

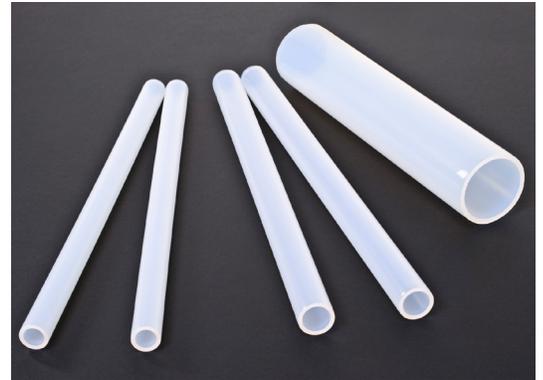
ULTRA HIGH PURITY TUBING AND PIPE

Fluoropolymer Tubing – A Choice of Standard and High Purity Resin Formulations

Fluoropolymer Tubing

Available in FEP, PFA, and UHP-PFA resins, AMETEK designs for a wide range of high-purity and corrosive resistant applications covering operating temperature ranges from -100°F to 400°F. The tubing is also available in THV and PVDF resins. The non-stick characteristics of fluoropolymer resins, combined with their low extractable levels and chemically inert nature make AMETEK tubing ideal for aerospace, automotive, electronics, food and beverage, medical, pharmaceutical, chemical processing, and DI water applications.

Each resin has unique characteristics that dominate in a variety of applications. The FEP for example offers a high clarity and transparency in the market while maintaining a high temperature range. Alternatively, the PFA offers a much wider operating temperature range. AMETEK also offers a high purity PFA for the certain applications that require the lowest possible level of impurities while maintaining a wide temperature operating range. At lower operating temperatures, THV resin can offer unmatched flexibility along with the highest clarity compared to all other fluoroplastics. These tubes are available in a wide range of standard sizes but can also be custom ordered to satisfy the industry's most challenging demands.



High Purity Tubing

AMETEK produces fluoropolymer tubing designed to meet the exact high purity requirements of the semiconductor and pharmaceutical industries. AMETEK produces tubing under strict standards utilizing premium High Purity grades of PFA. Our UHP-PFA tubing can be manufactured in a class 10,000 clean room environment and meets F-57 standards. Specifications defining exact resin grade and/or manufacturer can easily be accommodated. UHP-PFA exhibits a high temperature capability, along with the low extractable levels and low reactivity characteristics required in ultra high-purity chemical and water applications.

Key Properties

- Wide temperature service range
- Low permeability
- Exceptional physical and chemical resistance

Markets

- Semiconductor manufacturing
- Pharmaceutical processing
- Medical equipment industry
- Chemical processing
- Food and beverage processing
- Aerospace industry
- Automotive industry
- Electrical sleeving application
- DI water applications
- Solar panel industry

Features

- Custom configurations and shapes
- Dual, bonded tubing
- Wide range of sizes
- Natural and custom colors
- FEP, PFA, UHP-PFA, PVDF, and THV resins available
- Custom packaging and spooling
- TQM quality
- Stocking program for JIT delivery
- Competitive pricing
- Meets ASTM standards



Special Packaging Options

- Pre-cut coiled lengths
- Double poly bagged
- End capped
- Clean room packaged
- Clean room extruded
- Custom laser marked



Chemical Properties

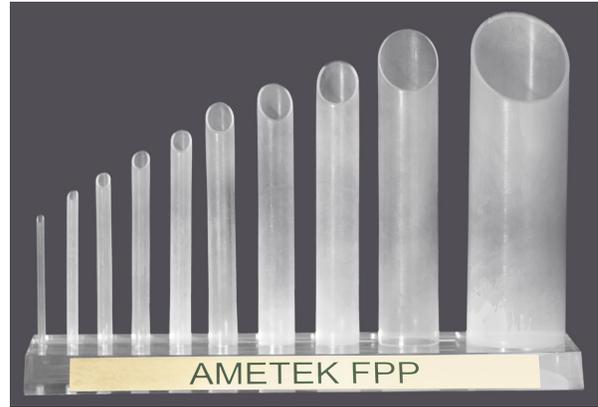
- Chemically inert, non-contaminating
- Resistant to corrosive agents
- Non-adhesive
- Non-flammable
- Low permeability

Electrical Properties

- Low dielectric constant
- Low dissipation factor
- High arc resistant
- High surface and volume resistivity

Mechanical Properties

- Temperature stability and flexibility (-275°F to 400°F)
- Low friction coefficient
- Resists thermal and mechanical shock
- Non-aging
- Anti-stick



PHYSICAL PROPERTIES	RESIN TYPE					
	FEP	PFA	UHP	PVDF	THV 221	THV 500
Ultimate Tensile Strength, Psi	3,000 (73° F)	4,000 (73°F) 2,000 (482°F)	4,000 (73°F) 2,000 (482°F)	5,000 - 8,000 (73°F)	2900	3770
Ultimate Elongation	300 (73°F) 500 (482°F)	300 (73°F) 500 (482°F)	300 (73°F)	20-100 (73°F)	700	520
Coefficient of Friction (Dynamic)	0.30 (AVG)	0.25 (AVG)	0.25 (AVG)	0.14	3.4	0.35
Flexural Modulus Psi X 10 ³ (ASTM D-790)	90 (73°F)	90 (73°F) 10 (482°F)	90 (73°F) 10 (482°F)	200 - 335 (73°F)	11.6	30.5
Impact Strength Notched Izod (Ft.Lb/In.) (ASTM D-256)	no break (73° F) 2.9 (-65° F)	no break (73° F) 1.2 (-320° F)	no break (73° F) 1.2 (-320° F)	1.8 - 4 (73°F)	no break (73° F)	no break (73° F)
Continuous Use Temperature, °F	400	500	500	245	158	248
Specific Gravity (ASTM D-792)	2.12-2.17	2.12-2.17	2.12-2.17	1.77 - 1.79	1.93	2.01
Dielectric Strength (ASTM D-149) Short Term Volts/Mil	2,000	2,000	2,000	1,700	1,550	1,200
Dielectric Constant (ASTM D-150)	2.1	2.03	2.03	4.5 -9.5	5.72 (1 MHz) 2.66 (9.4 GHz)	4.82 (1MHz) 2.48 (9.4 GHz)
Melting Point, °F	500	582	582	329	248	329

Specifications-Typical Sizes

Industrial Wall

SIZE (in.)		WALL THICKNESS	I.D/O.D TOL.	Bend Radius
I.D.	O.D.			
0.031	0.063	0.015 + 0.003	0.004	.20
0.031	0.094	0.030 + 0.005	0.004	-
0.063	0.125	0.030 + 0.005	0.005	.25
0.094	0.156	0.030 + 0.005	0.005	.40
0.125	0.188	0.030 + 0.005	0.005	.70
0.188	0.250	0.030 + 0.005	0.005	1.70
0.156	0.250	0.047 + 0.005	0.005	-
0.250	0.313	0.030 + 0.005	0.005	3.40
0.313	0.375	0.030 + 0.005	0.006	5.00
0.375	0.438	0.030 + 0.005	0.006	6.50
0.438	0.500	0.030 + 0.005	0.007	8.00
0.500	0.563	0.030 + 0.005	0.007	9.50
0.563	0.625	0.030 + 0.007	0.007	10.50
0.625	0.688	0.030 + 0.007	0.008	10.70
0.688	0.750	0.030 + 0.007	0.009	-
0.750	0.813	0.030 + 0.007	0.009	11.20
0.875	0.969	0.047 + 0.007	0.010	15.00
1.000	1.094	0.047 + 0.007	0.010	21.00

Tubing Burst Pressure

An approximate value for burst pressure may be calculated using the following formulas:

$$PB = S (OD/ID - 1) \quad S = X \cdot Y \cdot T$$

Where:

PB = Burst pressure, psi	X = Material constant:
S = Material strength, psi	X (FEP) = 1929
OD = Outer diameter of tubing, in.	X (PFA) = 2278
ID = Inner diameter of tubing, in.	Y = Material constant:
	Y (FEP) = 4.285
	Y (PFA) = 3.77
	T = Maximum temperature of the fluid in the tubing, °F

Note: This formula is only valid for values of T between 0°F and 500°F

Custom lengths, packaging, and spooling upon request. Supplied in natural color. Specific colors upon request.

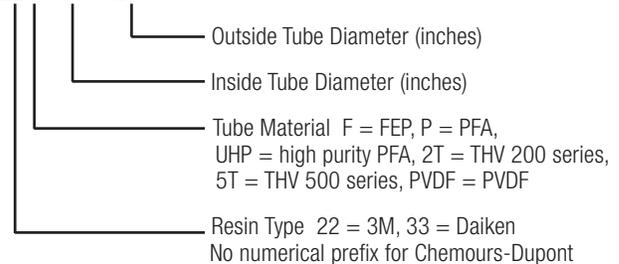
Heavy Wall

SIZE (in.)		WALL THICKNESS	I.D/O.D TOL.	Bend Radius
I.D.	O.D.			
0.063	0.188	0.062 + 0.008	0.005	-
0.125	0.250	0.062 + 0.008	0.005	1.00
0.188	0.313	0.062 + 0.008	0.005	1.50
0.250	0.375	0.062 + 0.008	0.005	1.75
0.313	0.438	0.062 + 0.008	0.006	2.63
0.375	0.500	0.062 + 0.008	0.006	3.00
0.438	0.563	0.062 + 0.008	0.007	4.00
0.500	0.625	0.062 + 0.008	0.007	4.60
0.563	0.688	0.062 + 0.008	0.008	5.00
0.625	0.750	0.062 + 0.008	0.008	8.50
0.688	0.813	0.062 + 0.008	0.009	-
0.750	0.875	0.062 + 0.008	0.009	10.00
0.875	1.000	0.062 + 0.008	0.010	12.00
1.000	1.125	0.062 + 0.008	0.010	16.50
1.250	1.400	0.075 + 0.008	0.010	-
1.308	1.500	0.096 + 0.008	0.010	-

Ordering Information

Part Number System

22 F .156 x .250



Packaging and Handling – AMETEK High Purity Fluoropolymer Tubing is produced and packaged under strict standards of cleanliness, with capped ends and tubing sealed in plastic for clean storage. Additionally, AMETEK FEP tubing can be supplied in 25, 50, and 100 foot coils as well as 500 and 1000 foot spools and custom lengths. Plastic spools can be overwrapped with plastic for added protection. The overwrapped plastic spools are differentiated using a color coding system.

Fluoropolymer resins are generally considered inert to most chemicals. Under certain conditions of pressure and temperature, or combinations of chemicals, fluoropolymer tubing should not be used. Please contact AMETEK for discussion of your specific process to be certain that our products are appropriate for your intended use.

Adequate ventilation should be used where fluoropolymers are heated. Flu-like symptoms may occur from exposure to vapors evolved from fluoropolymers at very high temperatures, up to 800°F or from smoking materials that contain particles of fluoropolymers. Symptoms pass within 48 hours and are the only adverse effects observed in humans to date. Unheated fluoropolymers are essentially inert and are nonirritating to the skin.

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