FLUOROTHERM™

FLUOROPOLYMER TUBING, COILS AND FABRICATED PRODUCTS

- **PTFE, FEP, PFA, MFA and Fabricated Products**
- **Corrosion Resistant**
- **Ultrapure Applications**
- **Non-Contaminating**
- **High Temperature Usage**
- **Non-Stick**
- **Excellent Electrical Properties**
- **Heat Shrink Tubing**
- **Compact Coils**
- **Fabricated And Formed Shapes**
- **Sanitary Tubing**

"A Universe of Possibilities"

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The wide usage of fluoropolymers in virtually all industry types and applications is proof of their versatility and unmatched properties. Issues such as safety, chemical resistance, electrical breakdown and signal loss, contamination and environmental requirements dictate the preference of fluoropolymers over other plastics. Fluorotherm serves many industry segments with a wide variety of fluoroplastic tubing - standard or custom, coils and formed or fabricated geometries.

APPLICATIONS

Fluoropolymer tubing is used in an extremely wide range of applications. Since they are premium materials, and have high performance properties, the application environment generally necessitates their use. Examples of performance requirements are high purity, nonstick, high temperature, high electrical breakdown voltage threshold and chemical inertness to corrosive attack.

Some examples of fluoropolymer tubing use are: fluid flow (gas or liquid), electrical insulation, medical devices, laboratory instrumentation, clean room environments, microwave applications, food and beverage processing where the nonstick feature of PTFE, PFA, FEP and MFA materials facilitates easy clean out.

Infinite Possibilities: New uses for tubing spawned by new ideas turn up with amazing frequency. Fluoropolymer tubing manufactured and supplied by Fluorotherm possesses either a unique property or a combination of properties that are ideally suited for a novel application. The experience of Fluorotherm can support your creative efforts that just might open up a brand new market.

MARKETS

Fluoropolymer tubing serves a very broad array of markets. Virtually everywhere you look, fluoropolymer tubing is there. Colors and stripes are used to identify tubing carrying specific materials. Household appliances, medical devices, tubes carrying syrupy solutions in the food industry, ultrapure water in semiconductor and pharmaceutical manufacturing, corrosive and hot chemicals, fuel transfer lines, steam heating, NMR instruments in the laboratory, environmental sampling of air and underground water, hospital and surgical devices, copying machine toners, deep sea oil fields, fiber optics, electrical power supplies and insulation, high frequency and radar devices, satellites and space.

MATERIALS

Fluorotherm tubing is available in a range of fluoropolymer materials. These include PTFE, FEP, PFA, MFA, ETFE, TFM, PVDF, HP-PFA, THV. Filled radio opaque tubing and colors are available for many of these materials. Fillers are generally used to enhance a single property or functionality such as electrical or thermal conductivity, color identification, improved tensile strength or abrasion resistance. In general, addition of fillers increases the stiffness-however, this may be dependent upon the amount and type of filler added.

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STANDARDS

Fluorotherm tubing conforms to most commercial and US Military Standards. The applicable specifications are as follows:

ASTM D3295 A
ASTM D3295 B
ASTM D3295 C
ASTM D3295 E - PTFE Heavy Wall

AMS 3654 - PTFE Light Wall
AMS 3655 - PTFE Thin Wall
AMS 3653 - MIL - I-22129 C - PTFE Standard Wall

PRICE AND DELIVERY

For price quotation, please contact Fluorotherm by phone at 1-877-777-2629 (US domestic and Canada), 973-575-0760 (General Number) or by e-mail to sales@fluorotherm.com

List of Common Chemical Names

PTFE - Polyetrafluoroethylene
FEP - Fluorinated ethylene propylene
PFA - Perfluoroalkoxy
MFA - Tetrafluoroethylene perfluoromethyl vinyl ether
ETFE - Ethylene Tetrafluoroethylene
ECTFE - Ethylene chlorotrifluoroethylene
PVDF - Polyvinylidene Fluoride
THV - Tetrafluoroethylene hexafluoropropylene vinylidene fluoride
CTFE - Chlorotrifluoroethylene
PEEK - Polyether etherketone

TUBING - INDUSTRIAL SIZES, FRACTIONAL INCHES

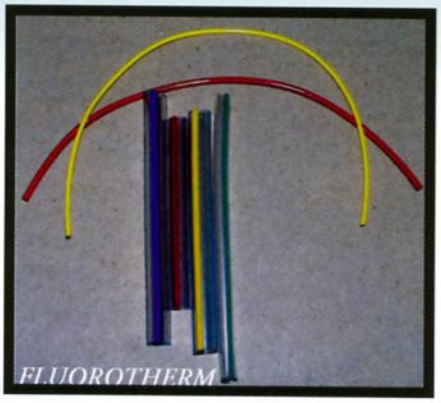
SIZE, FRACTIONAL FRACTIONAL	INSIDE DIAMETER, ID	WALL THICKNESS	TOLERANCE, +/-	OUTSIDE DIAMETER, OD	TOLERANCE, +/-
1/32	0.031	0.016	0.003	0.063	0.004
1/16	0.063	0.031	0.005	0.125	0.005
1/16	0.063	0.062	0.010	0.188	0.008
1/8	0.125	0.031	0.005	0.188	0.008
1/8	0.125	0.062	0.010	0.250	0.008
5/32	0.156	0.047	0.007	0.250	0.008
3/16	0.188	0.031	0.005	0.250	0.008
1/4	0.250	0.031	0.005	0.312	0.010
1/4	0.250	0.062	0.010	0.375	0.010
5/16	0.312	0.031	0.005	0.375	0.010
3/8	0.375	0.031	0.005	0.438	0.010
3/8	0.375	0.062	0.010	0.500	0.010
7/16	0.438	0.031	0.005	0.500	0.015
1/2	0.500	0.031	0.005	0.562	0.015
1/2	0.500	0.062	0.010	0.625	0.015
9/16	0.562	0.031	0.005	0.625	0.015
5/8	0.625	0.031	0.007	0.687	0.020
5/8	0.625	0.062	0.010	0.750	0.020
11/16	0.687	0.031	0.007	0.750	0.020
3/4	0.750	0.040	0.007	0.830	0.020
7/8	0.875	0.045	0.007	0.965	0.020
7/8	0.875	0.062	0.010	1.000	0.020
1	1.000	0.045	0.007	1.090	0.020
1-1/4	1.250	0.045	0.007	1.340	0.020
1-1/2	1.500	0.050	0.008	1.600	0.025

Standard color - Natural, clear. Custom colors and stripes available upon request. Customer specified cut lengths quoted upon request, Fractional sizes 1/32" through 1/2" available in spools, sizes exceeding 1/2" available in rolls.

All dimensions in inches

MATERIALS SELECTION

Selection of the right material can be confusing, given the wide choices now available for fluoropolymers. Although most of them share unique characteristics that distinguish them from other plastics such as polyethylene or nylon, it should be recognized that each fluoropolymer is optimally suited for use within a range of parameters that include technical considerations as well as price and availability. There may be some degree of overlap between two or three materials and Fluorotherm will assist you in making the best selection.



KEY FEATURES

CONTINUOUS USE TEMPERATURES

Fluoropolymer tubing, in general, may be used to operate at significantly higher temperatures than other common plastics. PTFE and PFA may be used up to 260 C (500F) while FEP can withstand temperatures up to 204 C (400F). These are among the few materials that can actually handle live steam, and are often used as heat exchanger tubing for heating applications in corrosive environments. They have excellent resistance to cryogenic temperatures. Please contact Fluorotherm for temperature ratings for other fluoropolymers. Please note that irradiation of any tubing alters its chemical structure and, in general, leads to some reduction in properties.

ELECTRICAL PROPERTIES

PTFE, PFA, MFA and FEP have outstanding dielectric strength and are generally the first choice in applications requiring a high voltage breakdown threshold. This property holds even when these materials are exposed to solvents or liquids. The dissipation factor for PTFE at frequencies up to 10 Hertz is extremely low. This characteristic is effectively utilized in signal transmission equipment and cables.

CHEMICAL RESISTANCE

Fluoropolymers, particularly, PTFE, PFA, MFA and FEP are inert to attack by virtually all industrial solvents, acids, bases and other chemicals over a wide range of temperatures. The few exceptions are molten alkali metals, halogenated complexes containing fluorine and molten sodium hydroxide.

NON-STICK PROPERTY

This is a unique property of perfluoropolymers such as PTFE, FEP and PFA. This feature is employed in a variety of ways, for example the transport of thick viscous materials such as molasses, batch operations where easy and rapid cleaning is required between batches (paint, for example), tube clarity or transparency requirement in sight glasses or sight tubes, and eliminating contamination from particulates or droplets sticking to tube.

LOW FRICTION

The low coefficient of friction of some fluoropolymers makes them the materials of choice in several applications; for example as insulation for primary conductors or as a secondary insulation sheath in wire harnesses.

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SIZES

Standard AWG, Fractional (inch) and Metric industrial sizes are available. Custom sizes and colors are available upon request. Standard dimensional tolerances are indicated in tables. Please consult Fluorotherm for special tolerances. Custom tolerances are based upon tube size and wall thickness. Material certifications, if required, will be furnished with shipment.

PACKAGING

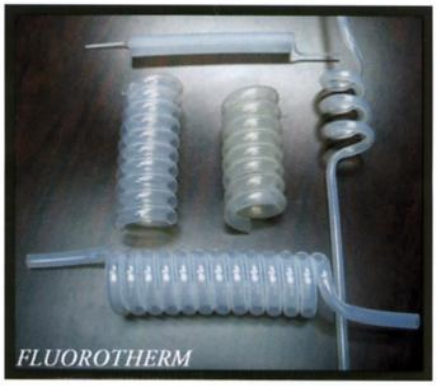
Packaging in random coil lengths is available. Special cut lengths provided upon customer request.

FABRICATED PRODUCTS

Fluorotherm has designed, constructed and produced fabricated geometries from tubing for a range of applications. These product forms can be made from a variety of materials, and are not limited to fluoropolymer tubing. Some examples of fabrication operations are as follows:

- Bending
- Shape Forming
- Flanging
- Flaring the ends of tube lengths
- Forming cuffs for fitting or other connections
- Coiling tubing, with predetermined diameter and length, to provide flexibility without kinks
- Supported structure for coils, with separation between turns to provide even fluid flow, for example.

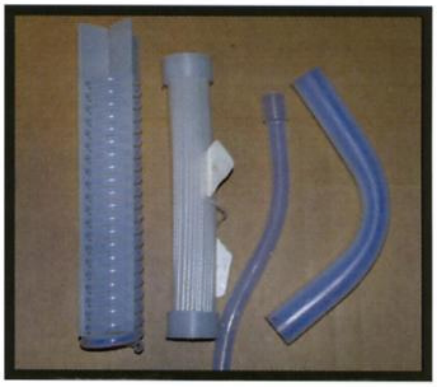
Fluorotherm continuously endeavors to research and develop new methods to adapt tube geometries to new, demanding applications. Some of these applications may require tight or restricted spaces or other special considerations.



HEAT SHRINK TUBING

The uses for Heat Shrink tubing are well established in applications requiring protective jacketing over parts. These parts are exposed to corrosive environments, electrostatic charges, high temperatures, moisture or other adverse ambient conditions. Heat shrink tubing is used in the commercial appliance industry, aerospace, electronic, chemical and electrical fields, among others.

Fluorotherm's fluoropolymer tubing can withstand normal sterilization procedures such as steam autoclave, ETO and radiation below specified dosages. For specific dosage limits, please consult Fluorotherm.



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FLUOROPOLYER TUBING, AWG SIZE, INCHES

AWG	INSIDE DIAMETER - ID		LIGHT WALL		THIN WALL		STD. WALL		HEAVY WALL	
SIZE	MIN	MAX	NOM.	TOL. +/-	NOM.	TOL. +/-	NOM.	TOL. +/-	NOM.	TOL. +/-
32	0.007	0.011	0.006	0.002	0.009	0.002				
30	0.010	0.015	0.006	0.002	0.009	0.002	0.009	0.002		
28	0.013	0.018	0.006	0.002	0.009	0.002	0.009	0.002		
26	0.016	0.021	0.006	0.002	0.009	0.002	0.009	0.002		
24	0.020	0.026	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
23	0.023	0.029	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
22	0.025	0.032	0.006	0.002	0.010	0.003	0.012	0.003	0.016	0.003
21	0.029	0.035	0.006	0.002	0.010	0.003	0.012	0.003	0.018	0.003
20	0.032	0.040	0.006	0.002	0.012	0.003	0.016	0.003	0.018	0.003
19	0.036	0.044	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
18	0.040	0.049	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
17	0.045	0.054	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
16	0.051	0.061	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
15	0.057	0.067	0.006	0.002	0.012	0.003	0.016	0.003	0.020	0.004
14	0.064	0.074	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
13	0.072	0.082	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
12	0.081	0.091	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
11	0.091	0.101	0.008	0.002	0.012	0.003	0.016	0.003	0.020	0.004
10	0.102	0.112	0.008	0.002	0.012	0.003	0.016	0.003	0.025	0.005
9	0.114	0.124	0.008	0.002	0.015	0.003	0.020	0.004	0.025	0.005
8	0.129	0.141	0.008	0.002	0.015	0.003	0.020	0.004	0.030	0.005
7	0.144	0.158	0.008	0.002	0.015	0.003	0.020	0.004	0.030	0.005
6	0.162	0.178	0.010	0.003	0.015	0.003	0.020	0.004	0.030	0.005
5	0.182	0.198	0.010	0.003	0.015	0.003	0.020	0.004	0.032	0.005
4	0.204	0.224	0.010	0.003	0.015	0.003	0.020	0.004		
3	0.229	0.249	0.010	0.003	0.015	0.003	0.020	0.004		
2	0.258	0.278	0.010	0.003	0.015	0.003	0.020	0.004		
1	0.289	0.311	0.010	0.003	0.015	0.003	0.020	0.004		
0	0.325	0.347	0.012	0.003	0.015	0.003	0.020	0.004		

ASTM D3295, ASTM D3295 B, ASTM D3295 C, ASTM D3295 E, AMS 3653, AMS 3654, AMS 3655, MIL-I-22129

Fluorotherm PTFE tubing demonstrates unmatched chemical resistance, temperature capability extending from cryogenic to high temperatures, high dielectric strength and electrical breakdown voltage, unique antistick and low friction properties, and high purity.

Dimensional specifications listed above are valid for standard PTFE AWG tubing. Custom specifications produced upon request. All AWG tubing complies with UL-224.

Standard color is natural (clear). Filled compositions and colors available upon request. A nominal upcharge apples for cut lengths.

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