# DuPont™ Tedlar®

**polyvinyl fluoride film**

## General Properties

### Summary of Properties

**General**

Unique properties of DuPont™ Tedlar® polyvinyl fluoride (PVF) film include excellent resistance to weathering, outstanding mechanical properties, and inertness towards a wide variety of chemicals, solvents, and staining agents. General properties are summarized in **Table 1**.

Biaxially oriented Tedlar® is available in clear or pigmented forms in Type 3. Tedlar® contains no plasticizers; hence, it has good aging properties and remains tough and flexible over a broad temperature range.

Tedlar® is supplied with both sides treated for adherability to enable bonding to a wide variety of substrates. Treated surfaces have excellent compatibility with many classes of engineering adhesives, including polyesters, epoxies, urethanes, phenolics, rubbers and pressure-sensitive mastics.

Outdoor weathering tests on Tedlar® pigmented films have been conducted for more than 30 years. The weather resistance, inertness and strength characteristics suggest broad use as a finish for architectural panels. The additional features of excellent hydrolytic stability, high dielectric strength and dielectric constant are of interest to the electrical and photovoltaic industries.

### Physical and Thermal Properties

DuPont™ Tedlar® PVF film is strong, flexible and fatigue-resistant. Its resistance to failure by flexing is outstanding. Tedlar® performs well in temperatures ranging from approximately -72 to 107°C (-98 to 225°F), with intermittent short-term peaking up to 204°C (400°F). Some physical and thermal properties of representative Tedlar® PVF films are summarized in **Table 2**.

50 years
DuPont™ Tedlar®
Celebrating the past, present & future of proven performance

## Table 1
## General Properties of DuPont™ Tedlar® PVF Films

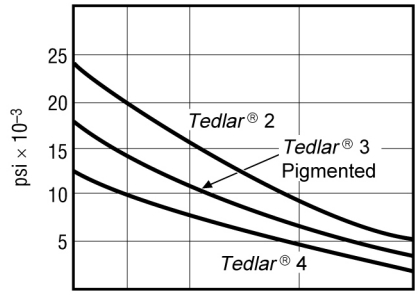
| | Property | Typical Value | Test Method | Test Condition |
|---|---|---|---|---|
| PHYSICAL | Bursting Strength | 29–65 psi | Mullen, ASTM D-774-67 | 22°C (72°F) |
| | Coefficient of Friction (Film/Metal) | 0.18–0.21 | ASTM D-1894-78 | 22°C (72°F) |
| | Density | 1.37–1.72 g/cc | ASTM D-1505-68 | 22°C (72°F) |
| | Impact Strength | 10–20 in lb/mil | Spencer ASTM D-3420-80 | 22°C (72°F) |
| | Moisture Absorption | <0.5% for most types | Water immersion | 22°C (72°F) |
| | Water Vapor Transmission | 9–57 g/m$^2$d | ASTM E-96-E-80 | 39.5°C, 80% RH |
| | Refractive Index | 1.46 $n_D$ | ASTM D-542-50 Abbe Refractometer | 30°C (86°F) |
| | Tear Strength | | | |
| | Propagated | 15–60 g/mil | Elmendorf-ASTM D-1922-67 | 22°C (72°F) |
| | Initial (Graves) | 260–500 g/mil | ASTM D-1004-66 | 22°C (72°F) |
| | Tensile Modulus | 300–380 x 10$^3$ psi | ASTM D-882-80, Method A 100% elong./min–Instron | 22°C (72°F) |
| | Ultimate Tensile Strength | 8–16 x 10$^3$ psi | ASTM D-882-80, Method A 100% elong./min–Instron | 22°C (72°F) |
| | Ultimate Elongation | 90–250% | ASTM D-882-80, Method A 100% elong./min–Instron | 22°C (72°F) |
| | Ultimate Yield | 6000–4900 psi | ASTM D-882-80, Method A 100% elong./min–Instron | 22°C (72°F) |
| CHEMICAL | Chemical Resistance | No visible effect | 1 yr immersion in | |
| | | | Acids | 25°C (77°F) |
| | | | Bases | 25°C (77°F) |
| | | | Solvents | 25°C (77°F) |
| | | | 2 hr immersion in | |
| | | | Acids | Boiling |
| | | | Bases | Boiling |
| | | | Solvents | Boiling |
| | | Strength and appearance not affected | Soil Burial—5 yr | — |
| | Gas Permeability | | | |
| | Carbon Dioxide | 11.1 cc/(100in$^2$)(24 hr)(atm)(mil) | ASTM D-1434-75 | 24°C (75°F) |
| | Helium | 150 cc/(100in$^2$)(24 hr)(atm)(mil) | ASTM D-1434-75 | 24°C (75°F) |
| | Hydrogen | 58.1 cc/(100in$^2$)(24 hr)(atm)(mil) | ASTM D-1434-75 | 24°C (75°F) |
| | Nitrogen | 0.25 cc/(100in$^2$)(24 hr)(atm)(mil) | ASTM D-1434-75 | 24°C (75°F) |
| | Oxygen | 3.2 cc/(100in$^2$)(24 hr)(atm)(mil) | ASTM D-3985-80 | 24°C (75°F) |
| | Vapor Permeability (at part. press. or vapor at given temp.) | | | |
| | Acetic Acid | 45 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Acetone | 10,000 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Benzene | 90 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Carbon Tetrachloride | 50 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Ethyl Acetate | 1000 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Ethyl Alcohol | 35 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Hexane | 55 g/(100m$^2$)(hr)(mil) | ASTM E-96-80, modified | 24°C (75°F) |
| | Weatherability | Excellent | Florida exposure | Facing South at 45° to horizontal |
| THERMAL | Aging | 3000 hr | Circulating Air Oven | 150°C (302°F) |
| | Heat Sealability | Some varieties—see Bulletin TD-14 | | |
| | Linear Coefficient of Expansion | 2.8 x 10$^{-5}$ in/in/°F | | |
| | Shrinkage (Type 2) MD and TD | 4% at 130°C (266°F) | Air Oven, 30 min | |
| | (Type 3) TD only | 4% at 170°C (338°F) | Air Oven, 30 min | |
| | (Type 4) TD only | 2.5% at 170°C (338°F) | Air Oven, 30 min | |
| | Temperature Range | | | |
| | Continuous Use | -72 to 107°C (-98 to 225°F) | | |
| | Short Cycles or Release (1-2 hr) | up to 175°C (350°F) | | |
| | Zero Strength | 260 to 300°C (500 to 570°F) | Hot Bar | |
| ELECTRICAL | | TTR20SG4 / TWH20BS3 | | |
| | Corona Endurance (hr) | 2.5 / 6.2 | ASTM Suggested T method | 60 cPs, 1000 V/mil) |
| | Dielectric Constant | 8.5 / 11.0 | ASTM D-150-81 | 1 Kc at 22°C (72°F) |
| | Dielectric Strength (kV/mil) | 3.4 / 3.5 | ASTM D-150-81 | 60 cPs, kV/mil |
| | Dissipation Factor (%) | 1.6 / 1.4 | ASTM D-150-81 | 1000 cPs, 22°C (72°F) |
| | | 2.7 / 1.7 | ASTM D-150-81 | 1000 cPs, 70°C (158°F) |
| | | 4.2 / 3.4 | ASTM D-150-81 | 10 Kc, 22°C (72°F) |
| | | 2.1 / 1.6 | ASTM D-150-81 | 10 Kc, 70°C (158°F) |
| | Volume Resistivity (ohm.cm) | 4 x 10$^{13}$ / 7 x 10$^{14}$ | ASTM D-257-78 | 22°C (72°F) |
| | | 2 x 10$^{10}$ / 1.5 x 10$^{11}$ | ASTM D-257-78 | 100°C (212°F) |

## Table 2
## Typical Properties of Tedlar® PVF Films

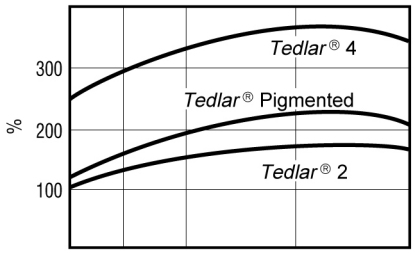
| Description | | 1.0 mil UV Screening Transparent Type 3 | 1.0 mil Transparent Type 3 | 1.5 mil Low Gloss White Type 3 | 2.0 mil Satin White Type 3 | |
|---|---|---|---|---|---|---|
| **Designation** | **Units** | **TUT10BG3** | **TTR10BG3** | **TWH15BL3** | **TWH20BS3** | **Test Method** |
| **Physical Properties** | | | | | | |
| Area Factor | $ft^2/lb$<br>$m^2/kg$ | 140<br>28.7 | 140<br>28.7 | 87<br>17.8 | 60<br>12.3 | |
| Ultimate Tensile Strength, Min. (MD) | kpsi<br>MPa | 13<br>90 | 13<br>90 | 8<br>55 | 9<br>62 | Instron ASTM D-882-80 Method A—100%/min |
| Tensile Modulus (MD) | kpsi<br>MPa | 310<br>2,138 | 301<br>2,075 | 305<br>2,103 | 385<br>2,655 | Instron ASTM D-882-80 Method A—100%/min |
| Ultimate Elongation, Min. (MD) | % | 95 | 95 | 90 | 110 | Instron ASTM D-882-80 Method A—100%/min |
| Bursting Strength | psi/mil<br>MPa/m | 56.9<br>15.446 | 48.1<br>13,057 | 28.9<br>7,845 | >34.7<br>>9,420 | Mullen ASTM-D-774-67 (1971) |
| Tear Strength—Propagating (MD) | g/mil<br>kN/m | 17.1<br>6.6 | 19.2<br>7.4 | 23.1<br>8.9 | 46.2<br>17.8 | Elmendorf ASTM-D-1922-67 (1978) |
| Tear Strength—Propagating (TD) | g/mil<br>kN/m | 19.0<br>7.3 | 17.4<br>6.7 | 18.6<br>7.2 | 26.6<br>10.3 | Elmendorf ASTM-D-1922-67 (1978) |
| Tear Strength—Initial (MD) | g/mil<br>kN/m | 373<br>144 | 423<br>163 | 333<br>129 | 506<br>195 | Graves ASTM-D-1004-66 (1981) |
| Tear Strength—Initial (TD) | g/mil<br>kN/m | 435<br>168 | 478<br>185 | 264<br>102 | 377<br>146 | Graves ASTM-D-1004-66 (1981) |
| Impact Strength | in lb/mil<br>kJ/m | 20.3<br>90.3 | 17.5<br>77.9 | 9.6<br>42.7 | 16.1<br>71.6 | Spencer ASTM D-3420-80 |
| Specific Gravity | — | 1.37 | 1.39 | 1.46 | 1.71 | ASTM D-1505-68 (1979) |
| Coefficient of Friction Film/Metal | — | 0.21 | 0.21 | 0.18 | 0.18 | ASTM D-1894-78 |
| Coefficient of Abrasion | — | — | — | 385 | — | ASTM D-658-81 |
| Moisture Absorption | % | <0.5 | <0.5 | <0.5 | <0.5 | ASTM D-570-81 |
| Moisture Vapor Transmission | $g/m^2d$ | 30.1 | 30.2 | 24.5 | 16.9 | ASTM E-96E-80 |
| **Thermal Properties** | | | | | | |
| Aging in Air | Hours to embrittlement | 3,000 | 3,000 | 3,000 | 3,000 | Oven at 300°F |
| Heat Sealability | — | — | Some varieties—see Bulletin TD-14 | | | |
| Linear Coefficient of Expansion (MD) | m/mK | $7.8 \times 10^{-5}$ | $8.8 \times 10^{-5}$ | $6.7 \times 10^{-5}$ | $9.7 \times 10^{-5}$ | D-696-79 (at 50–70°C) |
| Linear Coefficient of Expansion (TD) | m/mK | $8.1 \times 10^{-5}$ | $7.1 \times 10^{-5}$ | $8.0 \times 10^{-5}$ | $8.3 \times 10^{-5}$ | D-696-79 (at 50–70°C) |
| Shrinkage, Max. (TD) | % at °C | 6 at 150 | 5 at 170 | 5 at 170 | 5 at 170 | ASTM D-1204-78 |
| Specific Heat | cal/g °C<br>kJ/kg K | 0.42<br>1.76 | 0.24<br>1.01 | 0.26<br>1.09 | 0.25<br>1.05 | DuPont 990 Thermal Analyzer |

## Physical Properties vs. Temperature

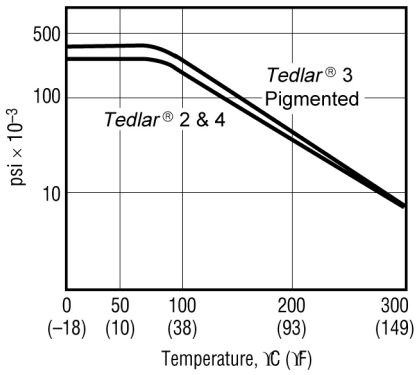
### Tensile Strength




### Elongation




### Tensile Modulus

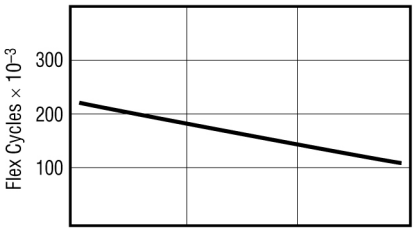



*DuPont pneumatic tester

## Hydrolytic Stability

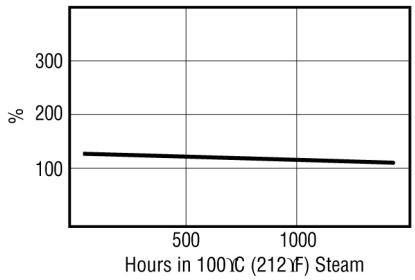
DuPont™ Tedlar® PVF film has excellent resistance to hydrolysis. Strength, yield stress, and elongation are not measurably affected after 60 hr exposure in 85 psig steam 163°C (325°F).

### Flex Life



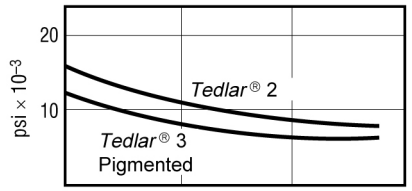

### Impact Strength*


### Elongation

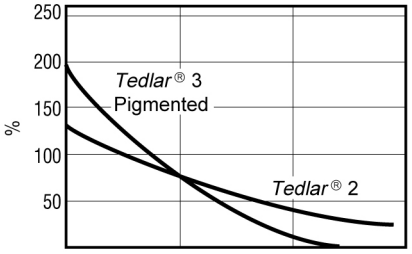



## Thermal Aging

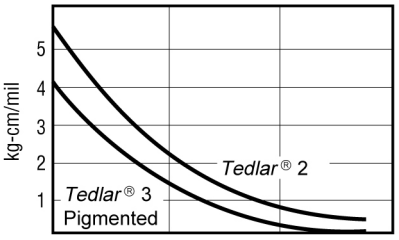
### Tensile Strength



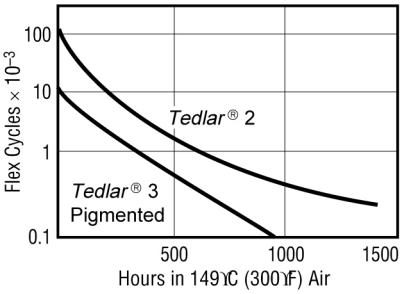

### Elongation




### Impact Strength*




### Flex Life

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