

MAKROLON®

POLYCARBONATE SIGN PRODUCTS



...Clearly the Right Choice
for the Toughest Outdoor
Sign Environments

Sheffield Plastics Inc.

A  Bayer MaterialScience Company

Outdoor Signs Look Better for Longer ...When “Made with MAK”

Unsurpassed for Product Excellence and Innovation

Sheffield Plastics Inc. continues to provide the sign industry with innovative and excellent product solutions for the toughest outdoor sign applications. Sheffield's MAKROLON sign products are produced exclusively with MAKROLON polycarbonate resin from Bayer Corporation. Made from the finest resins in modern production facilities, Sheffield's polycarbonate sign products offer outstanding toughness and weatherability. In addition, Sheffield's customer service, technology, and cost competitiveness make “Made with MAK” Polycarbonate Sheet products “Clearly the Right Choice” for signs that last.

“Made with MAK” sign products are providing long lasting, aesthetically pleasing alternatives to acrylic and impact modified acrylic (IMA) in a wide range of applications. MAKROLON Polycarbonate Sheet is often selected as a replacement for both standard and impact modified acrylic sheet due to its significantly greater impact strength (many times stronger than acrylic). Unlike IMA, MAKROLON Polycarbonate Sheet maintains its impact strength even at low temperatures. Superior toughness minimizes breakage while the product is being produced, installed, or used in the field. Because of its toughness and inner strength, thinner gauges of MAKROLON Polycarbonate Sheet can be used to achieve lighter weight, higher performance signage. MAKROLON Polycarbonate Sheet provides

high impact strength, heat resistance, and easy fabrication characteristics.

Utilized in major signage programs, MAKROLON Polycarbonate Sheet has demonstrated the built-in durability that allows signs to withstand all kinds of abuse and still look their best for years to come.

- Many Times Stronger than Acrylic
- More Strength–Less Weight
- Retains Impact Strength in Low Temperatures
- Easily Fabricated
- Aesthetically Pleasing



OUTSTANDING RESISTANCE TO SUNLIGHT AND SCRATCHES

“Made with MAK” polycarbonate signs offer superior light transmission, brighter whites, and more vibrant colors, even in the harshest environments. Outstanding resistance to sunlight and scratches reduces yellowing and keeps your sign looking good for longer.

MAKROLON® SL Polycarbonate Sheet: Enhanced UV Resistant sheet with exceptional weatherability and superior impact strength

MAKROLON SL offers the impact protection of MAKROLON Polycarbonate Sheet coupled with enhanced UV protection. SL sheet also has the design and structural advantage of thermoformability. Using advanced extrusion technology, Sheffield Plastics produces polycarbonate that withstands extreme environmental conditions.

MAKROLON® AR – Abrasion-Resistant Sheet: Polycarbonate strength, glass-like surface hardness

Where vandalism or graffiti is a problem, we can offer a proprietary abrasion resistant surface to assure long lasting protection. MAKROLON AR polycarbonate sheet has enhanced UV stability for long-term weatherability. The combination of impact strength and surface durability assures resistance to both cyclical cleaning and abuse.

PRODUCT OPTIONS ABOUND

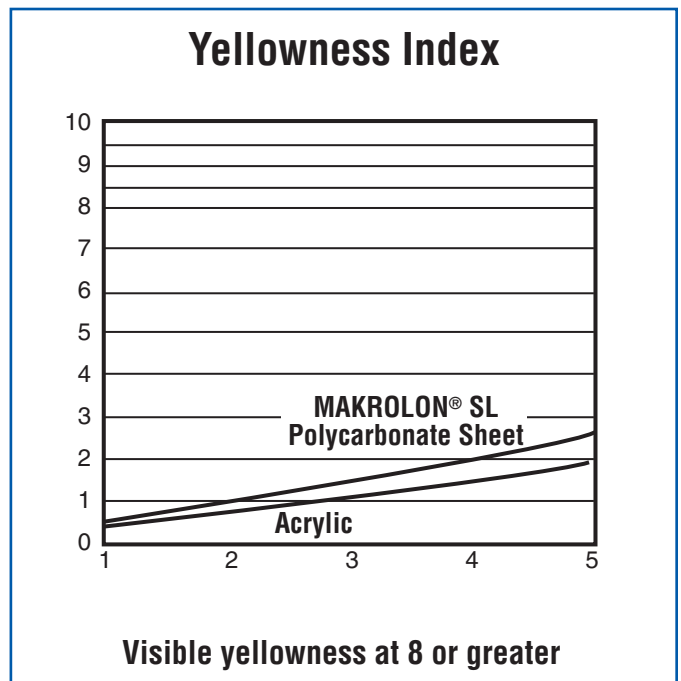
Sheffield offers a full range of standard MAKROLON SL Polycarbonate Sheet in clear and white. Custom colors, sizes, gauges, and patterns to match the requirements of even your most demanding customer are also available. For added protection and efficiency the material can be factory delivered on reels.

UL LISTED

MAKROLON SL Polycarbonate Sheet meets stringent UL Section 48 criteria for use in electric signs. This allows the use of less costly components during installation, making it a high performance yet economical choice for channel letters of all shapes and sizes.

PERFORMANCE WARRANTIES

The performance of MAKROLON SL and MAKROLON AR Polycarbonate Sheet products has been tested and proven through years of outdoor testing and everyday applications. Sheffield offers a limited warranty against excessive yellowing, haze, loss of light transmission, and breakage. Contact Sheffield for limited warranty details.



NOTES: Coated sides of MAKROLON AR Polycarbonate Sheet cannot be painted because of the abrasion-resistant coating. However, sheet that is only coated on one side (MAKROLON AR-1) can be reverse-screened on the uncoated side using standard painting techniques for polycarbonate. This material is an excellent choice for durable graphics in high traffic area applications.

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 use. No warranty is made for the fitness of any product, and nothing herein waives any of the seller's conditions of sale.

MATERIAL PREPARATION

PREDRYING TEMP: 250°F

GAUGE	DRYING TIME
.093	4 hrs.
.118	6 hrs.
.150	8 hrs.
.177	14 hrs.
.236	24 hrs.

Thermoforming

MAKROLON® SL Polycarbonate Sheet can be thermoformed with excellent results on standard equipment using conventional polycarbonate forming techniques. The sheet requires predrying to remove excess moisture. Drying guidelines are furnished in this chart with other production recommendations, which should be followed for optimum results.

FORMING GUIDELINES

Sheet Temperature:	
Typical:	340-380°F
Mold Temperature:	210-260°F

NOTE: Due to its abrasion-resistant coating, MAKROLON® AR cannot be formed like MAKROLON® SL.

Strip Heating

Strip heating is one way to achieve localized bending of MAKROLON SL Polycarbonate Sheet for use in signs. Heating both sides at the bend area will help achieve optimum results. Drying is recommended unless the material is .118" or less in thickness. Brake bending can be done on gauges less than .118".

Cutting and Sawing

MAKROLON SL Polycarbonate Sheet can be cut with most common hand-held and table-mounted saws, including circular saws, routers and band saws, using standard blade designs for polycarbonate. For end milling and routing, high rotating speeds or low feed rates are advisable.

Shearing, Punching, and Blanking

Unlike acrylic, which will shatter, MAKROLON SL Polycarbonate Sheet resists cracking or crazing when shearing, punching or blanking, as long as the proper sharp tools are used.

Painting and Silk Screening

MAKROLON SL Polycarbonate Sheet can be painted by silk screening or standard spray techniques using inks and paints commonly available for polycarbonate sheet.

Bonding and Cementing

In solvent bonding using MDC (methylene dichloride), apply to surfaces to be bonded and hold parts under pressure until cured. Add 10% glacial acetic acid for the best joint appearance.



PRODUCT AVAILABILITY	DESCRIPTIONS	STANDARD SIZES	STANDARD COLORS
MAKROLON SL Sheet (Enhanced UV-Resistant)	Polished Surfaces UV-Coat 1 Side	Gauge: .093" - .236" Length: 100" - 125" Width: 52", 64", 75", 100"	Clear, White
MAKROLON SL Reels (Enhanced UV-Resistant)	Polished Surfaces UV-Coat 1 Side	Gauge: .093" - .220" Length: 300' - 450' Width: 4', 5', 6', 8'	Clear, White
MAKROLON Sign Matte Sheet	Matte 1 Side, Polished 1 Side	Gauge: .118" - .236" Length: 100", 125" Width: 52", 64", 75", 100"	Clear
MAKROLON Sign Matte Reels	Matte 1 Side, Polished 1 Side	Gauge: .118" - .220" Length: 300' - 450' Width: 4', 5', 6', 8'	Clear
MAKROLON AR Sheet (Abrasion Resistant)	Polished Surfaces Coated 1 Side or 2 Sides	Gauge: .118" - .500" Length: 96" Width: 48", 60", 72"	Clear

TYPICAL PHYSICAL PROPERTIES

Property	MAKROLON®	Units	Test Method
<u>General</u>			
Specific Gravity	1.2	-	ASTM D-792
Water Absorption after 24 hrs.	0.15	%	ASTM D-570
Refractive Index	1.586	-	ASTM D-542
<u>Mechanical</u>			
Tensile Strength, Yield, .125"	9,000	psi	ASTM D-638
Tensile Strength, Ultimate	9,500	psi	ASTM D-638
Tensile Modulus	345,000	psi	ASTM D-638
Shear Strength	6,000	psi	ASTM D-732
Compressive Strength	12,500	psi	ASTM D-695
Flexural Strength .125"	13,500	psi	ASTM D-790
Flexural Modulus .125"	345,000	psi	ASTM D-790
Izod Impact Notched .125"	12-16	ft-lbs/in	ASTM D-256
Rockwell Hardness	R118/M70	-	ASTM D-785
Gardner Impact 1/2" Diameter DArt .125"	>320	in-lbs	ASTM D-5420
Instrumented Impact .125"	>45	ft-lbs	ASTM D-3763
Poisson's Ratio	.38	-	
<u>Thermal</u>			
Heat Deflection Temperature @ 264 psi	270	°F	ASTM D-648
Heat Deflection Temperature @ 66 psi	280	°F	ASTM D-648
Coefficient of Thermal Expansion	3.75 x 10 ⁻⁵	in/in/°F	ASTM D-696
Coefficient of Thermal Conductivity	1.35	BTU/hr/ft ² /°F	ASTM C-177
Smoke Density .125"	68	-	ASTM D-2843
Shading Coefficient Clear .125"	1.02	-	ASHRAE
Shading Coefficient Gray/Bronze .125"	.70	-	ASHRAE
Shading Coefficient Dark Gray .125"	.58	-	ASHRAE
Brittle Temperature	-200	°F	ASTM D-746
U Value .236" (summer gain, winter loss)	.90, .96	BTU/hr-sq/°F	
<u>Flammability</u>			
Horizontal Burn, AEB .125"	<1	in	ASTM D-635
Horizontal Burn, ATB .125"	<1	min	ASTM D-635
Ignition Temperature, Self	1,070	°F	ASTM D-1929
Ignition Temperature, Flash	870	°F	ASTM D-1929
UL 94* ≥ .060"	V-2	-	UL 94
UL 94 Clear ≥ .236"	V-0	-	UL 94
<u>Optical</u>			
Light Transmission, Clear .125"	86	%	ASTM D-1003
Haze, Clear .125"	<1	%	ASTM D-1003
Light Trans. I30 Gray, K09 Bronze	50	%	ASTM D-1003
<u>Electrical</u>			
Dielectric Constant 10 Hz	2.96	-	ASTM D-150
Dielectric Constant 60 Hz	3.17	-	ASTM D-150
Volume Resistivity	8.2 x 10 ¹⁶	ohm-cm	ASTM D-257
Dissipation Factor 60 Hz	0.0009	-	ASTM D-150
Dissipation Factor 1 MHz	0.010	-	ASTM D-150
<u>Arc Resistance</u>			
Stainless Steel Strip Electrodes	10-11	sec	ASTM D-495
Tungsten Electrodes	120	sec	ASTM D-495
Dielectric Strength, in air, 125 miles	380	V/mil	ASTM D-149

* UL 94 applies to MAKROLON SL Only



MAKROFOL® EPC Polycarbonate Film Protects Against Weather and Chemicals

Bayer Films Americas offers a “Made with MAK” polycarbonate film that protects signage against weather and chemicals. Makrofol® EPC (Extended Performance Composite), an enhanced performance composite film with a velvet first surface and a matte second surface, offers excellent durability, weatherability, and chemical resistance. Since the enhanced properties do not affect the second surface printability, embossability, and die cutting, Makrofol EPC is ideal for use in outdoor signage, petroleum decals, and other applications where the product is exposed to weather or chemicals. Makrofol EPC exhibits excellent weatherability with a Delta E shift less than 0.7 and has passed the automotive three year outdoor Florida/Arizona test. Makrofol EPC is available in thicknesses of 0.15” - .030” (0.375 - .750 mm). The composite offers total light transmission of >70% and moisture absorption of <.5% under ASTM testing standards. Makrofol EPC is thermoformable and easily embossed or die cut.

In addition to Makrofol EPC, Bayer Films Americas offers Makrofol DE 1-4 White 3723, a translucent polycarbonate film that is ideal for menu boards. Makrofol DE 1-4 features gloss on one side and fine matte on the other. This durable polycarbonate film includes many of the “Made with MAK” characteristics that ensure long product life. Makrofol DE 1-4 is available in thicknesses from 0.005”-0.030” (0.125 mm-0.75 mm).



VIVAK HT® Sheet...Cost Effective Thermoplastic for Outdoor Sign Fabrication

VIVAK HT Sheet is a proprietary, high performance thermoplastic sheet with enhanced UV resistance. It offers exceptional formability with outstanding impact strength that makes it ideal for a wide variety of outdoor sign applications. VIVAK HT Sheet is easily thermoformed and fabricated. It can be decorated with sign vinyl, paint, and inks to fit any sign company's capabilities. With lower forming temperatures and faster cooling cycles, VIVAK HT Sheet is an excellent substrate selection for faces formed with vinyl. If impact resistance is an issue, VIVAK HT Sheet has many times the impact strength of impact modified acrylic (IMA) and can be more cost effective than high impact acrylics.

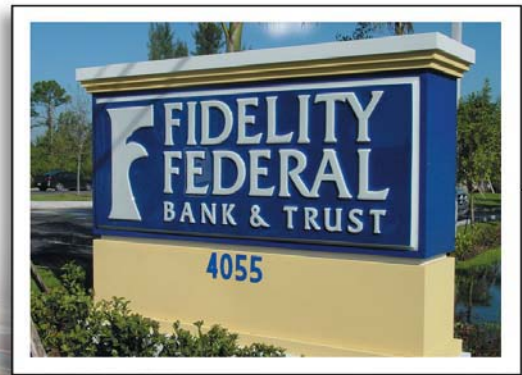
Key Features:

- Ideal for Forming Preapplied Vinyl
- No Drying Required
- Faster Cycle Times
- Easily Fabricated
- Excellent Thermoforming Definition

VIVAK HT Sheet provides sign fabricators high impact resistance, superior forming qualities, and faster cycle times. It is suitable for the production of formed vinyl faces, distortion printing, and detail-oriented images.

An advantage of VIVAK HT Sheet is its uniform shrink rates, which make it a highly desirable product for forming with distortion print screening. With a HDT (heat deflection temperature) of 185°F, VIVAK HT Sheet delivers the heat stability demanded by the sign industry.

The benefits of VIVAK HT Sheet's higher performance translates into faster thermoforming production rates. VIVAK HT Sheet offers higher impact strength and its forgiving nature means less breakage than acrylic and IMA. These significant advantages can result in higher margins and lower costs.



Curbell Plastics is a proud supplier
of Sheffield materials



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MAKROLON® SL
Polycarbonate Sheet is:
“Clearly the Right Choice”
for Any Sign 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 uses 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.

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