



TECHNICAL WHITEPAPER

Teflon Tubing: What you Absolutely Need to Know

Introduction to Fluoropolymers

Used successfully for many years in the medical industry, fluoropolymer tubing is fast becoming a preferred component in many industrial applications such as automotive, aerospace, fluid handling systems and electronics. Teflon® tubing in particular delivers performance attributes that are comparable, and in many cases, superior to metal tubing.

Let's start with the basics. Teflon® is a registered trademark that refers to three fluoropolymer plastic resins: PTFE, FEP, and PFA. Other important fluoropolymers include: ETFE, PVDF, PCTFE, and THV.

Key facts about Teflon® tubing: It will never corrode, eliminating concerns about corrosion-related failure or contamination. It's also lighter in weight, an important consideration for many industries.

If you must contend with temperature extremes, tubing made from fluoropolymers are the answer. They withstand extreme heat and cold with no changes in their mechanical properties. Flame resistant, they have high working temperatures (up to 500° C). Fluoropolymers are chemically resistant so they perform well in difficult environments. Their lubricious natures also lend well to applications that demand superior friction reduction and non-stick properties.

PTFE – Polytetrafluoroethylene



On the atomic level, a PTFE molecule resembles a carbon rod encased in a sheath of fluorine atoms. These atoms form a strong and continuous shield around the carbon-carbon bonds, providing it with chemical resistance and stability. This atomic make-up is what imbues PTFE with its key properties:

- High continuous service temperature (260°C)
- Very lubricious - lowest coefficient of friction of any polymer
- Chemical and solvent resistance
- Electrical resistance
- High melting point (342°C/648°F)

FEP – Fluorinated ethylene propylene



The discovery of PTFE was a giant leap forward in materials science, however there was one shortcoming for some applications. PTFE is a paste extrusion, and is not melt processable. The pursuit of a more processable material led to the discovery of FEP, which has advanced thermal stability and lower maximum continuous use temperature (200° C). Key performance attributes include:

- Lower melting point than PTFE (265°C)
- Lower processing temperature (360°)
- Continuous use temperature of 200°C
- Increased translucence compared to PTFE

PFA – Perfluoroalkoxy



PFA tubing is the next generation of Teflon® tubing, and was developed specifically for greater clarity, flexibility, melt processability and a higher continuous service temperature. A variation, PFA HP (high purity) tubing, is well suited for fluid handling applications in the semiconductor and pharmaceutical industries where an extremely low level of chemical extractables is required. Key performance attributes include:

- Combines the best attributes of PTFE and FEP
- Melt processable for longer continuous lengths
- Continuous use temperature of 260° C
- High purity
- Smoother surface texture than PTFE and FEP

ETFE – Ethylene tetrafluoroethylene



ETFE is used in applications requiring excellent impact resistance along with stress crack resistance. The resin maintains these properties up to its continuous working temperatures of 300° F/148° C. These properties make ETFE an excellent choice for applications in the chemical and mechanical industry. When compared to other fluoropolymers, ETFE delivers:

- Increased durability and stiffness
- Higher pressure rating
- Higher tensile strength and creep resistance

PVDF – Polyvinylidene Fluoride



PVDF is often referred to by its trade name, Kynar®. It was designed primarily for applications requiring excellent chemical resistance, high levels of purity, and superior mechanical properties. PVDF is often used as a lining or protective barrier in chemical industry applications. PVDF offers:

- Excellent resistance to creep and fatigue
- Thermal stability
- Radiation resistance

Properties	PTFE	FEP	PFA	ETFE	PVDF
Continuous Service Temperature	500°F	400°F	500°F	302°F	235°F
Coefficient of friction	0.1	0.2	0.2	0.23	0.3
Dielectric Strength (Short Term) 10Mil Film	>1,400	>2,000	>2,000	>2,000	<1,080
Tensile Strength	2500-4000 PSI	3500	4000	7500	D638 5000

Note: For more properties see our online [Summary of Properties](#) (PDF)



How Zeus Can Help

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Since 1966 Zeus has been built upon the core technology of precision extrusion of high temperature plastics. Today, with a broad portfolio of engineered resins and secondary operations, Zeus can provide turnkey solutions for development and high-volume supply requirements.

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