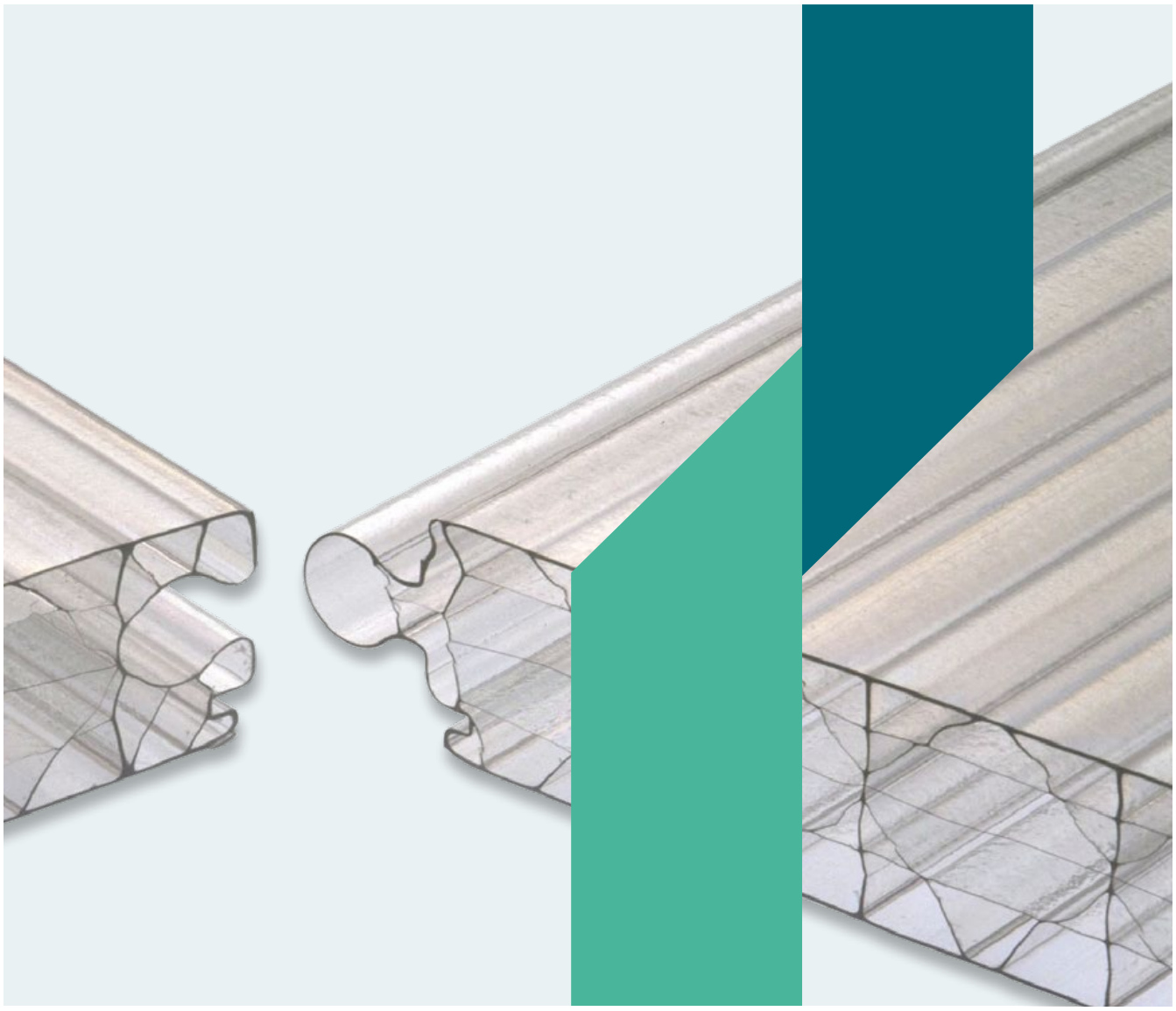
LEXAN™
FILM & SHEET

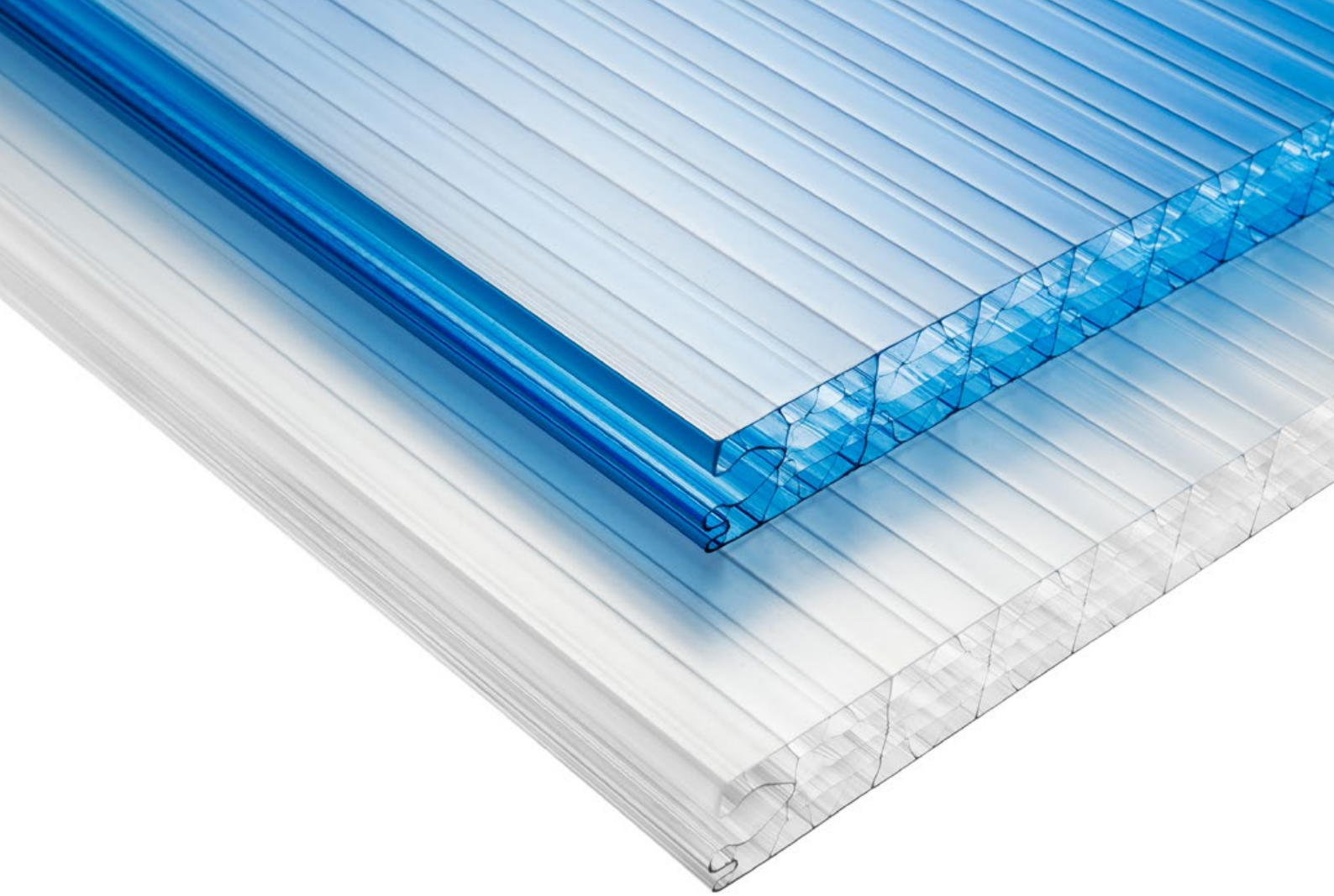
TECHNICAL MANUAL

LEXAN™ THERMOCLICK™ SHEET

NORTH AMERICA



POLYVANTIS



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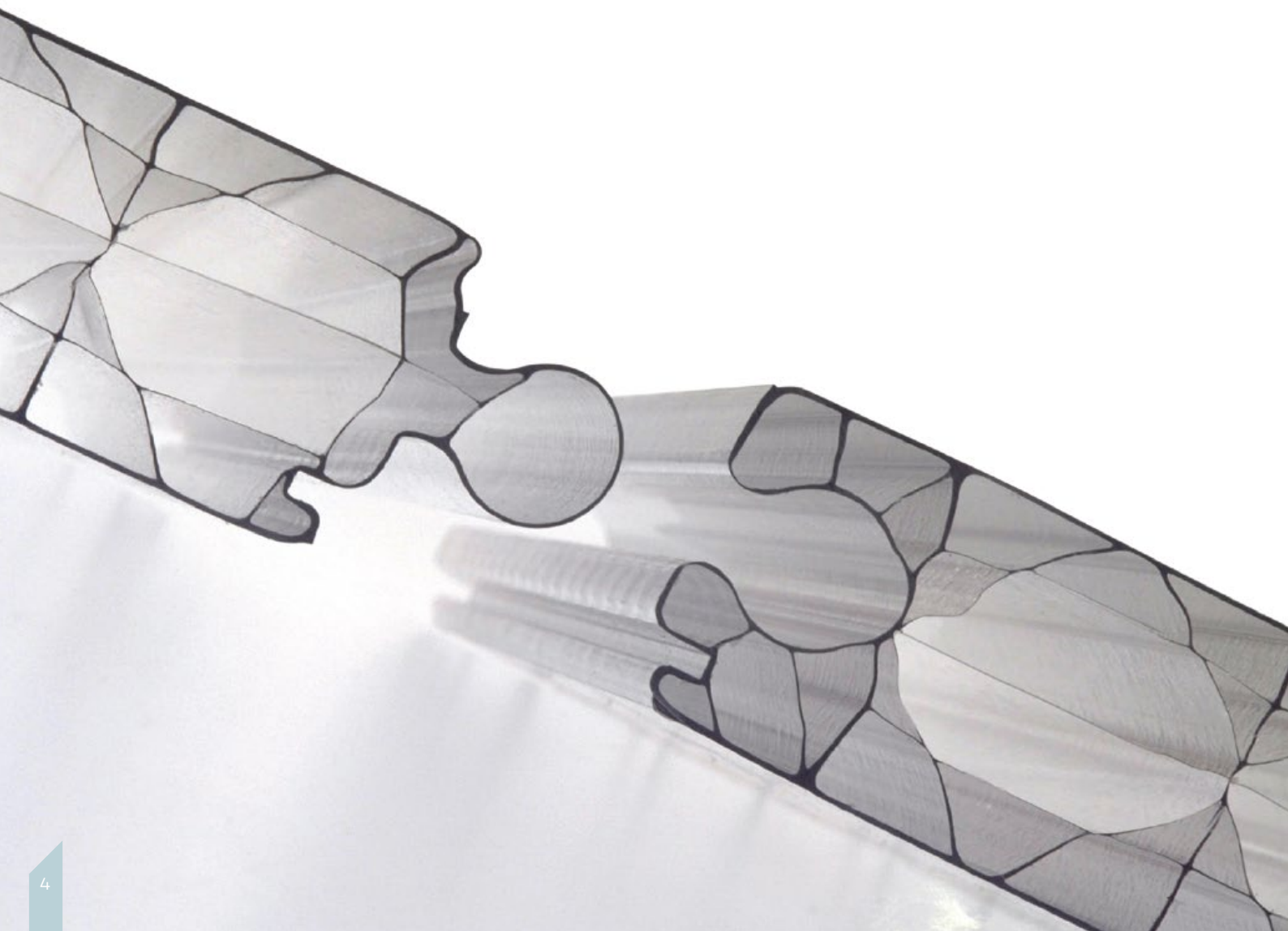
ABOUT POLYVANTIS

POLYVANTIS is committed to its customers around the world with a portfolio of Film & Sheet materials, application support and worldwide services.

We are a world-leading multi-material player for semi-finished plastic products. Our customers from a multitude of different industries can choose from an extensive range of high-quality products provided by a single source, including leading brands such as LEXAN™ film and sheet from polycarbonate resins and PLEXIGLAS® and ACRYLITE® for PMMA semi-finished products.

Our name stands for the variety of products we offer and our quest to secure progress in the area of polymers and related materials. POLYVANTIS offers innovative materials for different needs. The portfolio ranges from solid plastic sheets and films for a multitude of areas of application, through specialty products with custom properties, all the way up to the matching adhesives and auxiliaries. The POLYVANTIS umbrella unites strong plastics brands.

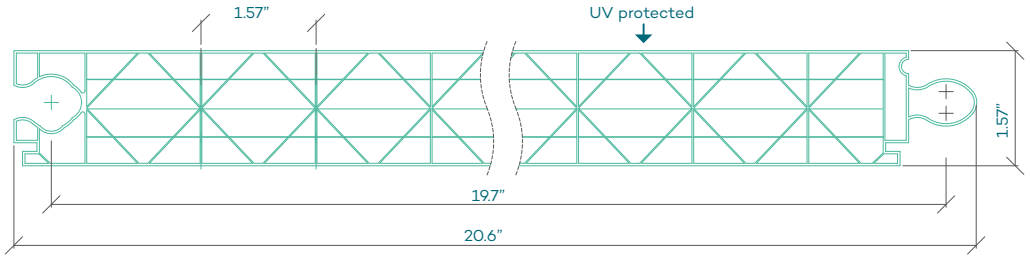
With 15 production sites across the United States, Europe, Asia and Africa, we offer innovative products and solutions for segments such as building and construction, transportation, aircraft & railway interiors, electrical engineering and electronics, automotive manufacturing and the home and garden sectors.



LEXAN™ THERMOCLICK™ sheet

LEXAN™ THERMOCLICK™ sheet LTC404X4000, is an impact resistant, energy-saving multi-wall sheet with profiled tongue and groove connection, including a groove for double sided tie on the inside.
This inter-connecting system eliminates the need for vertical profiles, thereby saving costs and enhancing aesthetics.

Figure 1



LEXAN™ THERMOCLICK™ SHEET LTC404X4000 OFFERS

- Unique four wall with X-structure
- UV protected outer surface
- Good light transmission and light diffusion characteristics
- Extremely high stiffness
- Excellent thermal insulation of 0.22 BTU/h ft²°F
- High impact strength
- 10 year limited warranty on breakage & weathering
- Easy and fast installation
- Wide range of colors and aesthetic effects

Table 1

PROPERTY PROFILE	VALUE	TEST METHOD
Panel width ctc	19.76" ± 0.098"	
Standard length	≤ 19.7 ft ± 0.8"	
	> 19.7 ft ± 1.18"	
Panel total thickness	1.57" ± 0.03"	
Weight	0.82 lb/SF ±5%	
Hail impact	diam. 0.79" v= 69 ft/sec	TNO Test
Temperature resist.	-40 up to +212°F	UL 746 BEN
Fire Rating	CC1, Class A	ASTM D635, E84
U-Value	0.22 BTU/h ft 2°F	ISO 10077 (EN673)
Sound insulation	21dB	EN ISO 10140-2:2010
Coeff. of linear thermal expansion	3.75 x 10-5 in/in °F	ASTM P696

LEXAN™ THERMOCLICK™ SHEET MECHANICAL PROPERTIES

Impact Strength

LEXAN™ THERMOCLICK™ sheet has outstanding impact performance over a wide temperature range of -40°F to +212°F. The product has been shown capable of withstanding many kinds of extreme weather, storms, hailstones, snowfall and ice formation.

Hail simulation

As a glazing material LEXAN THERMOCLICK sheet is subject to extremes of weather; storms, hailstones, wind, snowfalls and ice formation. Under these conditions, the product is virtually unbreakable and is able to withstand the sub-sequent temperature change to sunny conditions without breaking or buckling.

In a test developed by the Dutch Testing Institute TNO, samples of LEXAN THERMOCLICK sheet have been subjected to simulated hailstones of varying diameters without significant damage. Polyamide balls of varying diameters are shot at the surface of the THERMOCLICK sample using a pressurized airgun.

In practice, hailstones with a diameter of 0.79" can reach a terminal velocity of 69ft/s. Under these conditions, traditional roof glazing materials such as glass and acrylic fail.

It should be noted that when the glass and the acrylic are tested, their failure characteristics are typically brittle, while the LEXAN THERMOCLICK sheet shows ductile behavior - upon impact the ball will leave indentations but the sheet will not break.

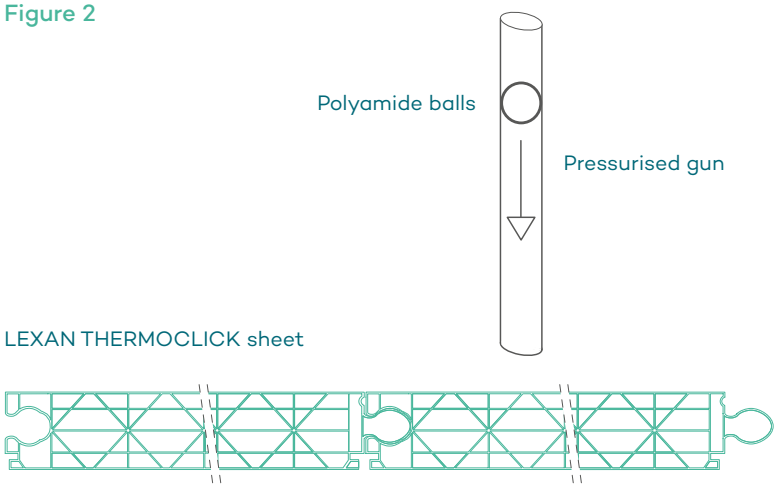
Table 2

HAIL SIMULATION TEST RESULTS	SIMULATION
Material	Velocity with ball diameter 0.79"
Acrylic multi-wall sheet t=0.36"	23-46 ft/s
Float glass t=0.16"	33 ft/s
LEXAN THERMOCLICK sheet t=1.57"	≥69 ft/s
Equilibrium velocity of hail	69 ft/s

UV protection

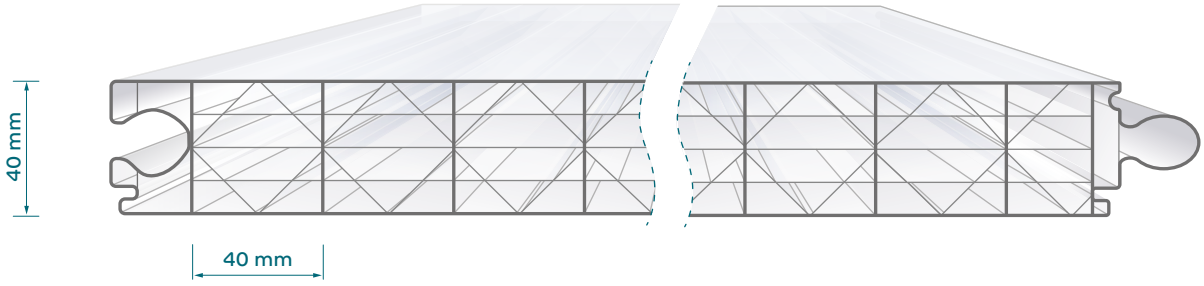
LEXAN THERMOCLICK sheet has one proprietary UV protected surface to help protect the system against the degrading effects of ultra violet radiation of sunlight and promotes long-term optical quality under many kinds of severe weather conditions. This UV protected surface, indicated on the masking, should always face outwards.

Figure 2



** POLYVANTIS offers a Ten Years Limited Warranty on LEXAN THERMOCLICK sheet covering loss of strength or impact due to weathering.

*** POLYVANTIS offers a ten year limited written warranty on LEXAN THERMOCLICK sheet covering discoloration, loss of light transmission and loss of impact strength due to weathering as more specifically defined in such warranty. Please consult your local distributor or POLYVANTIS Sales Office for more details.



LTC404X4000

Light / solar transmission properties

Solar heat gain within a building is caused by heat input from radiation emitted from the sun. Sunlight entering the building heats the air both directly and through absorption by the framework, furniture, etc. and is released as infrared energy. In combination with the insulating properties of LEXAN THERMOCLICK sheet, this prevents heat escaping faster than it is created causing a temperature increase, the so-called 'green-house effect'. The temperature can be controlled by venting, often in combination with specially tinted opal white or LEXAN THERMOCLICK Solar Control IR sheet which contains a proprietary additive which selectively absorbs the near infrared region of the light. LEXAN THERMOCLICK sheet is therefore available in many different colors or with an IR additive which both cut down the brightness of sunlight to a pleasing level and reduces heat build up inside the building. Calculations for solar heat input through glazing are normally based on data published in "The Institution of Heating and Ventilating Engineers Guide Book". These calculations are based on clear glass and correction factors or shading coefficients and are then applied when alternative glazing materials are used.

Table 3: THERMOCLICK colors

COLOR	COLOR	LT**	DIRECT ST**	TOTAL ST***	SOLAR HEAT GAIN COEFF.#	SHADING COEFF.##
LTC404X4000						
Clear	112	59%	56%	64%	0.64	0.73
Opal white	WH7A092X	50%	48%	57%	0.57	0.66
Blue	BL6C024T	20%	38%	51%	0.51	0.58
Green	GN7C018T	46%	44%	55%	0.55	0.63
Purple	VT5C010T	15%	41%	54%	0.54	0.62
Red	RD7C005T	27%	44%	56%	0.56	0.64
Orange	OR6C012T	34%	42%	59%	0.59	0.68
Yellow	YW9C007T	59%	52%	61%	0.61	0.70
LTCIR404X40						
Green	GN8B038T	38%	23%	40%	0.40	0.46

** Light Transmission (LT) and Direct Solar Transmission (Direct ST) acc. EN 410 as measured on 23.6" x 23.6" samples
*** Total Solar Transmission (Total ST) acc. EN 410 is the total solar energy that enters the interior of a building
# Solar heat gain coefficient or g-value is the total solar energy that enters the interior of a building, divided by 100
Shading coefficient or b-value is the ratio of the total solar energy that enters the interior of a building with a given material and the total solar energy that enters the interior of a building with a standard 0.118" glass panel

Thermal insulation

The multi-wall structure of LEXAN™ THERMO-CLICK™ sheet offers potential advantages where thermal insulation is a major consideration. The amount of energy transmitted through the material per square meter and per degree temperature difference, referred to as U-Value, is only 0.22BTU/h ft²°F.

Temperature resistance

LEXAN THERMOCLICK sheet is characterized by its excellent retention of impact strength and stiffness at elevated temperatures, even over an extended period. LEXAN THERMOCLICK sheet has a continuous use temperature rating of -40°F up to + 212°F.

Fire test performance

LEXAN THERMOCLICK sheet has good fire performance in accordance with many national fire standards. More detailed information is available from POLYVANTIS's service center or your local authorized dealer.

Storage

LEXAN THERMOCLICK sheet should be stored and protected against atmospheric influences like sun, rain, etc. Care should be exercised when handling and transporting LEXAN THERMOCLICK sheet in order to prevent scratches on the panel surface and damage to the panel edges.

Sawing

LEXAN THERMOCLICK sheet can be cut easily and accurately with most standard workshop equipment. This includes common circular, hand and hacksaws both with fine-toothed blades. The panel should be clamped to the worktable to avoid undesirable vibration and the sawdust should be blown out of the channels.

Figure 3: Typical glazing detail
Thermoplastic/alu glazing profile

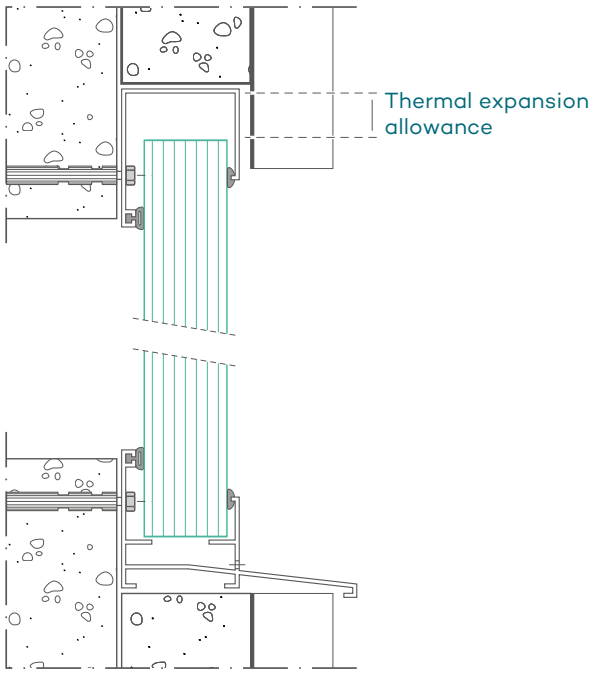
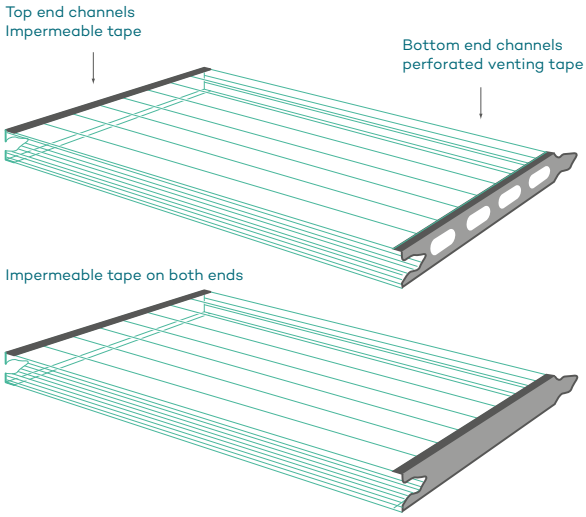


Figure 4



INSTALLATION GUIDELINES

Sealing recommendations

In order to minimize moisture build-up and dust contamination inside the channels, edge sealing of the open ended channels is very important. An impermeable tape and a perforating venting tape have been developed by the company Multifoil. Both tapes are available via your local authorized dealer.

Standard glazing

For standard glazing applications it is generally recommended to seal the top end channels with an impermeable tape and the bottom end channels with an anti-condensation venting tape. A clearance between the bottom panel end and the sash profile platform helps allow for condensation drainage.

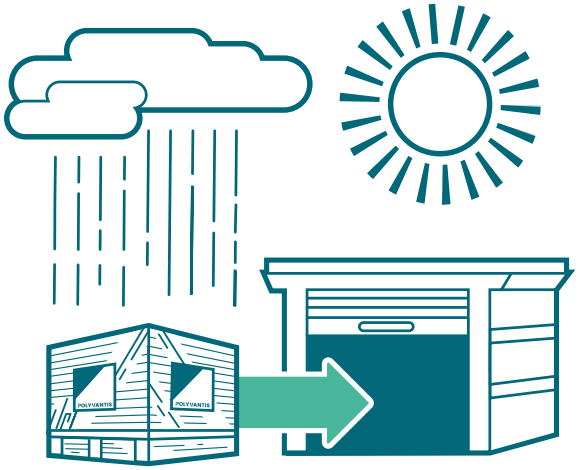
Specific conditions

In extremely dusty environments such as sawmills, welding stations, etc., it is usually advisable to seal both the top and bottom channel ends with an impermeable tape.

Thermal expansion allowance

Take into account a clearance of approximately 0.118" per 3.3 per linear meter between panel top edge and top glazing profile platform, and between the first and last panel side and side glazing profile platform. This thermal expansion clearance is already taken into account when using the special developed top and bottom glazing profiles indicated in this chapter.

Figure 5





LEXAN™ SHEET CLEANING RECOMMENDATIONS

These cleaning recommendations apply to all LEXAN™ polycarbonate sheet products, including, but not limited to, LEXAN solid sheet and sign grades, LEXAN™ MARGARD™ sheet and LEXAN™ THERMOCLEAR™ sheet. Periodic cleaning using correct procedures can help to prolong service life. For cleaning, it is recommended that the following instructions be adhered to:

Cleaning Procedure for Small Areas – Manual

1. Gently wash sheet with a solution of mild soap and lukewarm water, using a soft, grid-free cloth or sponge to loosen any dirt or grime.
2. Fresh paint splashes, grease and smeared glazing compounds can be removed easily before drying by rubbing lightly with a soft cloth using petroleum ether (BP65), hexane or heptane. Afterwards, wash the sheet using mild soap and lukewarm water.
3. Scratches and minor abrasions can be minimized by using a mild automobile polish. We suggest that a test be made on a small area of LEXAN sheet with the polish selected and that the polish manufacturer's instructions be followed, prior to using the polish on the entire sheet.
4. Finally, thoroughly rinse with clean water to remove any cleaner residue and dry the surface with a soft cloth to prevent water spotting.



Cleaning Procedure for Large Areas - Automated

1. Clean the surface using a high-pressure water cleaner (max. 100bar or 1,450psi) and/or a steam cleaner.
   We suggest that a test be made on a small area, prior to cleaning the entire sheet.
2. Use of additives to the water and/or steam should be avoided.

Other Important Instructions for All LEXAN sheets:

- Never use abrasive or highly alkaline cleaner on LEXAN sheet materials.
- Never use aromatic or halogenated solvents like toluene, benzene, gasoline, acetone or carbon tetrachloride on LEXAN polycarbonate materials.
- Use of incompatible cleaning materials with LEXAN sheet can cause structural and/or surface damage.
- Contact with harsh solvents such as methyl ethyl ketone (MEK) or hydrochloric acid can result in surface degradation and possible crazing of LEXAN sheet.
- Never scrub with brushes, steel wool or other abrasive materials.
- Never use squeegees, razorblades or other sharp instruments to remove deposits or spots.
- Do not clean LEXAN sheet in direct sunlight or at high temperatures as this can lead to staining.
- For all mentioned chemicals consult the manufacturer's material safety datasheet (MSDS) for proper safety precautions.

Additional Important Considerations for Multiwall, Corrugated and Sign sheet:

- Cleaners and solvents generally recommended for use on polycarbonate are not necessarily compatible with the UV-protected surfaces of LEXAN multiwall, corrugated and sign polycarbonate materials.
- Do not use alcohols on the UV-protected surfaces of LEXAN sheet.
- Never clean the Dripgard surface of LEXAN multiwall and corrugated sheets

WIND AND SNOW LOADING

Dynamic wind pressure

The wind speed is used to determine the actual loading upon the glazing panels. In mathematical terms, the pressure loading is calculated by multiplying the square of the design wind speed by 0.613.

$p = KV^2$
Where p = dynamic wind pressure in (lbf/ft^2)
K = 0.613
V = design wind speed in meters/second

Table 4: Values of p in SI units (lbf/ft^2)

WIND SPEED	WIND PRESSURE	WIND SPEED	WIND PRESSURE
ft/s	lbf/ft^2	ft/s	lbf/ft^2
33	1.3	131	20.5
49	2.9	148	25.9
66	5.1	164	32.0
82	8.0	180	38.6
98	11.5	197	46.2
115	15.7	213	54.1

Table 5: The Beaufort scale transforms wind into static pressure

WIND	LIGHT	MODERATE	STRONG	STORM
Speed (m/h)	11.4	25-37	50-62	75-140
Speed (ft/sec)	20	36-56	72-92	108-128
Static pressure (lbf/ft^2)	0.4	1.7-3.5	6.3-10.2	14.2-19.8

Pressure coefficient

To allow for local fluctuations in the acceleration/deceleration of the wind by building or glazing geometry, it is necessary to include an appropriate pressure coefficient. Determining pressure coefficients requires knowledge of

- Form and type of building
- Height of glazing
- Shape of glazing e.g.
  - flat vertical
  - inclined roofing
  - curved glazing

The wind loading is obtained by multiplying the dynamic wind pressure by the pressure coefficient. The total wind loading can be positive indicating a wind pressure load or negative indicating a wind suction load. Detailed pressure coefficient values can be found in the appropriate national building norms.

Snow loading

Snow loading on the roof glazings can be considered equivalent to a vertically, uniformly distributed load, acting per ft^2 of the horizontal projection of the glazing. A roof made of LEXAN™ THERMOCLICK™ sheet does not permit immediate melting of the snow, due to its excellent thermal insulation, and therefore the load produced by the snow must be carefully taken into consideration.

Indicative snow weights per 1/2" of height are as follows
- fresh snowfall - 0.16-0.39 lb/ft^2 per 1/2 "
- wet snowfall - 0.57 lbf/ft^2 per 1/2 "

Snow loading factors can be obtained from the appropriate local building norm.



Vertical wall glazing

This chapter illustrates some glazing proposals using commercially available aluminum glazing profiles which have been proven to be successful in combination with LEXAN™ THERMOCLICK™ sheet. A wide range of easy to use aluminum glazing profiles and metal fastener clips are available at the vast majority of authorized LEXAN THERMOCLICK sheet distributors and specialized installers. LEXAN THERMOCLICK sheet can be installed either from inside the building or from the outside.

Maximum recommended span 'H'

LEXAN THERMOCLICK sheet glazing recommendations without intermediate purlins.

WIND SUCTION (LBF/FT²)	MAXIMUM RECOMMENDED SPAN 'H' (FOOT)
12.5	7.9
18.8	6.9
25.0	5.9
31.3	5.2
37.6	4.6

When the glazing height exceeds the maximum recommended span 'H', intermediate horizontal purlins should be used to support the LEXAN THERMOCLICK sheet. LEXAN THERMOCLICK sheet may be fixed to these purlins using special non-rusting metal fastening clips positioned in the double sided tie on both panel sides. The distance between the horizontal intermediate purlins should not exceed the maximum recommended span dimensions 'P' as indicated in the table below.

Figure 5

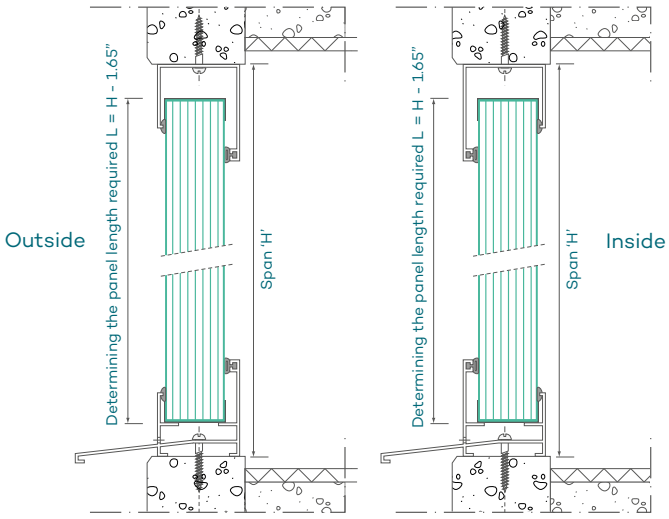


Figure 6

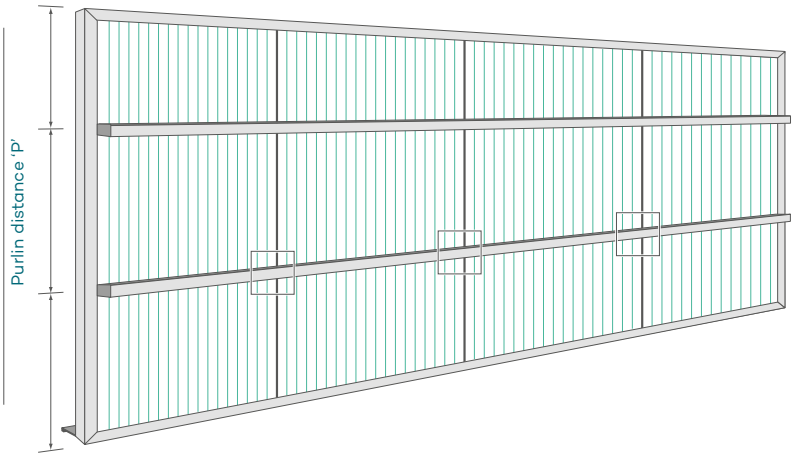
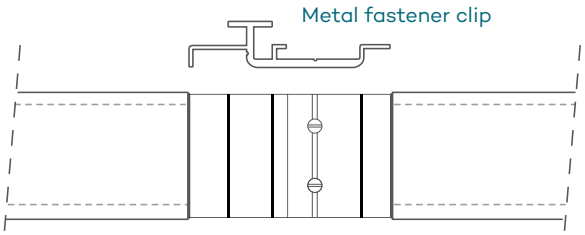


Figure 7



Maximum recommended span 'P'

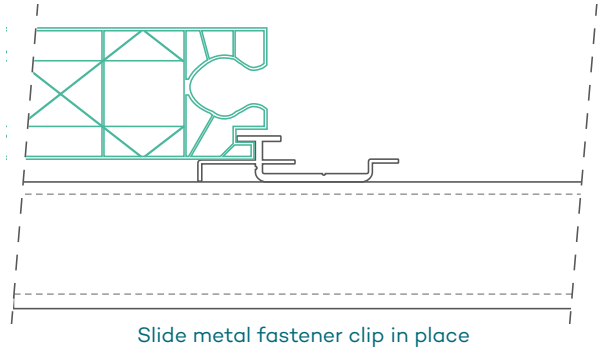
LEXAN™ THERMOCLICK™ sheet glazing recommendations with intermediate purlins and clip length of 2.95".

WIND SUCTION (LBF/FT²)	MAXIMUM RECOMMENDED SPAN 'P' (FOOT)
12.5	7.2
18.8	6.6
25.0	5.9
31.3	5.2
37.6	4.6

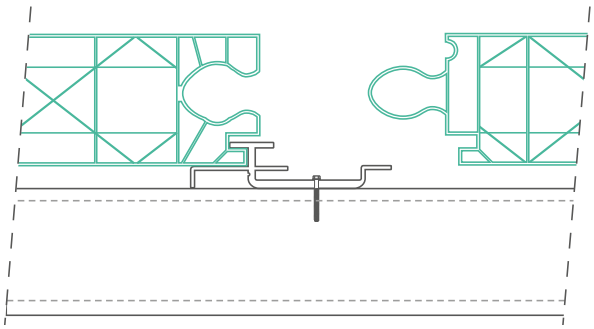
Alternative for connecting panels

Using the aluminum top and bottom glazing profiles, bolted to the intermediate purlins is a good alternative for connecting LEXAN THERMOCLICK sheet when the glazing height exceeds the maximum allowable span 'H'.

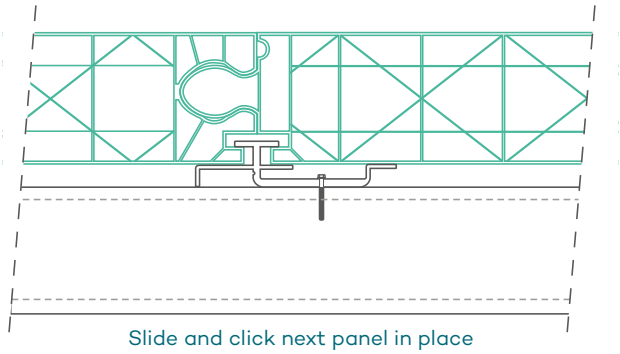
Figure 8



Slide metal fastener clip in place

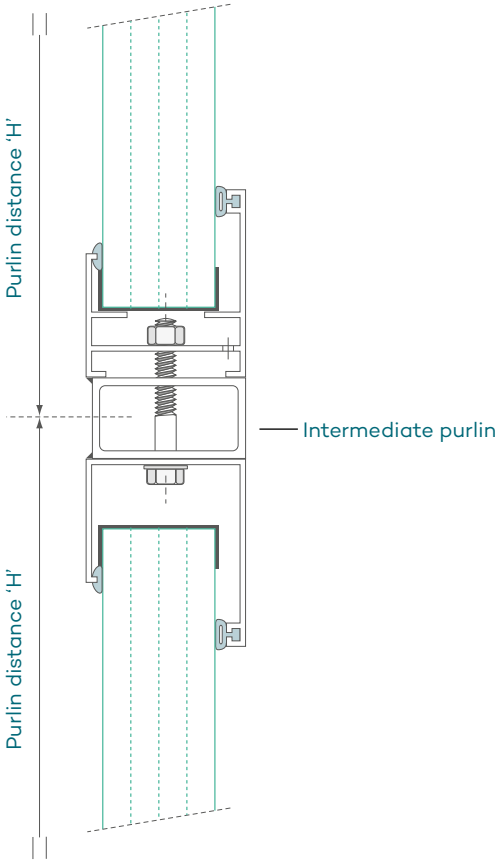


Bolt clip to purlin



Slide and click next panel in place

Figure 9



NOTES

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