



ETFE Fluoropolymer Extruded Films

ETHYLENE TETRAFLUOROETHYLENE FILM FOR USE IN PHARMACEUTICAL APPLICATIONS

ETFE films are the material of choice for use in pharmaceutical containers such as cap liners, stoppers, and plunger laminates. Like all TCI's fluoropolymer films, they are inherently inert and will not contaminate the contents of the pharmaceutical container. These films are free of plasticizers, processing aids, or additives that may cause contamination.

ETFE films possess excellent thermal stability, flexibility, and release over a broad continuous-use temperature range of -200°C to 165°C (-328°F to 330°F).

TCI's proprietary Plasma Surface Treatment creates ETFE films that are bondable to various elastomers, including silicone and butyl rubbers.

TCI offers several ETFE film options to match diverse processing techniques and applications:



ETFE PG (Premium Grade)

- General purpose grade for use in most flat cap liner and plunger applications
- Offers superior anti-stick and low friction properties, combined with high elongation and tear resistance
- Continuous use temperature range from -200°C to 165 °C (328°F to 330°F)

ETFE S1 Grade

- Specialty grade of ETFE that possesses superior elongation and formability characteristics when compared to standard ETFE PG grade
- Features 350-450% elongation which allows deeper draws in thermoforming
- Continuous use temperature range from -200°C to 165 °C (328°F to 330°F)

ETFE S2 Grade

- Specialty grade of ETFE that possess highest elongation and formability characteristics at molding temperatures amongst all ETFE films, due to its lower melt point (225°C versus 260°C for other grades)
- Engineered for deepest draws and most complex molding shapes
- Provides wrinkle and tear-free surface after molding
- ETFE B2 grade service temperature is from -200°C to 125°C (-328°F to 257°F)

TCI's ETFE Films - General Availability

- Thickness range from 0.0005" to 0.005" (12.5 to 125 µm)
- Plasma treated surfaces available – 1 side or both sides
- Standard width: 60" (1,524 mm)
- Width up to 62" (1,575 mm) available
- Any slit widths available upon request



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| | | | ETFE PG | ETFE S1 | ETFE S2 |
|----------------------------------|-------------------------|-------------|----------------------|--------------------|--------------------|
| General Properties | Units | Test Method | | | |
| Specific Gravity | | ASTM D792 | 1.74 | 1.74 | 1.78 |
| Area Yield | ft ² /lb/mil | | 110 | 110 | 108 |
| Area Yield | m ² /kg/25μ | | 22.6 | 22.6 | 22.2 |
| Flammability | | UL-94 | V-0 | V-0 | V-0 |
| Water Absorption | % | | <0.03 | <0.03 | n/a |
| Mechanical Properties | | | | | |
| Tensile Strength | psi (MPa) | ASTM D882 | 7,000 (48) | 7,500 (52) | 6,000 (42) |
| Elongation at Break, min. | % | ASTM D882 | 300 | 350 | 400 |
| Tensile Modulus | psi (MPa) | ASTM D882 | 140,000 (965) | 125,000 (850) | n/a |
| Folding Endurance (MIT) | cycles | ASTM D2176 | 50,000 | 80,000 | 200,000 |
| Thermal Properties | | | | | |
| Continuous Use Temp | °F (°C) | UL-746 B | 330 (165) | 330 (165) | 257 (125) |
| Melt Point | °F (°C) | ASTM D3418 | 500 (260) | 482 (250) | 437 (225) |
| Coeff. of Lin. Thermal Expansion | in/(in °F) | ASTM D696 | 7x10 ⁻⁵ | 7x10 ⁻⁵ | 7x10 ⁻⁵ |
| Product Offering | | | | | |
| Width | inches (mm) | | Up to 62" (1,575) | | |
| Thickness | mils (μm) | | 0.5 - 5 (12.5 - 125) | | |
| Standard Colors | | | Clear | | |
| Surface Treatments Available | | | | | |
| Chemical Etching | | | • | | |
| Plasma Treatment | | | • | | |

The above table contains typical representative values and is not to be used for product specification. Contact TCI for a formal specification.

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