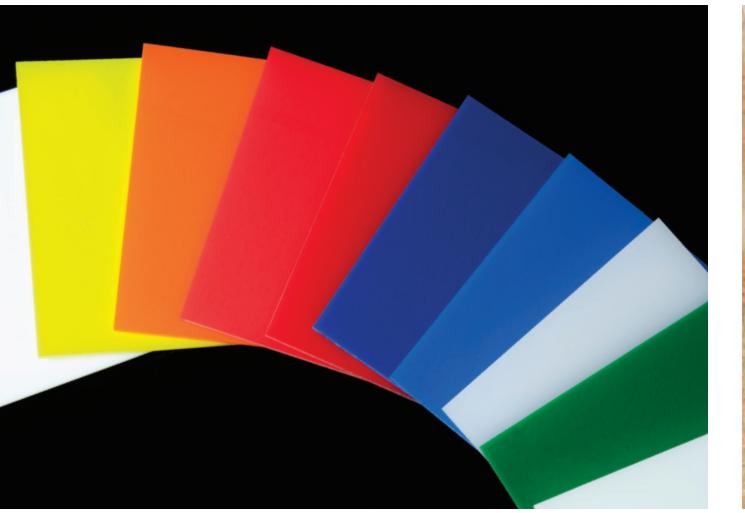


TUFFAK SL matte and TUFFAK AR

Abrasion resistant • Glare reduction



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TUFFAK AR transparent sheet expands design and application options

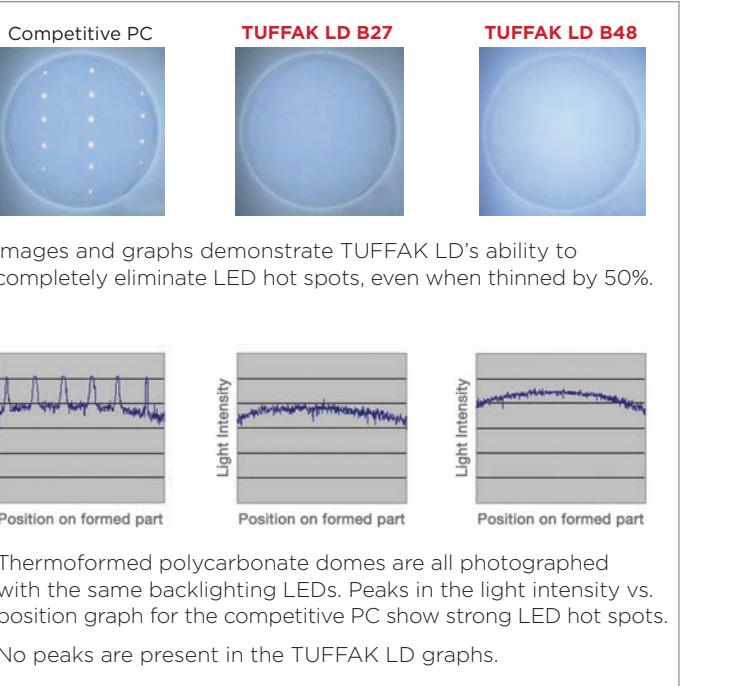
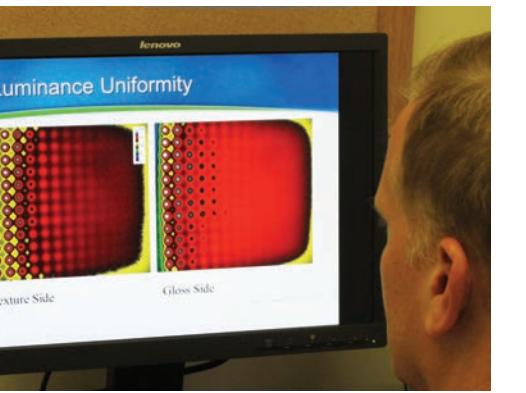
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Temperature Resistance (ASTM D 648)

Material	Heat Deflection Temperature (°F) @ 66 psi	Heat Deflection Temperature (°F) @ 264 psi
TUFFAK	280	270
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TUFFAK @ 0.125"	> 46
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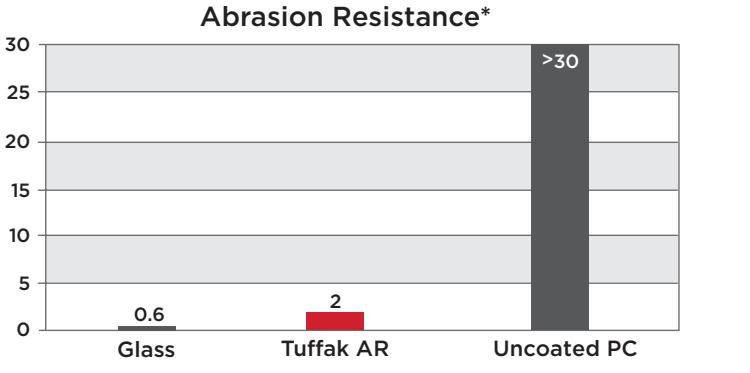
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BRO005

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

TUFFAK SL and TUFFAK LD

Tradition of delivering the right elements for outstanding electric signage



1) Three-dimensional depth

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



2) Versatile sheet and reel sizes

- » A broad inventory of standard sheet and reels 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 879 standard for use in electric signs
- » UL 94 V-2 flammability rating 0.093"-0.177"
- » 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 windload 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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TUFFAK[®]

TUFFAK NR

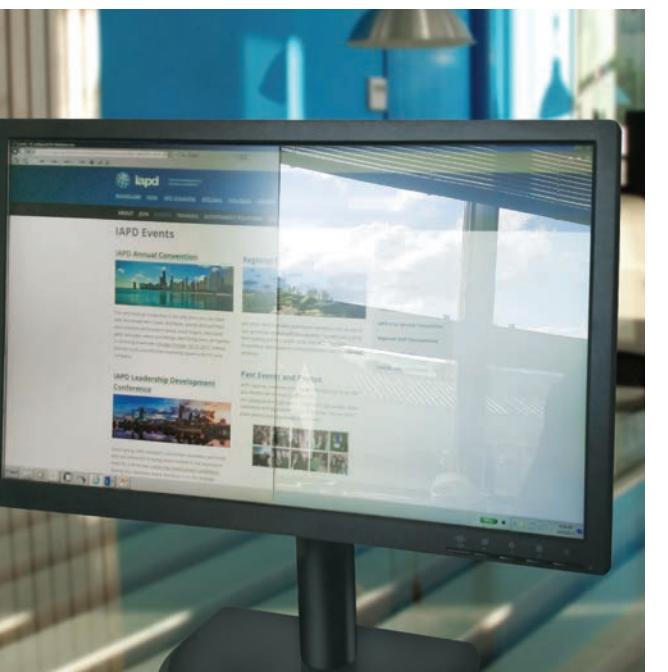
Non-reflective, co-extruded sheet

Anti-glare surface treatment provides impact resistant solution to current users of non-glare acrylic.

Non-reflective coating is lighter than most matte finishes reducing "pixel" effect.

INTENDED MARKETS

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



Specifications

Specifications	NR non-reflective (coex)	NR-C non-reflective, coated
Technology	Non-reflective coex layer	Non-reflective coated surface
Thickness range	0.040" - 0.200"	0.060" - 0.500"
Maximum width	80.70"	48.00"
Maximum length	120.00"	135.00"
Gloss level - 60°	Target 37 ±3	Target 37 ±5
Non-glare layer	One side only	One side only
Weathering	OK >3,500 hrs. Xenon	OK >3,500 hrs. Xenon
Haze (.0118" thick)	19 - 21	19 - 21
Light transmission (0.0118" thick)	88 - 91	88 - 91
Masking (non-reflective side)	Adhesive-based	Adhesive-based

TUFFAK NR-C

Non-reflective, coated sheet

Anti-glare surface with abrasion and chemical resistance.

INTENDED MARKETS

- » Digital displays
- » Outdoor menu boards
- » Ruggedized electronics for military, aerospace and consumer products

TUFFAK NR and NR-C

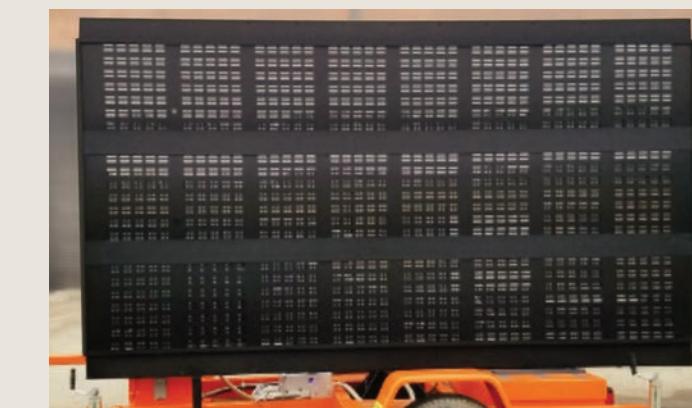
Non-reflective sheet applications



Menu boards



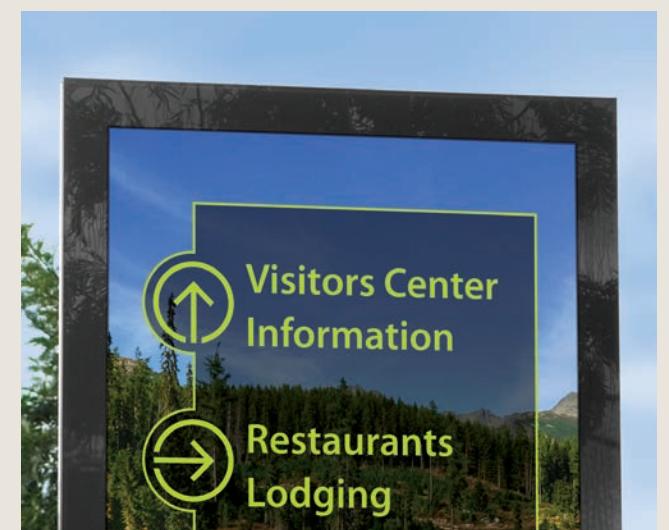
Medical monitors



Message centers



Heavy duty gauges



Visitors Center Information
Restaurants Lodging
Fueling Stations Service Center



Outdoor signage



Fuel dispensers

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TUFFAK[®]

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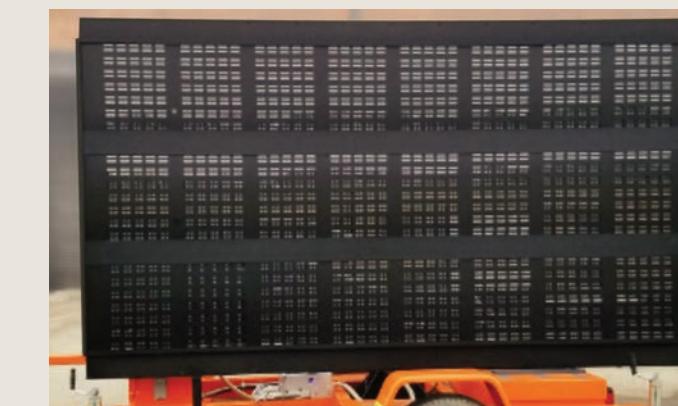
Non-reflective sheet applications



Menu boards



Medical monitors



Message centers



Heavy duty gauges



Outdoor signage



Fuel dispensers

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TUFFAK[®]

TUFFAK NR

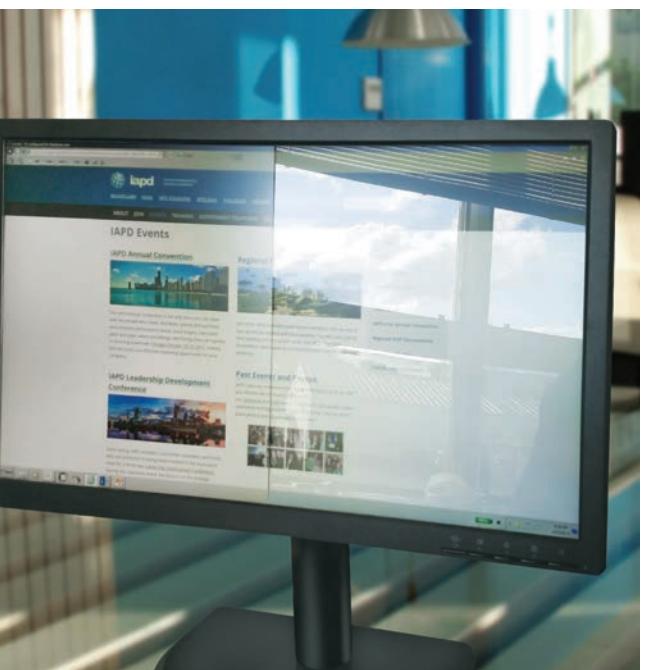
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TUFFAK NR-C

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TUFFAK NR and NR-C

Non-reflective sheet applications



Menu boards



Medical monitors



Message centers



Heavy duty gauges



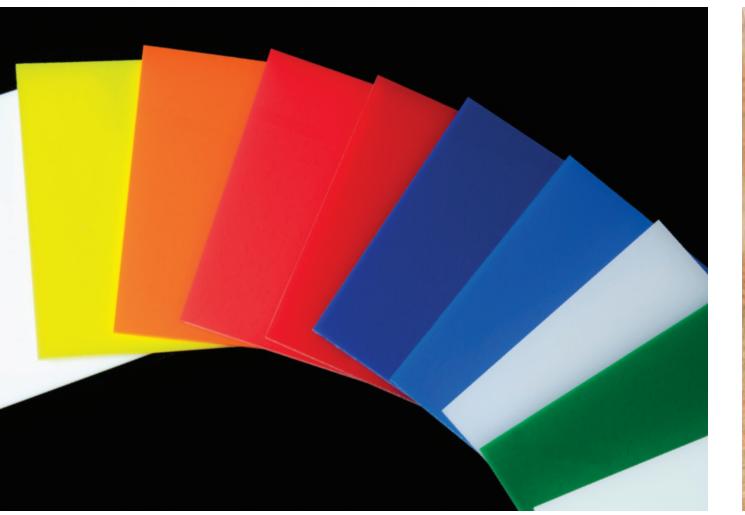
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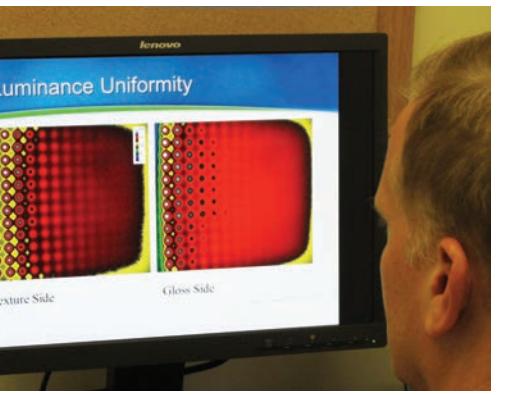
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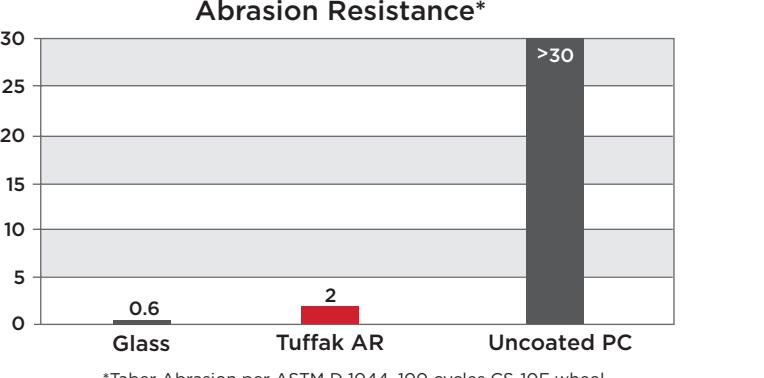
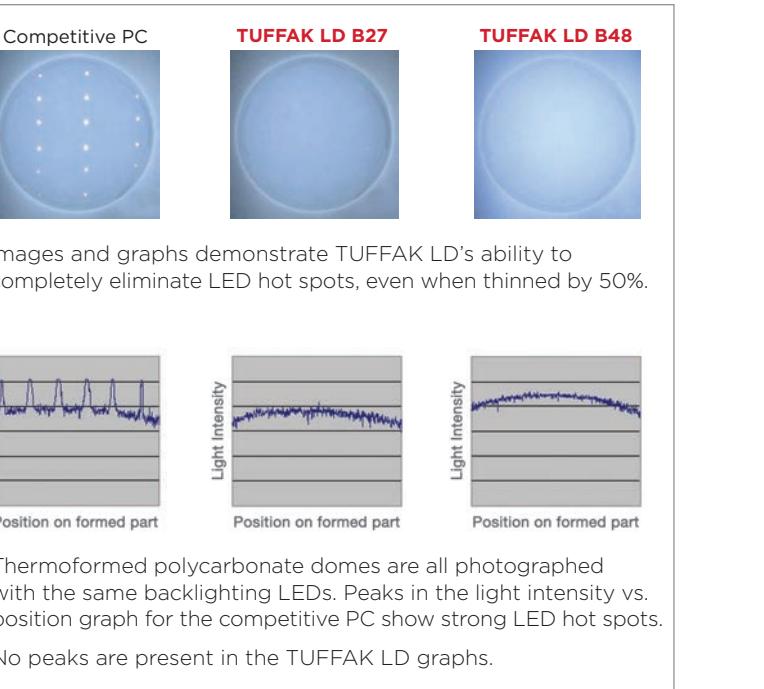


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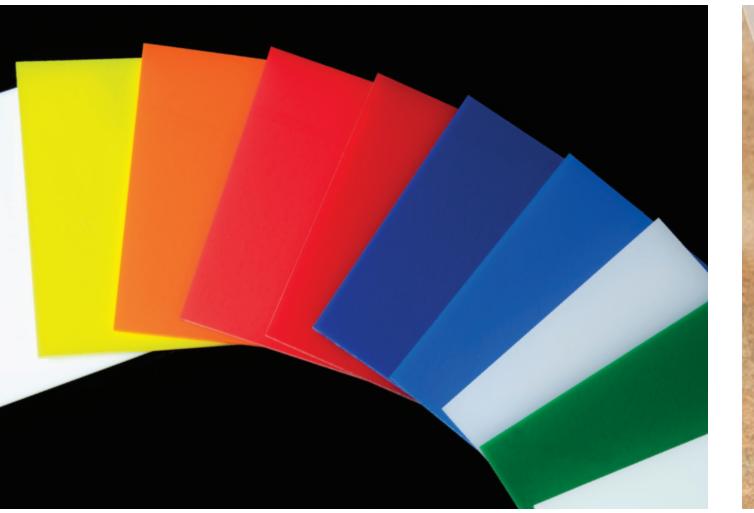
BRO005



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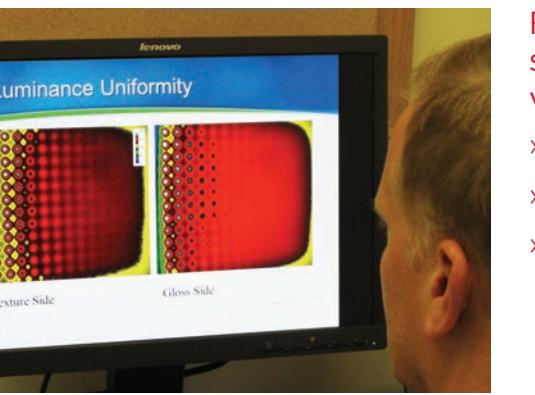
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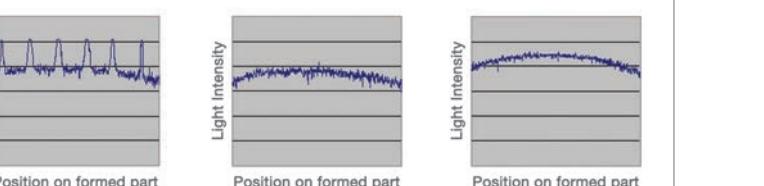
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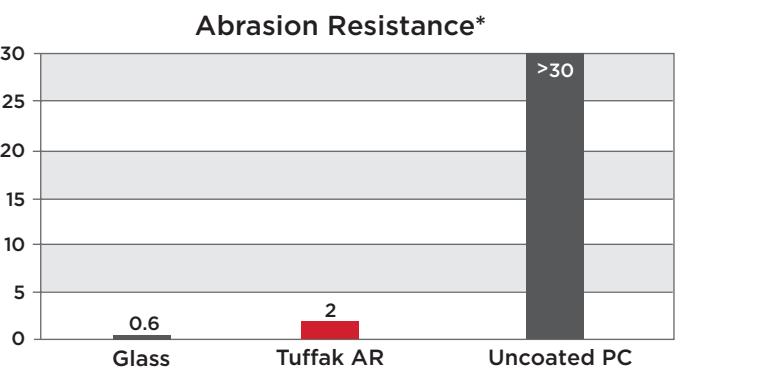


Images and graphs demonstrate TUFFAK LD's ability to completely eliminate LED hot spots, even when thinned by 50%.



Thermoformed polycarbonate domes are all photographed with the same backlighting LEDs. Peaks in the light intensity vs. position graph for the competitive PC show strong LED hot spots.

No peaks are present in the TUFFAK LD graphs.



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