TUFFAK® polycarbonate
A new generation of engineered sheet products for signage

The power of global.

Rassolite is one of the leading manufacturers of high-quality polycarbonate products, which are continually leaders in global markets. Behind the technologically sophisticated solutions you'll find the expertise of the global Rassolite network. Customer focus, innovation and environmental protection are objectives of equal importance in our corporate strategy.

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» Code compliance and UL listings
» Product information
» Fabrication and forming guide

TUFFAK SL matte and TUFFAK AR
Abrasion resistant • Glare reduction

TUFFAK SL matte adds a design dimension to high-performance signage
- Non-gloss finish on UV-protected side
- Same high performing physical properties as TUFFAK SL

TUFFAK AR transparent sheet expands design and application options
- Durable hard-coated surface on one or two sides offers abrasion resistance for applications that need frequent cleaning and in high traffic areas
- Anti-graffiti protection for indoor and outdoor kiosks/signs in airports, hotels, and other public facilities
- Enhanced chemical resistance
- UL 410/411 burglary resistant
- UL 94 HB flammability rating
- UL 94 V-0 > 0.394”

Abrasion Resistance

<table>
<thead>
<tr>
<th>Material</th>
<th>Impact Resistance (ASTM D 3783)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Energy (ft·lbs)</td>
</tr>
<tr>
<td>TUFFAK AR</td>
<td>&gt; 46</td>
</tr>
<tr>
<td>Acrylic (PMMA)</td>
<td>2</td>
</tr>
</tbody>
</table>

Temperature Resistance (ASTM D 648)

<table>
<thead>
<tr>
<th>Material</th>
<th>Heat Deflection @ 66 psi (°F)</th>
<th>Heat Deflection @ 264 psi (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUFFAK</td>
<td>280</td>
<td>270</td>
</tr>
<tr>
<td>Acrylic (PMMA)</td>
<td>190</td>
<td>181</td>
</tr>
</tbody>
</table>

Impact Resistance (ASTM D 3783)
1) Three-dimensional depth

- Thermoforming TUFFAK sheet adds dimension to enhance logos, letters, and messages
- Thinner deep draw areas retain strength

2) Versatile sheet and reel sizes

- A broad inventory of standard sheet and reeled speeds delivery and facilitates production planning
- Standard sign colors
- Custom sizes can minimize material waste in high volume production jobs

3) TUFFAK LD delivers uniform light diffusion for today’s LED signage

- Eliminates LED hot spots even in deep draw thermoformed areas that are often problematic for other materials
- Allows shallow channel letter designs: exceptional light diffusion reduces light intensity variations (shadowing) even at smaller LED-diffuser sheet distances
- Extensive standard color palette, color match technology consistently satisfies demanding corporate jobs
- Delivers TUFFAK sheet’s recognized performance on impact, temperature, and weather resistance
- UL recognition: Meets the UL 979 standard for use in electric signs
- UL 94 V-2 flammability rating 0.093”-0.177”
- UL 94 V-0 flammability rating 0.236”

Characteristics

- Anti-glare
- Non-pixelating
- Economical
- Outdoors suitable
- 2nd surface printing
- Chemical resistant
- Abrasion resistant
- Formability
- Cold bending
- Gloss consistency

Specifications

<table>
<thead>
<tr>
<th>Technology</th>
<th>NR</th>
<th>NR-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-reflective core layer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-reflective coated surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness range</td>
<td>0.040” – 0.100”</td>
<td>0.060” – 0.500”</td>
</tr>
<tr>
<td>Maximum width</td>
<td>60.7”</td>
<td>48.0”</td>
</tr>
<tr>
<td>Maximum length</td>
<td>120.0”</td>
<td>93.0”</td>
</tr>
<tr>
<td>Gloss level - 60°</td>
<td>Target 37 ±3</td>
<td>Target 37 ±5</td>
</tr>
<tr>
<td>Non-glare layer</td>
<td>One side only</td>
<td>One side only</td>
</tr>
<tr>
<td>Weathering</td>
<td>Ok, 1,500 hrs. Xenon</td>
<td>Ok, 1,500 hrs. Xenon</td>
</tr>
<tr>
<td>Haze (0.001” thick)</td>
<td>19 - 21</td>
<td>19 - 21</td>
</tr>
<tr>
<td>Light transmission (0.01” thick)</td>
<td>88 - 97</td>
<td>88 - 97</td>
</tr>
</tbody>
</table>
| Masking (non-reflective side) | Adhesive-based | Adhesive-based

INTENDED MARKETS

- TV enclosures
- Digital displays
- Menu boards
- Graphic panels

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INTENDED MARKETS

- Digital displays
- Outdoor menu boards
- Ruggedized electronics for military, aerospace and consumer products
TUFFAK SL and TUFFAK LD
Tradition of delivering the right elements for outstanding electric signage

1) Three-dimensional depth
Thermofoming TUFFAK sheet adds dimension to enhance logos, letters, and message 
Thicker deep draw areas retain strength

2) Versatile sheet and reel sizes
A broad inventory of standard sheet and reel speeds delivery and facilitates production planning 
Custom sizes can minimize material waste in high volume production jobs

3) TUFFAK LD delivers uniform light diffusion for today's LED signage
Eliminates LED hot spots even in deep draw thermoformed areas that are often problematic for other materials 
Allows shallow channel letter designs: exceptional light diffusion reduces light intensity variations (shadowing) even at smaller LED-diffuser sheet distances 
Extensive standard color palette, color match technology consistently satisfies demanding corporate jobs 
Delivers TUFFAK sheet's recognized performance on impact, temperature, and weather resistance 
UL recognition: Meets the UL 94 standard for use in electric signs 
UL 94 V-0 flammability rating 0.093˝-0.177˝ 
UL 94 V-0 flammability rating 0.236˝

INTENDED MARKETS
» TV enclosures 
» Digital displays 
» Menu boards 
» Graphic panels

Performance that protects the image
» Weather resistance 
» UV protection technology provides long-lasting outdoor life
» Exceptional toughness properties provide windload and hail impact protection across a broad temperature range 
» Unsurpassed durability in production and use 
» TUFFAK sheet helps minimize breakage losses for high production yields and ensures on-schedule installation

1) Design versatility and dimensional stability 
Allows closer placement of lighting sources to the sign face for more versatile and cost-effective designs 
UL Listed: TUFFAK sign grades meet UL 94 standard for use in electric signs 
UL 94 HB flammability rating

Characteristics | NR | NR-C
--- | --- | ---
Anti-glare | ✔ | ✔
Non-pixelating | ✔ | ✔
Economical | ✔ | ✔
Outdoors suitable | ✔ | ✔
2nd surface printing | ✔ | ✔
Chemical resistant | ✔ | ✔
Abrasion resistant | ✔ | ✔
Formability | ✔ | ✔
Cold bending | ✔ | ✔
Gloss consistency | ✔ | ✔

Specifications | NR non-reflective (coex) | NR-C non-reflective, coated
--- | --- | ---
Technology | Non-reflective co-extruded | Non-reflective coated surface
Thickness range | 0.040˝ – 0.200˝ | 0.060˝ – 0.500˝
Maximum width | 80.70˝ | 48.00˝
Maximum length | 135.00˝ | 135.00˝
Gloss level - 60° | Target 37 ±5 | Target 37 ±5
Non-glare layer | One side only | One side only
Weathering | OK | OK 
Haze (0.018” thick) | 19 - 21 | 19 - 21
Light transmission (0.018” thick) | 88 - 91 | 88 - 91
Masking (non-reflective side) | Adhesive-based | Adhesive-based

TUFFAK NR
Non-reflective, co-extruded sheet
Anti-glare surface treatment provides impact resistant solution to current uses of non-gore acrylic 
Non-reflective coating is lighter than most matte finishes reducing “pixel” effect

TUFFAK NR-C
Non-reflective, coated sheet
Anti-glare surface with abrasion and chemical resistance

INTENDED MARKETS
» Outdoor menu boards 
» Ruggedized electronics for military, aerospace and consumer products

Characteristics | NR | NR-C
--- | --- | ---
Anti-glare | ✔ | ✔
Non-pixelating | ✔ | ✔
Economical | ✔ | ✔
Outdoors suitable | ✔ | ✔
2nd surface printing | ✔ | ✔
Chemical resistant | ✔ | ✔
Abrasion resistant | ✔ | ✔
Formability | ✔ | ✔
Cold bending | ✔ | ✔
Gloss consistency | ✔ | ✔

Specifications | NR non-reflective (coex) | NR-C non-reflective, coated
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Weathering | OK | OK 
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- UL 94 V-0 flammability rating 0.236˝
- Performance that protects the image
- Weather resistance
- UV protection technology provides long lasting outdoor life
- Exceptional toughness properties provide wind and hail impact protection across a broad temperature range
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- TUFFAK sheet helps minimize breakage losses for high production yields and ensures on-schedule installation

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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Non-glareblinding</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Economical</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Outdoors suitable</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2nd surface printing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical resistant</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Abrasion resistant</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Formability</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cold bending</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Gloss consistency</td>
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<tr>
<td>Technology</td>
<td>Non-reflective co-ex layer</td>
<td>Non-reflective coated surface</td>
</tr>
<tr>
<td>Thickness range</td>
<td>0.040˝ – 0.200˝</td>
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</tr>
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</tr>
<tr>
<td>Maximum length</td>
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</tr>
<tr>
<td>Gloss level - 60°</td>
<td>Target 37 ±3</td>
<td>Target 37 ±5</td>
</tr>
<tr>
<td>Non-glare layer</td>
<td>One side only</td>
<td>One side only</td>
</tr>
<tr>
<td>Weathering</td>
<td>OK - 7500 hrs. Xenon</td>
<td>OK - 15,000 hrs. Xenon</td>
</tr>
<tr>
<td>Haze (0.018” thick)</td>
<td>19 - 21</td>
<td>19 - 21</td>
</tr>
<tr>
<td>Light transmission (0.018” thick)</td>
<td>68 - 3I</td>
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</tr>
<tr>
<td>Hazing (non-reflective side)</td>
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The power of global.
The service of local.

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- Enhanced chemical resistance
- UL 94 HB flammability rating
- UL 94 V-0 > 0.394"*

TUFFAK LD B27
TUFFAK LD B48

Images and graphs demonstrate TUFFAK LD's ability to completely eliminate LED hot spots, even when thinned by 50%.

Delta Haze (%)

<table>
<thead>
<tr>
<th>Material</th>
<th>Heat Deflection Temperature (°F) @ 66 psi</th>
<th>Heat Deflection Temperature (°F) @ 264 psi</th>
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Impact Resistance (ASTM D 3765)

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Thermformed polycarbonate domes are all photographed with the same backlighting LEDs. Peaks in the light vs. position graph for the competitive PC show strong LED hot spots. No peaks are present in the TUFFAK LD graphs.

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 determine the suitability of our materials and suggestions before adopting them on a commercial scale.

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082018
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1-800-CURBELL
www.curbellplastics.com
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