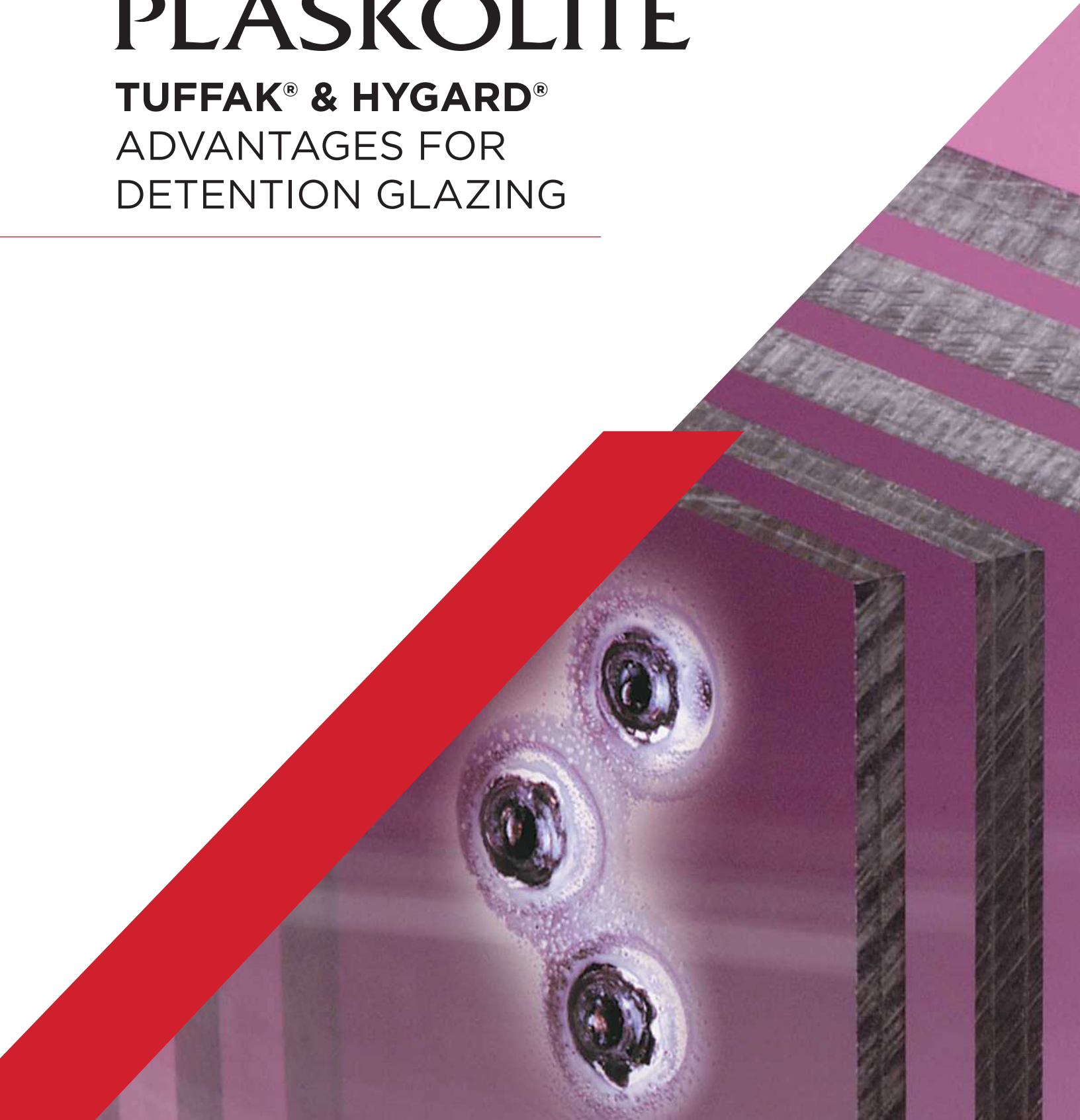


PLASKOLITE

TUFFAK® & HYGARD®

ADVANTAGES FOR
DETENTION GLAZING



HYGARD & TUFFAK

...PROTECTION AGAINST FORCED ENTRY ATTEMPTS OR ATTACKS TO AESTHETICS OR INTEGRITY

Plaskolite has built a reputation for quality polycarbonate materials

With a complete line of containment, forced entry, and ballistic rated polycarbonate products, Plaskolite is committed to supplying high quality security glazing materials to commercial, public, private, and government buildings.

Based on the virtually unbreakable TUFFAK polycarbonate sheet, the products maintain an aesthetically pleasing, glass-like appearance while providing forced entry and ballistics resistance. Performance has been tested by accredited laboratories and the results show the materials are an effective first level of defense against attack or unlawful entry and gives time for law enforcement officials to gain control.



The TUFFAK and HYGARD** Advantages

- » Detention glazing
- » Virtually unbreakable
- » Exceptionally durable
- » Optically clear
- » Forced entry protection
- » Ballistic rating
- » Reduced Weight: Approximately 50% lighter than glass laminate of the same thickness
- » No spall – providing an extra level of protection.
- » Won't spider web or white-out – clear line of site under attack
- » TUFFAK and HYGARD products feature a hard coat that resists abrasion, chemical, and graffiti attack
- » TUFFAK15 sheet has a 15-year limited product warranty
See website for details – www.plaskolite.com
- » HYGARD products offer a 7-year limited product warranty
See website for details – www.plaskolite.com

Security Tests & Product Ratings Overview

Forced Entry Test, Ratings					Ballistics Tests, Ratings		
Product	Gauge Inches	ASTM F1233 Class Achieved	ASTM F1915 Security Grade	HPW TP-0500 Level	HPW TP-0500 Level	UL 752 Level	NIJ 0108 Level
AR/15	.500	2.0 BP* / 1.4 C*	3	I			
CG 375	.390	2.88 BP / 1.5 C	3	I	A		
CG 500	.530	3.2 BP / 1.5 C	1	I	A		
CG 750	.780	3.5 BP / 2.4 C	1	II	B		
BR 750	.780				B	1	
BR 1000	1.05	5.0 BP / 2.4 C	1	IV		2	
BR 1250	1.30	5.0 BP / 2.5 C	1	IV		3	II / IIIA
MS 1250	1.30					6	

* BP - Body Passage; C - Contraband

As with any security glazing, performance of HYGARD products is based on use in appropriate framing systems.

For information on glazing system suppliers and full details on performance, test results and agency listings, visit www.plaskolite.com.

**Please see product data sheet for additional information.

HYGARD LAMINATE

THE ULTIMATE SECURITY PRODUCT WITH AR HARD-COAT TECHNOLOGY PROVIDES EXCEPTIONAL RESISTANCE FOR ABRASION AND UV DEGRADATION

Plaskolite is a recognized market leader in the production of high performance thermoplastic sheet for over half a century. As a global leader of high performance polycarbonate glazing products, Plaskolite has been at the forefront of security glazing innovation. Plaskolite's laminated sheet products, featuring TUFFAK AR hard-coat technology, assures long lasting surface clarity and resistance to yellowing. Whatever the security application, HYGARD laminates offer unsurpassed performance versus competitive glass and glass clad polycarbonate products.

With its unique multilayer construction, HYGARD can protect against both physical attack and gunfire from high powered hand guns. This laminate line offers multiple levels of protection ranging from certified containment glazing to Level 6 bullet-resistant material.

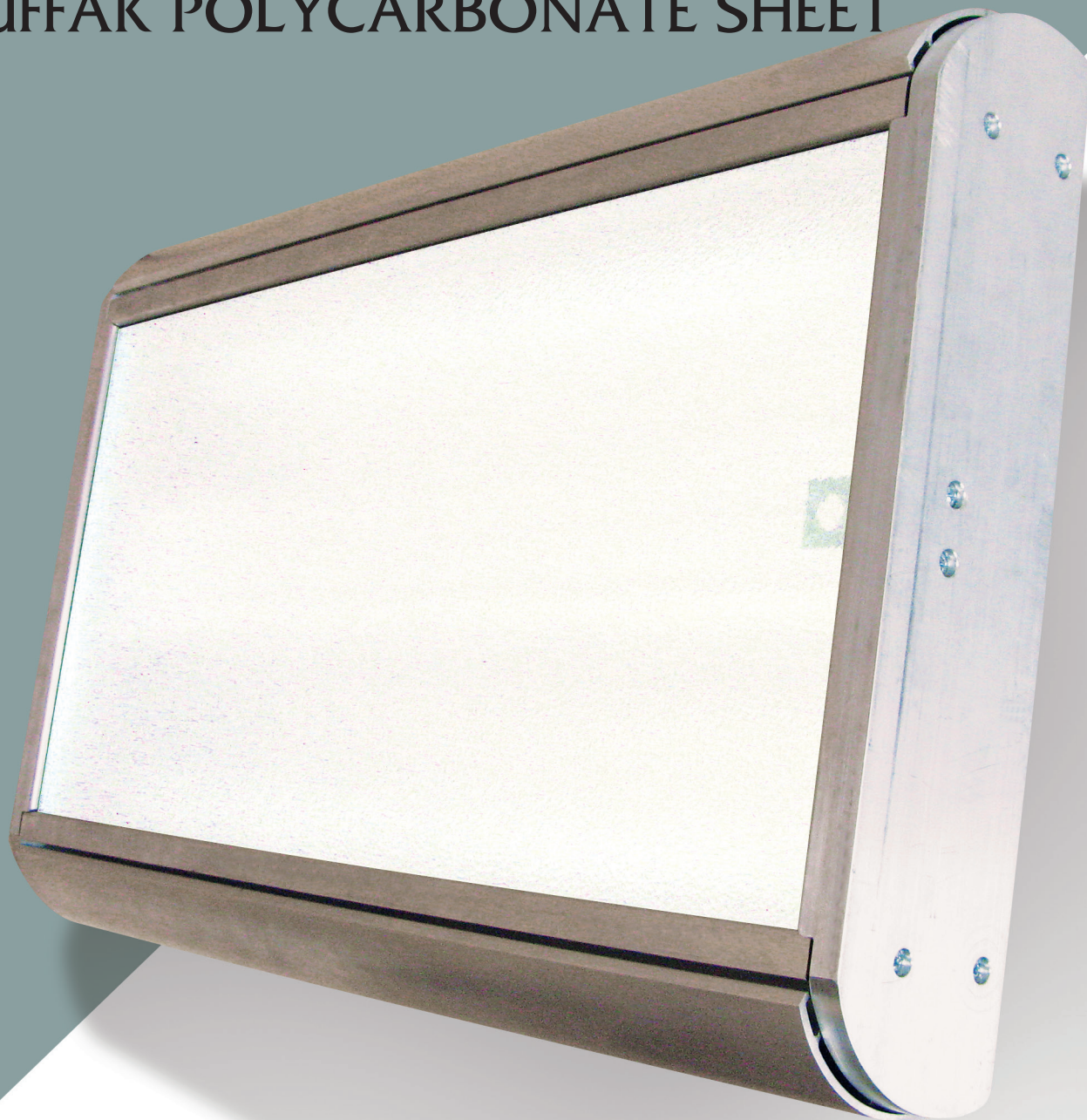
HYGARD laminates will not "spider web" or spall. This allows for clear line of sight, which can be critical for appropriate response in the event of an attack.

Designed for security installations such as detention and correctional centers, government facilities, and banks, HYGARD is being used increasingly for protection in gas stations, convenience stores and other cash transaction areas.

- » Jails/Prisons
- » Detention Centers
- » Correctional Facilities
- » Psychiatric Hospitals
- » Government Facilities
- » Physical Attack Areas
- » Educational Facilities
- » Gas Stations and Convenience Stores
- » Drive-Up Windows
- » Bus Shelters
- » Ticket Booths
- » Kiosks
- » Banks



TUFFAK POLYCARBONATE SHEET



TUFFAK GP PRISMATIC

TUFFAK GP Prismatic is virtually unbreakable and an excellent choice for lighting lenses, privacy panels and security glazing.

This prismatic pattern has been optimized for light diffusion and high light transmission, making it an excellent choice for most conventional lighting applications. This textured product features outstanding impact strength, high temperature resistance, superior dimensional stability, and is easy to fabricate.

- » TUFFAK Prismatic sheet is certified under ICC-ESR #2728 as a CC1 burn rated product @ 0.060" - 0.500"
- » ANSI/UL972 #BP2126 Approved Burglary Resistant Glazing Material
- » UL94 File #E87887 - HB Flammability Rated

TUFFAK LUMEN XT

TUFFAK Lumen XT sheet is a translucent polycarbonate product with a textured surface on one side specifically designed for lighting lenses. It features a unique combination of high light diffusion and high light transmission through a combination of optimized surface texture and advanced diffuser technologies.

When compared to other light diffusing products such as glass and acrylic, TUFFAK Lumen XT sheet has superior impact strength and toughness. Its higher flammability resistance and wider service temperature range provide an additional performance advantage over acrylic diffusers.

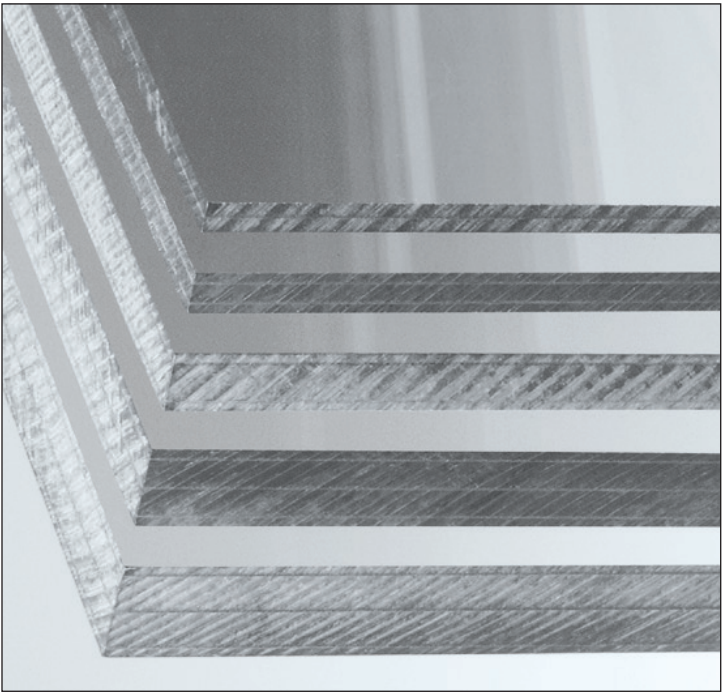
- » TUFFAK Lumen XT and Lumen XTV sheets are approved as ASTM D635 CC1 burn rated products @ 0.060" - 0.118"
- » UL94 File #E87887 - Lumen XT: V-2 Flammability Rated, Lumen XT-V: V-0, 5VA Flammability Rated

FABRICATION

HYGARD laminates and TUFFAK WG and MG plate products are designed for heavy fabrication.

It is possible to fabricate parts with tight tolerance design using standard cutting tools. Use carbide-tipped cutters for greater duability and a cleaner cut edge. Leave the masking on the product while fabricating to protect against surface damage. Remove masking soon after installation as prolonged outdoor exposure degrades the film making it difficult or impossible to remove.

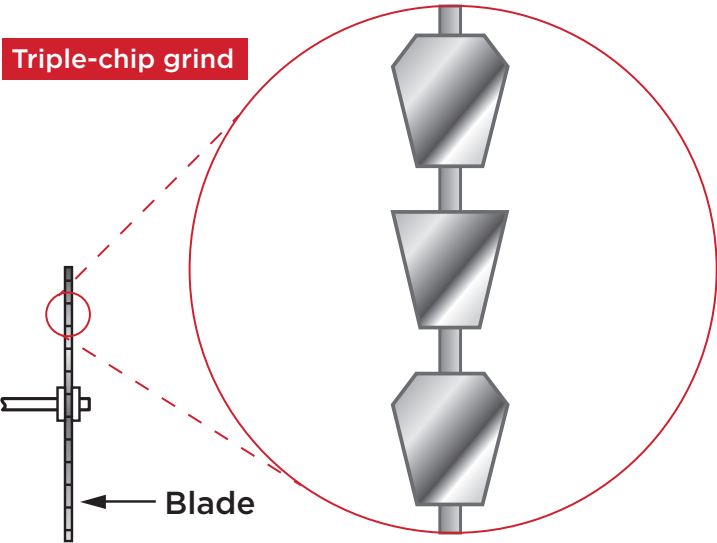
Proper fabricating practices are especially important when cutting parts intended for security applications. This ensures product integrity with respect to strength properties and performance ratings. Sharp cutting tools are important, as is feed rate control. To avoid material overheating, decrease cutting speed and feed rate.



CIRCULAR SAWING

Use a carbide-tipped, circular saw blade with triple chip tooth design. It allows for cleaner cuts and greater durability than high- strength steel. Blade is hollow-ground, and slotted for expansion and cooling. Recommended blade cutting speed is 5000-6000 ft/min.

Circular saw blade and cutting	
Cutting speed (ft/min)	5000 - 6000
Blade	~3 teeth/inch



Circular saw troubleshooting

PROBLEM: Melting or Gummed Edges

SUGGESTED SOLUTIONS:

- 1. Increase blade tooth size
- 2. Reduce saw speed
- 3. Increase feed rate
- 4. Use compressed air to cool blade
- 5. Inspect blade for sharpness
- 6. Check blade-fence alignment
- 7. Reduce number of sheets in stack

PROBLEM: Chipping

SUGGESTED SOLUTIONS:

- 1. Decrease blade tooth size
- 2. Increase saw size
- 3. Provide better clamping/support for sheet stack
- 4. Reduce feed rate
- 5. Check blade and arbor for wobble
- 6. Inspect blade for sharpness

TECH TIP:

The edges of HYGARD laminates are not protected with abrasion and chemical resistant hard coating. Do not allow cleaning solutions and solvents to pool along the edges for any length of time. Always rinse edges thoroughly with generous amounts of lukewarm, clean water.

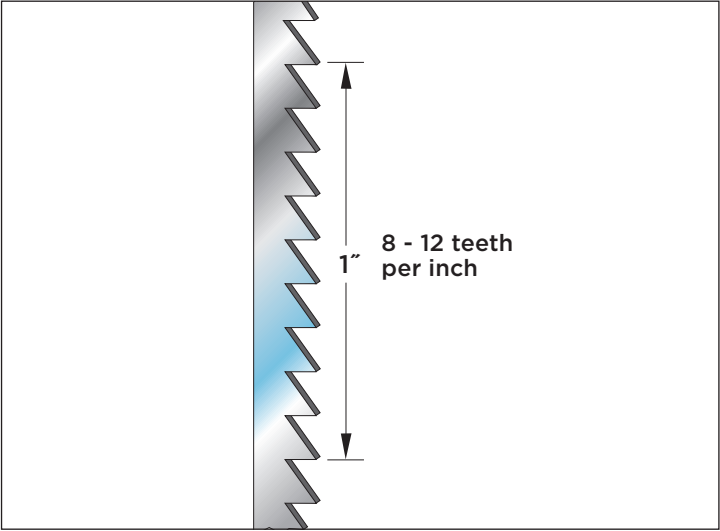
FABRICATION

BAND SAWING

HYGARD laminates, TUFFAK WG and MG products, can be band saw cut with blades having 8-12 teeth per inch. Carefully choose feed rates and blade speed to avoid gumming or melting the plastic edge.

Pitch (teeth/inch)	Band speed (ft/min.)	Blade set (inch)
8 - 12	2500 - 3000	0.020 - 0.030

Band saw blade design



TECH TIP:

Solvent polishing edges of a laminated sheet is not recommended due to the possibility of the TPU bonding layer absorbing the solvent and swelling, resulting in the potential delamination of the product. Microcracking may also occur along solvent polished edges.

TECH TIP:

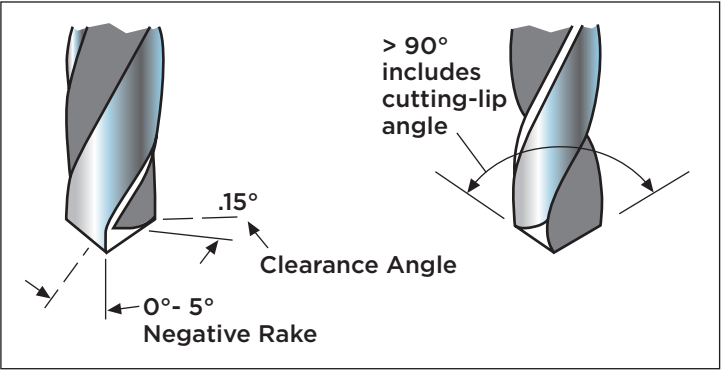
Laser cutting of HYGARD laminates is not recommended due to increased stress level and higher risk for discolored edges. Water jet cutting of laminates is not recommended due to the potential for delamination.

DRILLING

While standard drills and bits can be used when fabricating HYGARD laminates, TUFFAK WG and MG products, those specifically designed for use with plastics perform with greater precision. Drills for plastics generally have wide, polished flutes to reduce friction, as well as spiral or helix designs to remove chips quickly.

» Use drill-point angles larger than 90 degrees

Drill bit design



General guidelines for drilling HYGARD laminates, TUFFAK WG and MG:

- » Use carbide-tipped drills, they resist gumming and maintain edge sharpness longer than standard drills
- » Avoid cutting fluids; most are not compatible with polycarbonate
- » Cool work if necessary by forced-air stream
- » Avoid drilling into the edge of laminated sheets due to possible loss of interlayer adhesion

Use sharp drills for cleanest cut and frequently clear the hole of chips. Avoid overheating as stress buildup in the material may have an adverse effect on mechanical properties compromising product performance and reliability. If drilling holes, place them no closer than 2 times the diameter of the hole from the edge. Avoid holes in parts intended for ballistic rated applications.

Hole diameter	Drill speed (rpm)
1/8"	1750
1/4"	1050 - 1500
1/2"	350 - 500

RESOURCE ON DRILLING AND ROUTER CUTTING:

<https://www.onsrud.com/plusdocs/Doc/list.html?pg=0&sf=code&sd=d&model.category=TECH>

FABRICATION

MILLING/ROUTING

To cut clean edges on HYGARD laminates and TUFFAK WG and MG, use straight, 2-3 fluted carbide tipped or high-speed bits, and router speeds of 20,000- 25,000 rpm. Feed sheet against the router bit rotation at a controlled rate to avoid overheating, minimize vibration and produce a smooth part edge. Use a fence for sizing when making straight cuts.

Summary on cutting:

- » Use only sharp cutters
- » Drill holes slightly oversized
- » Drill holes off sheet edge by distance at least 2 times diameter of hole
- » Countersink is not recommended, counter-bore is acceptable in heavy gauge sheet
- » Countersink and counter-bore is not recommended for HYGARD laminates
- » As cooling medium use forced air, not cutting fluids
- » Do not allow material to overheat
- » Cut edges must be smooth; sand coarse surfaces and chatter marks
- » Leave masking on product during fabrication, remove soon after installation
- » Use cleaners compatible with polycarbonate. If unsure, consult with manufacturer before use

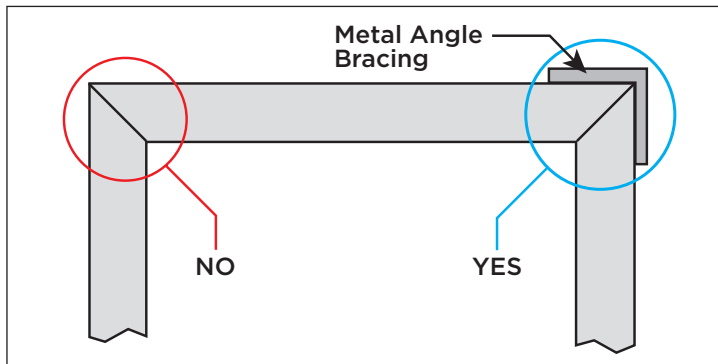
FRAME DESIGN

Select a metal frame that matches the same level of security-rated protection as the specified HYGARD laminate.

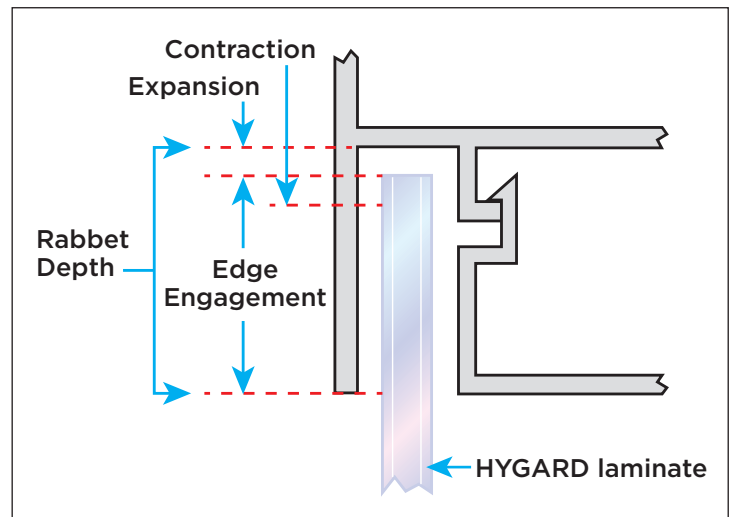
Corner design

Mitered corners require added bracing. Attach metal angle bracing at the corners to strengthen the overall frame.

For optimal frame design, use a continuous metal extrusion.



Product performance relies heavily on the method of attachment, the assembly and the potential for thermal expansion.



Glazing recommendations

- » Frame system must meet or exceed Hygard laminate ballistic rating
- » HYGARD laminate dimension must allow for at least 1 inch edge engagement
- » Use only gaskets, tapes and sealants compatible with polycarbonate

- » Use setting block strips of polycarbonate, EPDM, neoprene or Santoprene® synthetic rubber
 - » Remove protective masking soon after completing the installation, as prolonged exposure to the outdoors will degrade the film making it difficult or impossible to remove
- Santoprene® is a registered trademark of Exxon Mobil Corporation

PLASKOLITE

NORTH AMERICA'S LEADING MANUFACTURER OF THERMOPLASTIC SHEET

FOUNDED IN 1950

Our Mission: to deliver superior thermoplastic sheet, coatings and polymers to the world, through long-lasting customer relationships and hands-on customer service.

MANUFACTURING LOCATIONS



From our founding, PLASKOLITE strives to treat our employees, our customers, our community and the world, with kindness, dignity and respect. This drives our continuing effort to create sustainable products, in a sustainable manner, for future generations. This on-going commitment is expressed in the

PLASKOLITE Sustainable Ecosystem:

QUICK FACTS

STATUS: Privately held

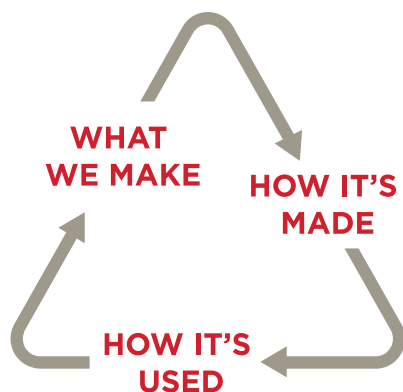
GLOBAL HEADQUARTERS: Columbus, OH

EMPLOYEES: 2200 Worldwide

MARKETS SERVED: Signage, Lighting, Retail Display, Construction, Transportation, Security, Bat & Spa, Industrial, Architecture, Green Houses

OUR PILLARS OF SUSTAINABILITY

EACH CONTRIBUTES TO MAKING THE WORLD A BETTER PLACE



WHAT WE MAKE

Versatile, high-quality, durable thermoplastic materials...not single-use plastics

HOW IT'S MADE

How we make our products reflects our overall philosophy of continuous environmental improvement

HOW IT'S USED

Our thermoplastics play an important role in advancing human well-being, energy conservation and quality of life

These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee, as conditions and methods of use are beyond our control. We recommend that the prospective user determines the suitability of our materials and suggestions before adopting them on a commercial scale.

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