

autotype

AUTOTEX UV & AUTOTEX XE HARDCOATED, TEXTURED POLYESTER FILMS FOR OUTDOOR APPLICATIONS

Electronic displays and membrane touch switches are seen on a wide range of products including flat panel displays, touchscreens, electroluminescent lamp displays, handheld computers and control panels on mechanical equipment.

Most applications incorporating electronic displays require the display screen to be tough, durable and capable of operating reliably in different types of environment. The clarity and the cosmetic quality of the screen is also required to meet a high specification.

Autotype offers **Autotex UV** and **Autotex XE** to meet the rigid specifications for electronic displays destined for the outdoors. Autotex UV and Autotex XE are specifically designed for outdoor applications. Autotex is a textured, screen printable, hardcoated polyester film which offers all the key benefits of a hardcoated polyester film. Autotex UV is primarily resistant to UV radiation and XE has additional humidity resistance, being able to withstand 85% RH at 85° C. (185° F.).

Autotex is available in two textures, Fine and Velvet, for a choice of finishes.



INNOVATION AT THE INTERFACE

Typical Data for Autotex UV and Autotex XE

ENVIRONMENTAL DATA

Autotex UV & XE contain a UV absorbing chemical which dramatically increases resistance to yellowing and resistance to premature embrittlement in outdoor applications.

Minimum use temperature: -40°C (-40°F);

Maximum use temperature: Autotex XE can withstand the following conditions: High humidity environments (85% RH): at 85°C / 185° F for a continuous period of 10 days.

Additional durability testing is ongoing. Autotex UV can withstand the following conditions: Greater than 80% RH at 40°C / 104°F; 10-80 RH at 60°C / 140°F; less than 10% RH at 85°C /185°F.

UV RESISTANCE

The UV resistance testing of Autotex UV & XE has been carried out using accelerated aging tests. Results from real time tests are not currently complete or available. Accelerated ageing uses an Atlas UVCON or Q Panel accelerated aging cabinet utilizing fluorescent sun lamps.

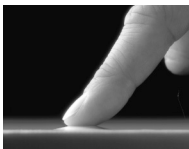
Test Conditions:

Apparatus:	Atlas UVCON or Q Panel Accelerated Aging Cabinet
Lamps:	8 Phillips UVA 340 sun lamps
Cycle:	Alternating cycle of 4 hours UV, 4 hours condensation
Temperature:	50°C (122°F) UV / 40°C (104°F) Condensation

Product	Yellowness Index		Flexibility
	Initial	After 1200 hour UVCON or Q Panel cycle	
Autotex	3	26	Minimum diameter of curvature to which material can be formed before cracking occurs (coating side outwards) 16mm (5/8")
Autotex UV and Autotex UV	5	9	Material can be folded completely back on itself (180°) without cracking

Typical data for 0.008", 200µ product

After a 1600 hour cycle switch life testing of Autotex V8XE on a non-embossed panel is expected to exceed 5 million actuations with no adverse effect on the product. *This is currently under test.*



INNOVATION AT THE INTERFACE

MECHANICAL PROPERTIES

Property	Autotex UV & XE	Test Method
Burst strength ¹	1.75 Mpa	ASTM D774-67
Elastic modulus (1% secant) 0.008", 200μ	4 - 5.5 Gpa	ASTM D882-83 23°C @ 50% RH, Strain rate - 10%/minute
Elongation at break 0.008", 200μ	MD 125% TD 80%	ASTM D882-83 23°C @ 50% RH, Strain rate - 50%/minute
MIT fold durability	>20,000 folds TD	ASTM D2176-69 ²
Switch Life ³	>5 million flexes	Autotype Method ³
Tensile strength at break, 200μ	160-250 Mpa (160-250N/cm ²)	ASTM D882-83
Yield point	6%	ASTM D882-83
Yield strength	95 - 140 Mpa TD	ASTM D882-83

1 Data derived from Dupont Teijin Films literature for 125μ Melinex[®] OD polyester film.

2 Adapted to Autotype Method, see Test Method Manual

3 See Switch Actuation Testing, test conditions

CHEMICAL PROPERTIES

Property	Autotex UV & XE	Test Method
Coefficient of hygroscopic expansion ¹	MD 8×10^{-6} (per 1% RH) TD 8×10^{-6} (per 1% RH)	ICI Method ¹ Between 40-80% RH
Moisture vapor transmission rate (MVTR) ¹	3.57g/m ² /24 hours	ASTM F372--73
Oxygen transmission rate ¹	8.2 ml/m ² / 24 hours	ASTM D1434-82 @ 25° C, 77% RH
Chemical resistance	See Solvent Resistance data	

1 Data derived from Dupont Teijin Films literature for 125μ Melinex[®] OD polyester film. The Autotex UV & XE coating slightly enhances most properties.

SWITCH ACTUATION TESTING

Test Conditions

Apparatus: Itronic Fuchs Pneumatic A8274 PS/IEC system with A8274 ZB cylinders rated at 10N at 6 Bar (6.08 x 10⁵ Nm⁻²)

Actuator finger: 8.5mm diameter, 45° Shore D hardness rubber.

Actuation rate: 120 per minute

All testing is performed on a flat panel with a total spacer thickness of 0.008" / 200μ and a spacer hole diameter of 13mm. Depending on the nature of the emboss and the level of exposure to sunlight, switch life is likely to be reduced compared to an unembossed overlay due to the increased stresses experienced during actuation.

Although conclusions may be drawn, it is important to note that any accelerated aging technique is unique and cannot be related directly to real time performance.

The use of Autotype Windotex on Autotex UV and XE will yellow and embrittle when exposed to sunlight over time, contact Autotype for further information. (Windotex is a UV-curable clear window lacquer.)

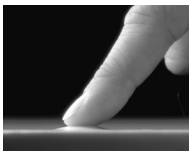
All results published here are offered in good faith, but due to the variations in the environmental conditions, do not constitute a specification and no guarantee is given or implied. Customers are therefore encouraged to carry out their own tests to establish whether the product has sufficient durability for the proposed end use.

THERMAL PROPERTIES

Property	Autotex UV & XE	Test Method
Coefficient of thermal expansion ¹	MD 19x10 ⁻⁶ cm cm ⁻¹ °C ⁻¹ TD 16x10 ⁻⁶ cm cm ⁻¹ °C ⁻¹	ICI Method between 20-50°C
Dimensional stability	<0.2% at 120°C MD maximum shrinkage	Autotype Method ²
Maximum and minimum use temperatures	See Environmental Data	Autotype Method ²

¹ Data derived from Dupont Teijin Films literature for 125μ Melinex[®] OD polyester film.

² See Test Method Manual



INNOVATION AT THE INTERFACE

SOLVENT RESISTANCE DATA

With continuous contact, some chemicals will begin to remove the UV absorber, reducing its UV resistance. Autotex UV & XE withstand exposure of 5 hours duration under DIN 42 115 Part 2 to the following chemicals without significant visible change or loss of UV resistance:

Acetic acid (10%)	Hydrochloric acid (10%)	White Spirit
Ajax / Vim in solution	Nitric acid (10%)	Windex ¹
Ammonia (2%) ¹	Persil powder in solution ¹	Wisk
Ariel powder in solution ¹	Petroleum spirit ¹	Paraffin oil
Bleach ¹	Potassium carbonate solution ¹	Pure Turpentine
Caustic soda (2%) ¹	Potassium ferricyanide	Linseed oil
Cutting oil	SBP 60/95 ¹	Castor oil
Diesel	Sodium carbonate solution ¹	
Downey / Lenor ¹	Sulfuric acid (10%)	¹ Extremely faint glossing of the texture was noted.
Glycerine	Tomato ketchup	
Gumption ¹	Water	

Exposure to the following chemicals under the above conditions causes slight glossing of the texture and a reduction in the UV resistance of the product. Occasional splashing with the chemicals will not affect the texture or reduce UV resistance.

Cyclohexanol ²	Formic acid (50%)	Formaldehyde solution
Glycol	Industrial Methylated Spirits	Isopropanol
Methanol		

²A white stain was noted.

Exposure to the following chemicals under the above conditions will cause blistering to the texture. However occasional splashing will not affect texture or reduce UV resistance.

Acetone	Methyl Ethyl Ketone	Toluene
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Autotex UV & XE are **not** resistant to the following:

Concentrated mineral acids	Concentrated caustic solution	Benzyl alcohol
Methylene chloride	High pressure steam at over 100°C	

OPTICAL PROPERTIES

Property	Autotex UV & XE	Test Method
BYK Gardner Haze Fine Velvet	68% ± 5% 71% ± 5%	ASTM D1003-77 ¹
Gloss Level (60°) Fine Velvet	5.5% ± 0.5% 4% ± 0.5%	ASTM D2457-70 ¹
Texture Profile Fine Velvet	Ra 1.9 ± 0.2μ; Rtm 10.0μ ± 2μ Ra 2.6 ± 0.2μ; Rtm 13.4μ ± 2μ	Autotype Method ²
Total Luminous Transmission	92% ± 2%	ASTM D1003-77 ¹
UV Transmission Density	0.7 ± 0.2	Autotype Method ² 365nm narrow pass filter
Yellowness Index ³	4.5 ± 0.5	ASTM D1925-70

1 Adapted to Autotype method, see Test Method Manual

2 See Test Method Manual

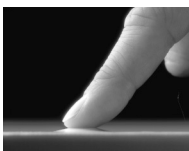
3 Typical result on 150μm product tested using X-Rite SP68

PHYSICAL PROPERTIES

Property	Autotex UV & XE	Test Method
Relative Density ¹	1.40	ASTM D1505-85 modified to ICI method at 23°C
Pencil Hardness	2H	Autotype Method ²
Thicknesses 0.006" 0.008" 0.010"	150μ ± 10% 200μ ± 10% 250μ ± 10%	

1 Data derived from Dupont Teijin Films literature for 125μ Melinex[®] OD polyester film.

2 See Test Method Manual



INNOVATION AT THE INTERFACE

ELECTRICAL PROPERTIES

Property	Autotex UV & XE	Test Method
Dielectric strength ¹ : 0.006", 150 μ 0.008", 200 μ	125kV/mm 105kV/mm	ASTM D149-81 6.35mm electrodes in dry air @25° C.
Dissipation factor ¹	0.005	ASTM D150-70
Surface resistivity	>10 ¹³ Ω /sq. 500 Vd.c	ASTM D257-83 @ 20°C./54% RH
Volume resistivity ¹	10 ¹⁵ Ω m 100 Vd.c	ASTM D257-83 @ 25°C/1000s

¹ Data derived from Dupont Teijin Films literature for 125 μ Melinex[®] OD polyester film. The Autotex XE coating slightly enhances most properties.

OZONE DEPLETING SUBSTANCES

EC Regulation 594/91 classifies ozone depleting substances into a number of different groups, I-VI. Autotex UV and XE do NOT contain any substance classified in groups I-VI nor have any of the substances been used by Autotype during manufacture.

For details of the content of each of the groups, please see separate Ozone Depleting Substances document.

AUTOTEX UV & AUTOTEX XE PRODUCT RANGE

Autotex UV and **Autotex XE** comprise of a range of hardcoated, thermally stabilized polyester films designed for outdoor displays and membrane touch switches used in rigorous environmental conditions. Both films are designed for outdoor use and are resistant to UV exposure.

Autotex XE is recommended for use in the most extreme environmental conditions, including high temperatures and high humidity.

Autotex UV and Autotex XE are offered in Fine or Velvet textures on the first surface, with an ink receptive second surface. The second surface provides excellent adhesion properties for screen printing inks. Both Autotex UV and XE offer high optical clarity and a flexible hardcoated surface that combines excellent solvent and abrasion resistance. They are designed specifically for use in applications where conventional polycarbonates or polyesters will undergo premature aging due to environmental conditions.

Product	First Surface (Textured Hardcoat) Finish	First Surface (Textured Hardcoat) Film Gauge	Second Surface (Ink Receptive Coating) For Solvent Based Inks	Second Surface (Ink Receptive Coating) For UV Curable Inks
AUTOTEX F8UV	Fine	8 mil (200µ)	■	
AUTOTEX V6UV	Velvet	6 mil (150µ)	■	
AUTOTEX V8UV	Velvet	8 mil (200µ)	■	
AUTOTEX V10UV	Velvet	10 mil (250µ)	■	
AUTOTEX V67UV	Velvet	6 mil (150µ)		■
AUTOTEX V87UV	Velvet	8 mil (200µ)		■
AUTOTEX V8XE	Velvet	8 mil (200µ)	■	
AUTOTEX F8XE	Fine	8 mil (200µ)	■	
AUTOTEX V6XE	Velvet	6 mil (150µ)	■	
AUTOTEX V87XE	Velvet	8 mil (200µ)		■

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