MAKROLON HYGARD®
POLYCARBONATE SHEET

...Ideal for Security, Forced Entry, and Bullet Resistant Applications

Sheffield Plastics Inc.
A Bayer MaterialsScience Company
MAKROLON® MAKHYBRO 1206

Sheffield Plastics Inc. is a recognized market leader in the production of high performance thermoplastic sheet for over half a century. As one of the leading suppliers of high performance polycarbonate glazing products, Sheffield has been at the forefront of security glazing for years. Sheffield’s new generation of laminates, featuring MAKROLON AR hard-coat technology, assures long lasting surface clarity and resistance to yellowing. Whatever the security application, MAKROLON HYGARD laminates offer unsurpassed performance versus competitive glass and glass clad polycarbonate products.

With its unique multilayer construction, MAKROLON HYGARD can withstand both physical attack and gunfire from high powered hand guns. This “None Tougher” laminate line offers multiple levels of protection ranging from certified containment glazing to Level 3 bullet-resistant material.

MAKROLON HYGARD laminates will not “spider web” or spall. This allows for complete vision, which can be critical for appropriate response in the event of an attack.

MAKROLON HYGARD®—The Ultimate Security Product

AR Hard-Coat Technology Provides Exceptional Resistance to Physical Attack, Abrasion, and UV Degradation

Designed for security installations such as detention and correctional centers, government facilities, and banks, MAKROLON HYGARD is being used increasingly for employee protection in 24-hour gas stations and convenience stores as well as other cash transaction areas.

- Jails/Prisons
- Detention Centers
- Correctional Facilities
- Psychiatric Hospitals
- Government Facilities
- Physical Attack Areas
- Schools and Institutions
- 24-Hour Gas Stations and Convenience Stores
- Drive-Up Windows
- Train/Bus Glazing
- Bus Shelters
- Ticket Booths
- Kiosks
- Banks

Typical applications include:

- Jails/Prisons
- Detention Centers
- Correctional Facilities
- Psychiatric Hospitals
- Government Facilities
- Physical Attack Areas
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- 24-Hour Gas Stations and Convenience Stores
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MAKROLON HYGARD®–
Combines MAKROLON AR Technology with the Latest Security Glazing Techniques for High Level Security and Cost Effective Installation

Increasing violent crime, readily available weapons, and larger glazed areas in modern detention center designs have created a need for higher performing security glazing materials. Sheffield Plastics has developed MAKROLON HYGARD to meet this need. Consisting of multiple layers of polycarbonate or polycarbonate/ acrylic with bonding interlayers, these “None Tougher”, yet lightweight materials, offer proven resistance to physical and ballistic attack. Additionally, the relative light weight of MAKROLON HYGARD laminates, combined with easy on-site fabrication, give you a competitive edge on remodeling or retrofit projects where timely job completion is essential. Sheffield offers MAKROLON HYGARD laminates in six levels of protection ranging from containment rated sheet to UL Level 3 bullet resistant material capable of withstanding multiple rounds fired from super-powered handguns. All MAKROLON HYGARD laminated products feature hard coated surfaces for exceptional resistance to abrasion and UV degradation and are covered by a limited warranty against coating failure, excessive yellowing, and structural delamination caused by manufacturing defects.

MAKROLON® AR
Abrasion Resistant

MAKROLON AR offers the dual protection of impact strength and superior hard-coat. MAKROLON AR, polycarbonate coating is manufactured to demanding specifications for long lasting performance when the glazing materials are exposed to graffiti, vandalism, and chemical attack. This “None Tougher” material can withstand punishing abuse as it maintains superior clarity and protection when subjected to repeated contact from cyclical cleaning and vandalism. In addition to being easy to clean, MAKROLON AR can also reduce replacement costs. Every sheet of MAKROLON AR carries a limited warranty against breakage, coating delamination, yellowing, and hazing.

Chemical Resistance

Based on tests dated 6/12/02, MAKROLON AR 3/8 satisfied modified forced entry resistance requirements of HPW-TP-0500-02, Level I

H.P. White TP0500-02 and AST ballistic and sequent criteria, these laminates have proven performance. No material can withstand physical attack indefinitely. MAKROLON HYGARD laminates offer sufficient protection in riot situations to protect employees while regular operations are under way.

Chemical Resistance

MAKROLON AR Sheet

Samples tested per ASTM D1308

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>&lt;24 hrs.</td>
</tr>
<tr>
<td>Ethylene Dichloride</td>
<td>&gt;24 hrs.</td>
</tr>
<tr>
<td>Gasoline</td>
<td>&gt;24 hrs.</td>
</tr>
<tr>
<td>Hydrochloric Acids  (10%)</td>
<td>&gt;24 hrs.</td>
</tr>
<tr>
<td>Methyl Alcohol</td>
<td>&gt;24 hrs.</td>
</tr>
<tr>
<td>Nitric Acid (100%)</td>
<td>&lt;24 hrs.</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>&lt;24 hrs.</td>
</tr>
<tr>
<td>Sulfuric Acid (1%)</td>
<td>&gt;24 hrs.</td>
</tr>
</tbody>
</table>

Sheetfild Plastics Inc. will not be held responsible for determination of its suitability for the fitness of any product.
**MAKROLON HYGARD®—The Ultimate Security Product...Gives You Top Industry Containment Ratings, Ballistics Testing, and UL Listings**

**MAKROLON HYGARD Laminates**

**Tested to H.P. White TP0500.02 and ASTM F1233 ballistic and sequential attack criteria, these laminates offer proven performance. While no material can withstand physical attack indefinitely, MAKROLON HYGARD laminates offer sufficient time in riot situations to protect employees while rescue operations are underway.**

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**H.P. White TP0500.02-Ballistic/Forced Entry—Actual Ratings**

<table>
<thead>
<tr>
<th>Phase I Ballistic Gauge</th>
<th>Level A (38 Special)</th>
<th>Level B (.44 Mag)</th>
<th>Level C (.357)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ply</td>
<td>3/16 MAKROLON AR</td>
<td>1/8 MAKROLON AR</td>
<td>.390 (± 5%)</td>
</tr>
<tr>
<td>3 ply</td>
<td></td>
<td>Interlayer</td>
<td>2.4</td>
</tr>
<tr>
<td>4 ply</td>
<td>Interlayer</td>
<td></td>
<td>.92 (± 5%)</td>
</tr>
<tr>
<td></td>
<td>Interlayer</td>
<td></td>
<td>.88 (± 5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UL 752 - Bullet-Resistant—Actual Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating</td>
</tr>
<tr>
<td>Weapon</td>
</tr>
<tr>
<td>Grain</td>
</tr>
<tr>
<td>Ammunition</td>
</tr>
<tr>
<td>Muzzle Velocity</td>
</tr>
<tr>
<td>Muzzle Energy</td>
</tr>
<tr>
<td>Level 1 - Medium Power Small Arms</td>
</tr>
<tr>
<td>Level II - High Power Small Arms</td>
</tr>
<tr>
<td>Level III - Super Power Small Arms</td>
</tr>
<tr>
<td>Level IV - Total Forcible Entry Sequences</td>
</tr>
<tr>
<td>Level V - UL 752 - Bullet-Resistant</td>
</tr>
<tr>
<td>Level C - Phase II First Ballistic</td>
</tr>
<tr>
<td>Level D - Phase II Forced Entry</td>
</tr>
<tr>
<td>Total Forcible Entry Sequences</td>
</tr>
<tr>
<td>Level E - UL 752 - Bullet-Resistant</td>
</tr>
</tbody>
</table>

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**MAKROLON HYGARD CG375**

- HPW Level II Step 12
- HPW TP0500.02 Level A Ballistics
  - (38 Special)

**MAKROLON HYGARD CG500**

- HPW Level II Step 12
- HPW TP0500.02 Level A Ballistics
  - (38 Special)

**MAKROLON HYGARD CG750**

- HPW Level IV Step 26
- HPW TP0500.02 Level B Ballistics
  - (9 mm)

**MAKROLON HYGARD BR750**

- UL Level 1
- HPW TP0500.02 Level B Ballistics
  - (9 mm)

**MAKROLON HYGARD BR1000**

- HPW Level V Step 42
- HPW TP0500.02 Level B Ballistics
  - (44 magnum)

**MAKROLON HYGARD BR1250**

- HPW Level V
- HPW TP0500.02 Level C Ballistics
  - (44 magnum)

**UL 752 - Bullet-Resistant—Actual Ratings**

**Sheffield Plastics Inc. will not be responsible for the use of this information relative to actual application. Users must make their own determination of its suitability for their specific application. No warranty is made for the fitness of any product, and nothing herein waives any of the seller's conditions of sale.**

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**PART 1: GENERAL**

1. **Section Includes**
   - A. Polycarbonate plastics glazing
   - B. Abrasion-resistant poly carbonate
   - C. Enhanced UV-resistant poly carbonate
   - D. Laminated polycarbonate plastic

2. **Related Sections**
   - A. Section 07820—Metal Framed Shutter
   - B. Section 07920—Metal Framed Shutters
   - C. Section 08320—Aluminum Windows
   - D. Section 08520—Glass and Glazing
   - E. Section 09030—Glazed Aluminum Frames

3. **References**
   - A. ANSI Z97.1—Safety performance, safety glazing used in buildings
   - B. ASTM E036—Standard test method for determination of suitability for their specific application. No warranty is made for the fitness of any product, and nothing herein waives any of the seller's conditions of sale.
PART I: GENERAL
PRODUCT SPECIFICATIONS

A. Provide plastic glazing material comprised of layers of MAKROLON AR polycarbonate sheet, factory laminated into high impact security glazing assemblies.

B. Containment Glazing
1. Provide HYDRAGARD CG75 2-ply polycarbonate laminate with the following properties:
   a. Forced entry rating: HPW TP0500.02 Level II, Step 11; HPW TP0500.02 Level II (38 special); ASTM F1233 Class III Step 12
   b. Gauge: 0.380” ± 5% tolerance
   c. Weight: 9.8 lbs./sq. ft.
   d. Shading coefficient: 0.90
   e. Light transmittance (clear): 88%
2. Provide HYDRAGARD CG200 3-ply polycarbonate laminate with the following properties:
   a. Forced entry rating: HPW TP0500.02 Level II, Step 12; HPW TP0500.02 Level II (38 special); ASTM F1233 Class III Step 15
   b. Gauge: 0.530” ± 5% tolerance
   c. Weight: 9.3 lbs./sq. ft.
   d. Shading coefficient: 0.90
   e. Light transmittance (clear): 87%
3. Provide HYDRAGARD CG275 3-ply polycarbonate laminate with the following properties:
   a. Forced entry rating: HPW TP0500.02 Level II, Step 12; HPW TP0500.02 Level II (38 special); ASTM F1233 Class III Step 26
   b. Gauge: 0.787” ± 5% tolerance
   c. Weight: 9.9 lbs./sq. ft.
   d. Shading coefficient: 0.87
   e. Light transmittance (clear): 77%

A. Polycarbonate plastics glazing
1. Provide HYDRAGARD BR100 3-ply polycarbonate laminate with acrylic interlayer with the following properties:
   a. Ballistic ratings: UL 752 Level 1 MSP9 .38 Super Automatic/.357 magnum; HPW TP0500.02 Level IV (clear) 9 mm; HPW TP0500.02 Level II (clear) 9 mm
   b. Gauge: 0.775” ± 5% tolerance
   c. Weight: 5.7 lbs./sq. ft.
   d. Shading coefficient: 0.88
   e. Light transmittance (clear): 87%
2. Provide HYDRAGARD BR1200 4-ply polycarbonate laminate with the following properties:
   a. Ballistic ratings: UL 752 Level 2 HPSA .357 magnum
   b. Forced entry rating: HPW TP0500.02 Level II, Step 5; HPW TP0500.02 Level II (clear) 9 mm
   c. Gauge: 0.875” ± 5% tolerance
   d. Weight: 6.5 lbs./sq. ft.
   e. Light transmittance (clear): 72%
3. Provide HYDRAGARD BR21250 3-ply polycarbonate laminate with the following properties:
   a. Ballistic ratings: UL 752 Level 2 SPAA .44 magnum
   b. Forced entry rating: HPW TP0500.02 Level II, Step 2; HPW TP0500.02 Level II (clear) 9 mm; HPW TP0500.02 Level IV (clear) 9 mm
   c. Gauge: 1.00” ± 5% tolerance
   d. Weight: 8.1 lbs./sq. ft.
   e. Light transmittance (clear): 67%

PART II: PRODUCTS

2.1 Manufacturer
A. Makrofol Sheet: Comply with ANSI Z97.1 and properties as follows:
   1. Specific gravity: 1.2 per ASTM D792
   2. Tensile strength (5% strain): 13,500 psi per ASTM D638
   3. Tensile modulus: 345,000 psi per ASTM D638
   4. Flexural strength at 5% strain: 13,500 psi per ASTM D790
   5. Flexural modulus: 345,000 psi per ASTM D790
   6. Impact strength (0.100” notched): 12-15 ft.-lbs per ASTM D256
   7. Self-ignition temperature: 1070°F per ASTM D1929

B. General Purpose Type: Provide MAKROLON GP, UV inhibiting polycarbonate glazing sheet
   1. Thickness range: .118 nominal, .177 nominal, .236 nominal, .375 nominal
   2. Color: clear A00
   3. Color: grey I30
   4. Color: bronzel K09
   5. Color: dark grey I35
   6. Custom color to match architect’s sample

C. Bullet Resistance Glazing
   1. Provide HYGARD CG375 2-ply polycarbonate laminate with the following properties:
      a. Ballistic rating: UL 752 Level 1 MSP9 .38 Super Automatic/.357 magnum
      b. Gauge: 0.775” ± 5% tolerance
      c. Weight: 5.7 lbs./sq. ft.
      d. Shading coefficient: 0.88
      e. Light transmittance (clear): 87%
   2. Provide HYGARD CG500 3-ply polycarbonate laminate with the following properties:
      a. Ballistic rating: UL 752 Level 2 HPSA .357 magnum
      b. Forced entry rating: HPW TP0500.02 Level II, Step 5; HPW TP0500.02 Level II (clear) 9 mm; HPW TP0500.02 Level IV (clear) 9 mm
      c. Gauge: 1.00” ± 5% tolerance
      d. Weight: 6.5 lbs./sq. ft.
      e. Light transmittance (clear): 72%
   3. Provide HYGARD CG75 3-ply polycarbonate laminate with the following properties:
      a. Ballistic rating: UL 752 Level 2 SPAA .44 magnum
      b. Forced entry rating: HPW TP0500.02 Level II, Step 2; HPW TP0500.02 Level II (clear) 9 mm; HPW TP0500.02 Level IV (clear) 9 mm
      c. Gauge: 1.00” ± 5% tolerance
      d. Weight: 8.1 lbs./sq. ft.
      e. Light transmittance (clear): 67%

PART III: EXECUTION

3.1 Glazing
A. Inspect pallets upon delivery for evidence of damage
B. Impact and verify frame openings are correct size and conform to recommendations of plastic glazing sheet manufacturer

3.2 Preparation
A. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels
B. Remove protective masking immediately after all glazing operations
C. Remove protective masking after all glazing operations are completed
D. Inspect pallets upon delivery for evidence of damage
E. Use only approved and glazing accessories that have been approved by manufacturer of polycarbonate glazing sheet
F. Remove protective masking immediately after all glazing operations are completed

3.3 Adjusting and Cleaning
A. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels
B. Use only approved and glazing accessories that have been approved by manufacturer of polycarbonate glazing sheet
C. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels
D. Use only approved and glazing accessories that have been approved by manufacturer of polycarbonate glazing sheet

Support Documentation and Technical Assistance
Additional information regarding the installation, forming and fabricating, UL testing, and product evaluation tests of MAKROLON polycarbonate sheet products are available upon request. For more information, please write or call Sheffield Plastics Customer Service Department at 800-254-1707, 119 Salisbury Road, Sheffield, MA 01257.
MAKROTON HYGARD®

Polycarbonate Sheet is:

"Clearly the Right Choice"

for Any Application

Disclaimer

The manner in which you use and the purpose to which you put and utilize our products, technical assistance, and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations, are beyond our control. Therefore, it is imperative that you test our products, technical assistance, and information to determine to your own satisfaction whether they are suitable for your intended use and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee, and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

For Additional Information Please Contact...

Sheffield Plastics Inc.
Customer Service Department
Phone: 800-254-1707
Fax: 800-457-3553
www.sheffieldplastics.com
E-mail: info@sheffieldplastics.com