

Autotex[®] XE has been developed for applications where high or widely fluctuating temperatures, excessive humidity and strong levels of ultraviolet light are encountered and is ideal for both flat and tactile membrane switches and keyboards. XE stands for Extreme Environment and typical applications for the material are as a substrate for instrument, fascia and membrane switch panels that are used in outdoor or harsh industrial conditions.

PRODUCT DESCRIPTION

Autotex[®] XE is a polyester* based film, with specially constructed hard coat and primer layers. Unlike conventional films that can delaminate, become brittle or flake under extreme conditions; the various layers in Autotex[®] XE are formulated to resist ultraviolet light, moisture and wide variations in temperature. Conventional films without the special MacDermid Autotype UV resistance go brittle and yellow very quickly when subjected to UV light.

* The term polyester is the generic term for a number of different polymers, of which polyethylene terephthalate (PET) is the most common. PET is used in MacDermid Autotype Industrial Polyester film products.

Product range:

Autotex [®] XE Velvet	Velvet texture
V150, V200, V157, V207	150 and 200 micron

Autotex [®] XE Fine	Fine texture
F150, F200 F207	150 and 200 micron

Primer:

Autotex XE (V150, V200, F150, F200)

Autotex[®] XE has the same ink adhesion primer on the reverse surface as Autotex. This primer confers excellent adhesion to a wide range of solvent based graphic inks. The primer is not recommended for use with UV cured graphic inks or a combination of solvent and UV graphic inks because the adhesion performance will be inconsistent.

Autotex XE (7 Series) (V157, V207, F207)

The primer on Autotex[®] XE (7 Series) offers excellent adhesion to a wide range of solvent inks and improved adhesion to UV graphic inks. We recommend that you carry out your own full printing trials and in-house evaluation.

Please note that some of the electrical and mechanical properties of the 7 Series films differ from the standard product.



Windows:

Windotex™ is not a UV resistant product and is therefore not recommended for prolonged use outdoors. Due to the stabilising chemistry used in Autotex® XE, the adhesion of Windotex™ to the surface may be impaired. Contact MacDermid Autotype for further information.

Blocking:

Polyester films with high gloss surfaces are prone to blocking when stored with the film surfaces touching each other. Blocking is the term given when two surfaces adhere or merge into each other and when separated leave immovable marks on the film. For this reason we recommend that users make sure that the non-textured (ink primer) surfaces are not left in contact with each other for extended periods of time.

PRODUCT APPLICATIONS

Autotex® XE may be used as a substrate in the following applications:

Membrane switch overlays
Fascia panels
Signage
Nameplates
Labels/Product marking

Major benefits:

- Increased UV resistance compared with standard Autotex
- Increased humidity resistance
- Increased scratch resistance
- Consistent textured surface
- Attractive appearance

CHEMICAL PROPERTIES

Property	Autotex XE	Test Method
Chemical Resistance	See Autotex XE Solvent Resistance and Environmental Data	
Coefficient of hygroscopic expansion ¹	MD 8×10^{-6} (per 1% RH) TD 7×10^{-6} (per 1% RH)	Base film manufacturer's Method 40-80% RH
Moisture vapour transmission rate (MVTR) ¹	3.57g/m ² /24hours	ASTM F372-73
Oxygen transmission rate ¹	8.2ml/m ² /24 hours	ASTM D1434-82 @ 25°C, 77% RH

¹ Data derived from base film manufacturer's literature for 125µ polyester. The Autotex® XE coating slightly enhances most properties.



ELECTRICAL PROPERTIES

Property	Autotex XE	Test Method
Dielectric strength ¹ 125 μ	13.5 kV	ASTM D149 6.35mm electrodes in dry air @ 25°C
Dissipation factor ¹	0.005	ASTM D150-70
Surface resistivity ¹	>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 base film manufacturer's literature for 125 μ polyester. The Autotex[®] XE coating slightly enhances most properties

MECHANICAL PROPERTIES

Property	Autotex XE	Test Method
Young's modulus ¹	3700 N/mm ²	ASTM D882
Elongation at break	70%	ASTM D1505
Switch life ²	>5 million flexes	MacDermid Autotype Method ³
Tensile strength at break	150 N/mm ²	ASTM D882
Tensile strength at yield point	100 N/mm ²	ASTM D882
Tear strength	350 N/mm ²	ASTM D882

¹ Data derived from base film manufacturer's data. ² See section 4 - switch actuation testing.

³ See Test Method Manual.

OPTICAL PROPERTIES

Property	Autotex XE	Test Method
Gardner Haze Fine Velvet	58% \pm 5% 71% \pm 5%	ASTM D1003-77 ¹
Gloss Level (60°) Fine Velvet	7% \pm 1.5% 4.5% \pm 1%	ASTM D2457-70 ¹
Total luminous transmission	92% \pm 2%	ASTM D1003-77 ¹
UV absorption	2.5-3.6	MacDermid Autotype Method ² (370nm)
Yellowness index ²	<5	ASTM E313

¹ Adapted to MacDermid Autotype Method, see Test Method Manual.

² See Test Method Manual



PHYSICAL PROPERTIES

Property	Autotex XE	Test Method
Density ¹	1.39 g/cm ³	ASTM D1505
Thicknesses		MacDermid Autotype Method ²
	F200 200µ ±10%	
	V150 150µ ±10%	
	V200 200µ ±10%	

¹ Data derived from base film manufacturer's data.

² See Test Method Manual

THERMAL PROPERTIES

Property	Autotex XE	Test Method
Coefficient of thermal expansion ¹	0.002%/degree	Base film manufacturer's test method
Coefficient of humidity expansion ¹	0.0009%/RH	Base film manufacturer's test method
Dimensional stability	<0.2% MD at 120°C maximum shrinkage	MacDermid Autotype Method ²
Maximum processing temperature	120°C	
Maximum use temperature	Low humidity (<10%RH) 85°C High humidity (85%RH) 85°C	
Minimum use temperature	-40°C (-40°F)	MacDermid Autotype Method ²

¹ Data derived from base film manufacturer's data for 125µ polyester.

² See Test Method Manual



UV RESISTANCE

The testing of Autotex[®] XE has incorporated three separate techniques, which are detailed below.

1. ACCELERATED AGEING USING AN ATLAS UVCON ACCELERATED AGEING CABINET UTILISING FLUORESCENT SUN LAMPS.

Test Conditions

Apparatus: Atlas UVCON Accelerated ageing cabinet
 Lamps: 8 Phillips UVA 340 sun lamps
 Cycle: Alternating cycle of 4 hours UV,
 4 hours condensation
 Temperature: 40°C during condensation cycle
 60°C during UV cycle

Results

Product	Yellowness Index		Flexibility
	Initial	After 1600 hour UVCON cycle	
Autotex	1.6	26.3*	Minimum diameter of curvature to which material can be formed before cracking occurs (coating side outwards) 16mm (5/8"), Poor
Autotex XE	4.8	8.1	Material can be folded completely back on itself (180°) without cracking, Very Good

Typical results for 150µ product

*Standard Autotex[®] becomes brittle after 100 hours and flaking of the coating occurs later in the UVCON cycle

Switch life testing (see section 4 Switch Actuation testing for test conditions)

After a 1600 hour UVCON cycle, switch life testing of Autotex[®] XE on a non-embossed panel exceeded 5 million actuations with no adverse effect on the product.

2. REAL TIME CONTINUOUS EXPOSURE IN MIAMI, FLORIDA TEST CONDITIONS

Apparatus

South facing 45° angled mounting frame in Miami, Florida, USA.

Test method

Samples of Autotex[®] XE were subjected to real time ageing in Florida continuously for 12 months.

Results

Product	Yellowness Index		Flexibility
	Initial	Final	
Autotex [®] XE	4.8	7.55	Minimum diameter of curvature to which material can be formed before cracking occurs (coating side outwards) Material can be folded completely back on itself (180°) without cracking. Good.



3. ACCELERATED AGEING BY FOCUSING DIRECT SUNLIGHT ONTO TEST SAMPLES TEST CONDITIONS

Apparatus

The South Florida Tests Service Sun Accelerated Weathering Device

Test method

Samples are subjected to Arizona (USA) sunlight (total UV 290-385nm) concentrated via mirrors/ lenses into the target area.

No temperature control is performed other than the use of a localised fan. Samples are subjected to a water spray (8 min/hour of active sunlight) to simulate rain.

The samples were exposed to 333 mJ/m² (total UV), which is calculated to simulate one year's real time exposure in Arizona.

Results

Product	Yellowness Index		Flexibility
	Initial	Final	
Autotex [®]	1.7	10.6	Minimum diameter of curvature to which material can be formed before cracking occurs (coating side outwards) 9.5mm (3/8"), Poor
Autotex [®] XE	4.7	7.5	Material can be folded completely back on itself (180°) without cracking. Very Good.

Typical results for 150µ product

Switch life testing (see section 4 Switch Actuation testing for test conditions)

After exposure, switch life testing of Autotex[®] XE on a non-embossed panel exceeded 5 million actuations with no adverse effect on the product.

4. 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 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 un-embossed overlay due to the increased stresses experienced during actuation.

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

The use of Windotex[™] on Autotex[®] XE is not recommended as it will yellow and embrittle when exposed to sunlight. Due to the stabilising chemistry used in Autotex[®] XE the adhesion of Windotex[™] to the surface may be impaired. Contact MacDermid Autotype for further information.



All results published are offered in good faith but due to the variations in the weather they 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.

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LEGISLATIVE DIRECTIVES

This product does not knowingly contain any phthalates, or substances listed in the European End-of-Life Vehicles (ELV), Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS) or Waste Electrical and Electronic Equipment (WEEE) Directives.

EC Regulation 594/91 classifies ozone depleting substances into a number of different groups, I-VI. Autotex[®] XE does NOT contain any substance classified in groups I-VI nor have any of the substances been used by MacDermid Autotype during manufacture. For details of the content of each of the groups, please see separate ozone depleting substances document

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