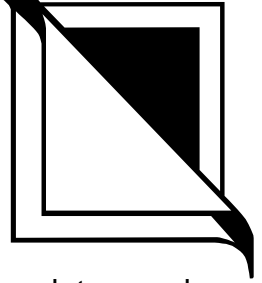


# OptiGrafix™

## QW & QWEP Grade Polymer Film

### Quarter Wave Optical Light Retarder Base Film



OptiGrafix™ QW and QWEP Grade Films are high clarity, chromatic quarter-wave plates made from a single layer of polymer film. Our QW & QWEP Grade film products have superior light transmission and dimensional stability. They are more economical than traditional PVA laminates as QW & QWEP Grade film can serve as both a retarder layer as well as a protective base film. Our QW & QWEP Grade Film products are easy to handle and apply in a variety of retarder applications such as circular polarizers, LCD's, fiber optics, and other coherent and polarized light applications.

- ⇒ **QWEP Grade Films** are high performance, with high heat resistance up to 85° C. This grade of retarder contains no silica or other additives so transparency is maximized while haze and light scattering is minimized. This film will not yellow over time and can withstand high lux and temperature exposure without shifts in its optical properties.
- ⇒ **QW Grade films** are excellent high clarity general purpose products for use in room temperature optical applications.

#### Our Quarter-Wave Optical Film can be custom manufactured to meet specific customer requirements:

- ⇒ Manufactured to custom levels of birefringence up to 200nm.
 

Thickness	OPD
.003"(70um), .005" (120um):	120nm to 200nm (+/- 10nm)
Standard Widths: 20+", available up to 42+"	
- ⇒ Film base can be custom manufactured with additives such as color filter dyes, pigments, fluorescent dyes, optical brighteners, UV inhibitors and other additives. Minimum orders may apply.

#### Product Features:

- ⇒ Very Uniform Birefringence
- ⇒ 50% Thinner Than Most Polymer Light Retarder Plates
- ⇒ A Solid Polymer Film (Not a Composite Lamination)
- ⇒ High Clarity, Low Haze, Excellent Optical Transmission
- ⇒ Minimal Defect Count
- ⇒ Good Dimensional Stability
- ⇒ Commercially Available
- ⇒ Cost Effective Alternative to PVA Laminates

## GRAFIX® Plastics

A Division of GRAFIX, Inc.

19499 Miles Rd. Cleveland, OH. 44128

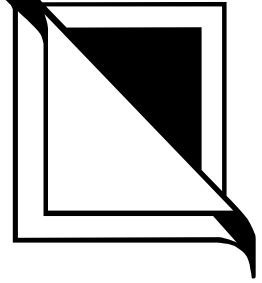
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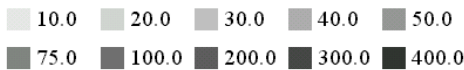
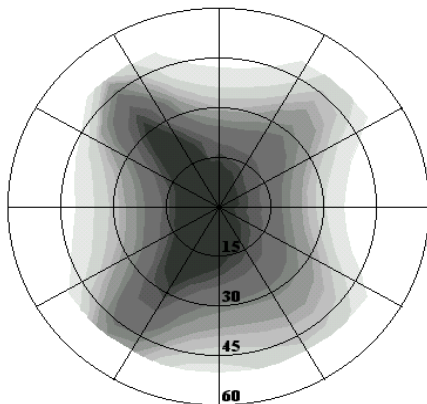
## QW & QWEP Grade Polymer Film

Quarter Wave Optical Light Retarder Base Film

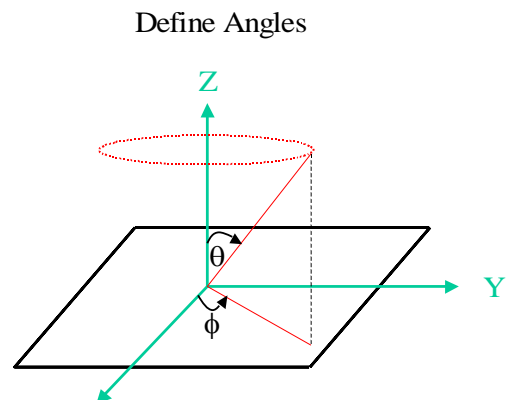
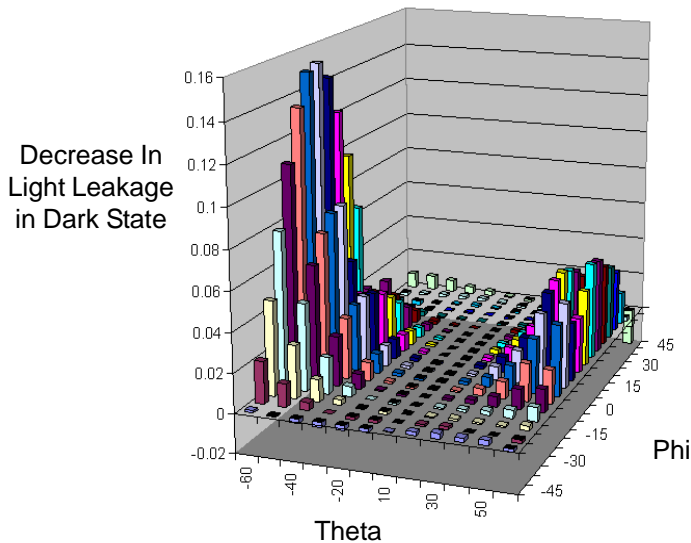
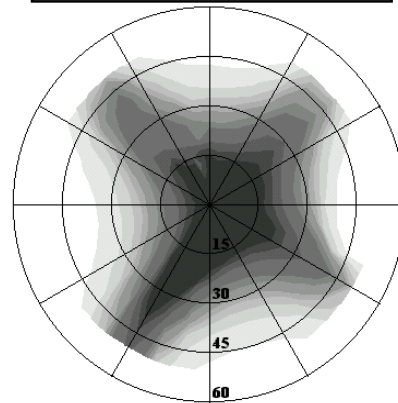


OptiGrafix QW and QWEP Grade quarter wave films are ideal for compensating a variety of different LCD modes and configurations. They function as both A plates and -C Plates (-225 nm). This powerful combination of optical properties are especially appropriate for improving viewing angle and contrast in VA (and similar modes) LCD technologies.

**Contrast Contour Plot**  
Compensated VA Cell



**Contrast Contour Plot**  
Un-Compensated VA



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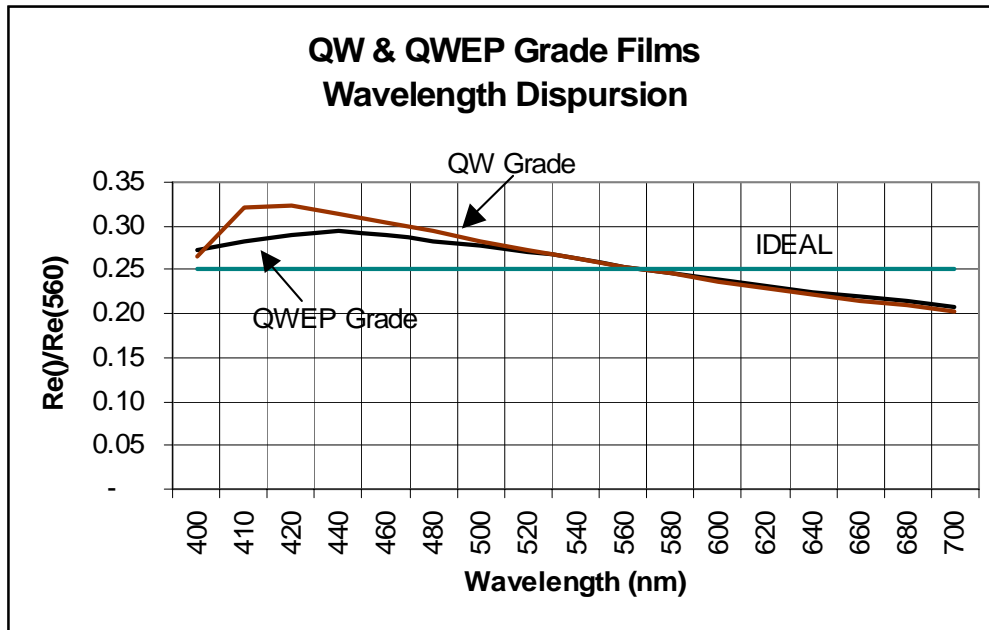
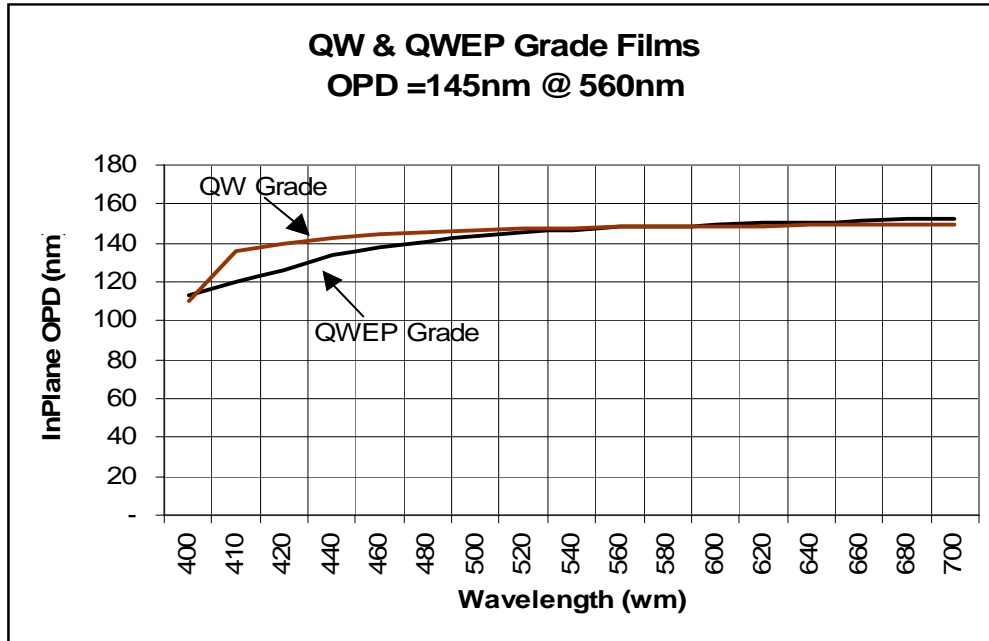
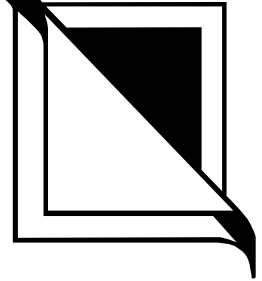
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# QW & QWEP Grade Polymer Film

Quarter Wave Optical Light Retarder Base Film

Birefringence Analysis



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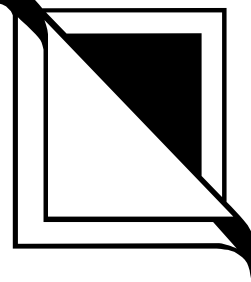
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# OptiGrafix™ QW & QWEP Grade Polymer Film

## Optical Light Retarder Base Film

Properties based on .005" Gloss/Gloss Base Film properties of other gauges and finishes of may vary.  
The following technical information and data should be considered representative or typical only,  
and not used for specification purposes.



### TYPICAL OPTICAL PROPERTIES

Property	QW Grade Value	QWEP Grade Values	Units	Test Method
Phase Uniformity:	< 5	<5	%	
Transparency:	>90	>93	%	ASTM D1476
Hazy	1.1	<1	%	ASTM D1003
Gloss	137	140	%	20° ASTM D523
	145	145	%	60° ASTM D523
	122	115	%	85° ASTM D523
Refractive Index	1.485	1.485		ASTM D542

### TYPICAL PHYSICAL PROPERTIES

Property	QW Grade Value	QWEP Grade Values	Units	Test Method
Specific Gravity	1.31	1.31		
Softening Temp.	65°	85°	°C	
Linear Heat Shrinkage 80°C @ 85% RH for 20 Hrs..	1.17	0	%	ASTM D1204-4
Water Vapor Permeability	685	685	g/m <sup>2</sup> /day	
Gas Permeability - O <sub>2</sub>	1800	1800	g/m <sup>2</sup> /day	
Yield Strength MD	65.4	65.4	Yield/Nmm <sup>2</sup>	ASTM D882-91
	TD	61.5	61.5	Yield/Nmm <sup>2</sup>
Tensile Strength	58.6	58.6	Yield/Nmm <sup>2</sup>	ASTM D882-91
Elongation at Break	47.2	47.2	%	ASTM D882-91
Modulus of Elasticity MD	975	975	Nmm <sup>2</sup>	ASTM D882-91
Mullen Bursting Strength	72.5	72.5	PSI	BS 4768

**Important Notice:** Grafix makes no warranties, express or implied, including but not limited to any implied warranty of merchantability of fitness for a particular purpose. The user is responsible for determining whether the Grafix product is fit for a particular purpose and suitable for the user's method of application. Please remember that many factors can affect the use and performance of an OptiGrafix optical film product in a particular application. Given the variety of factors that can affect the use and performance of a Grafix product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the Grafix product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

**Limitation of Remedies and Liability:** If the Grafix product is proven to be defective, THE EXCLUSIVE REMEDY, AT GRAFIX'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE GRAFIX PRODUCT. Grafix shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including, but not limited to, contract, negligence, warranty or strict liability.

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