



Choosing the right tubing

As easy as S-T-A-M-P!

Size

Consider inner diameter (ID), outer diameter (OD), wall thickness, and cut lengths. ID, OD, and wall are significant factors in pressure and vacuum ratings. The tolerances are a concern for leak points and critical design dimensions. Understanding connection options helps ensure proper fit and eliminate problems later.

Temperature

Operating temperature, cleaning temperature, ambient temperature, and the complete temperature fluctuation should figure into the selection of tubing. Sudden changes or extreme temperatures can negatively affect performance and cause premature failures.

Application

Knowing how the tubing will be used is critical. Regulatory concerns and required documentation is important. FDA, USDA, 3A, ISO, EPA, USP and NSF all carry different compliance concerns which warrant different material selection. Proper supporting documentation and certificates should be reviewed before placing the order. Knowing the dynamics of the application will help in selecting material for clarity, durometer (relative hardness), flexural fatigue or abrasion resistance, and pump use.

Media

Understanding the media being transported ensures zero extractables, adsorption/absorption, and particulate entrapment. Various chemicals attack materials at different rates. Often, cleaning agents are the most aggressive fluids used, but be aware of any chemical reactions which might be caused by changing fluids. Ambient chemicals present in the air surrounding the tubing product or dripping via leaks or condensation are sometimes overlooked.

Pressure

Vacuum and positive pressure both create stress on tubing. Increased or decreased temperatures greatly reduce the pressure rating for materials. Changing the wall thickness can help increase pressure rating, as can reducing the overall OD/ID.

Key to Chemical Resistance Classifications:

- A**—No damage after 30 days of constant exposure.
- B**—Little or no damage after 30 days of constant exposure.
- C**—Some effect after 7 days of constant exposure. Effects may include: cracking, crazing, loss of strength, discoloration, softening, or swelling. Softening and swelling are reversible in some cases.
- D**—Not recommended for continuous use. Immediate damage may occur.

Rigid Tubing

Formulation	Operating temperature	Material certification(s)	Durometer	Color	Chemical resistance summary						Sterilization			Permeability (approx) at 25°C			
					UV light	Ozone	Bases, strong	Bases, weak	Acids, strong	Acids, weak	EIO	Gamma irradiation	Autoclave	Units: $\left\{ \frac{\text{cc-mm}}{\text{sec-cm}^2\text{-cm Hg}} \right\} \times 10^{-10}$			
					CO ₂	H ₂	O ₂	N ₂									
Bev-A-Line® IV	-60 to 160°F (-51 to 71°C)	FDA, USP, USDA	80 (D)	Translucent	B	D	B	B	D	—	✓	✓	237	—	—	18	
Bev-A-Line V	-60 to 200°F (-51 to 93°C)†	National Formulary	80 (D)	Translucent	B	B	B	B	D	—	✓	✓	237	—	—	18	
Bev-A-Line XX	-60 to 160°F (-51 to 71°C)	FDA†, NSF†	55 (D)	Opaque	C	D	C	D	C	A	✓	✓	237	—	—	18	
Chemfluor® (ETFE/FEP/PFA/PTFE)	-400 to 550°F (-240 to 288°C)	FDA	58 (A)	Translucent	A	A	A	A	A	—	✓	✓	—	—	—	—	
Chemfluor 367	-400 to 450°F (-240 to 232°C)	FDA	58 (D)	Clear	A	A	A	A	A	A	✓	✓	150	—	59	19	
Copper	-60 to 400°F (-53 to 204°C)	None	—	Opaque	D	D	C	C	C	A	✓	✓	—	—	—	—	
ETFE, Chemfluor	-150 to 302°F (-101 to 150°C)	GMP	75 (D)	Translucent	A	A	A	A	A	A	✓	✓	—	—	—	—	
FEP	-454 to 400°F (-270 to 205°C)	FDA, USP, GMP	55 (D)	Clear or translucent	A	A	A	A	A	A	✓	✓	5.9	1.3	14	2	
Glass (borosilicate)	-18 to 392°F (0 to 200°C)	USP	—	Clear	A	—	D	B	D	A	✓	✓	—	—	—	—	
Nylon	-60 to 200°F (-51 to 93°C)	None	—	Translucent	A	D	A	C	C	D	✓	✓	20	19	5.4	1.1	
PEEK	-60 to 212°F (-51 to 100°C)	None	—	Opaque	A	A	A	A	B	A	✓	✓	184	614	33	5.2	
PFA	-320 to 500°F (-195 to 260°C)	FDA, USP, GMP	60 (D)	Translucent	A	A	A	A	A	A	✓	✓	—	—	—	—	
PFA-450 high-purity	-320 to 500°F (-195 to 260°C)	FDA, GMP	60 (D)	Translucent	A	A	A	A	A	A	✓	✓	—	—	—	—	
Polyethylene (LLDPE, LDPE, HDPE)	-100 to 175°F (-73 to 80°C)	FDA, USDA	50 (D)	Translucent	A	D	B	B	B	A	✓	✓	280	—	60	20	
Polyethylene, FEP-lined	-100 to 175°F (-73 to 80°C)	FDA, GMP	—	Translucent	A	A	A	A	A	A	✓	✓	5.9†	1.3†	14†	2.0†	
Polyimide	-418 to 896°F (-250 to 480°C)	USP, NEMA	—	Clear	A	A	A	A	A	A	✓	✓	—	—	—	—	
Polypropylene	32 to 250°F (0 to 121°C)	FDA, USDA	75 (D)	Translucent	A	D	B	B	C	D	✓	✓	90	—	25	4	
PTFE	-400 to 500°F (-240 to 260°C)	None	50 (D)	Translucent	A	A	A	A	A	A	✓	✓	6.8	—	—	1	
PTFE, color-coded	-5 to 180°F (-21 to 82°C)	None	55 (A)	Opaque	A	D	A	D	B	D	✓	✓	1305	—	1345	—	
PVDF	-40 to 260°F (-40 to 127°C)	FDA, USP, USDA	80 (D)	Translucent	A	A	A	A	A	A	✓	✓	—	—	—	—	
Thermo Scientific™ Nalgene™ 489 linear LDPE	-100 to 175°F (-73 to 79°C)	FDA	50 (D)	Translucent	—	A	B	A	A	A	✓	✓	280	—	60	20	

†Based on liner ‡At 100°F (38°C)

