Cole-Parmer®

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	EtO	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	A	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)

Flexible 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	EtO	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
Black rubber	0 to 150°F (–18 to 65°C)	None	40 (A)	Opaque	B	D	B	A	D	B	✔		✔	—	—	—	—
C-Flex® (001)	–100 to 275°F (–73 to 135°C)	FDA, USP, GMP	50 (A)	White	A	A	A	A†	—	B	✔	✔	✔	—	—	150	—
C-Flex ADCF (374)	–88 to 275°F (–67 to 135°C)	FDA, USP, GMP	62 (A)	Clear	A	A	A	A	—	B	✔	✔	✔	—	—	150	—
C-Flex CLEAR (082)	–100 to 275°F (–73 to 135°C)	FDA, USP, GMP	62 (A)	Clear	A	A	A	A	—	B	✔	✔	✔	—	—	150	—
C-Flex Braided	–50 to 250°F (–45 to 121°C)	USP, EP, ISO	60 (A)	Clear	—	—	—	—	—	—		✔	✔	—	—	—	—
C-Flex ULTRA	–77 to 250°F (–60 to 121°C)	USP Class VI, EP	60 (A)	Opaque	—	—	C	C	C	C			✔	2.1	—	1.1	3.4
Chem-Durance® Bio	–71 to 130°F (–57 to 54°C)	FDA, USP	61 (A)	Opaque	A	B	A†	A†	C†	A†		✔	✔	745	—	135	45
Cleargreen™ DEHP-Free	–40 to 165°F (–40 to 74°C)	USP Class VI, RE	70 (A)	Clear	B	A	D	C	D	C		✔	✔	360	—	80	40
Cole-Parmer non-DEHP PVC	–58 to 165°F (–48 to 73°C)	FDA, USP, RE	55 (A)	Translucent	A	A	B	A	C	B			✔	—	—	—	—
Dow Corning® Pharma-50	–60 to 460°F (–51 to 232°C)	USP, GMP, EP	50 (A)	Translucent	A	A	A	A	A	A	✔	✔	✔	—	—	—	—
Dow Corning Pharma-65 / Pharma Reinforced	–60 to 460°F (–51 to 232°C)	USP, GMP, EP	65 (A)	Translucent	A	A	A	A	A	A	✔	✔	✔	—	—	—	—
Dow Corning Pharma-80	–60 to 460°F (–51 to 232°C)	USP, GMP, EP	80 (A)	Translucent	A	A	A	A	A	A	✔	✔	✔	—	—	—	—
EPDM, reinforced (hose only)	–40 to 200°F (–40 to 121°C)	None	—	Opaque	A	A	B	A	D	A	✔	✔	✔	—	—	—	—
EVA	–29 to 180°F (–39 to 82°C)	FDA, USP	90 (A)	Translucent	—	A	B	A	C	B	✔	✔	✔	—	—	—	—
Flexelene™ flexible polyethylene	–40 to 170°F (–40 to 76°C)	NSF, FDA	78 (A)	Clear	A	D	B	B	C	D	✔			90	—	25	4
Flexelene SFX soft flexible polyethylene	–40 to 110°F (–40 to 43°C)	USP	68 (A)	Translucent	A	D	B	B	C	C	✔	✔		—	—	—	—
Gum rubber	–15 to 158°F (–26 to 70°C)	GMP	35 (A)	Opaque	A	D	A	B	C	D	✔			1311	492	307	118
Hubtron™ Advance/Black Advance	14 to 248°F (–10 to 120°C)	None	—	Opaque	A	A	A	A	A	A				—	—	—	—
Hubtron Pascal/Black Pascal	14 to 248°F (–10 to 120°C)	None	—	Opaque	A	A	A	A	A	A				—	—	—	—
Kynar® Flex 2750 PVDF	–40 to 275°F (–40 to 135°C)	FDA, USP, USDA, GMP	60 (D)	Translucent	A	A	A	A	A	A	✔	✔	✔	—	—	—	—
Norprene®	–75 to 275°F (–60 to 135°C)	GMP	61 (A)	Opaque	A	B	A	C	A	B			✔	1200	—	80	200
Norprene Chemical	–71 to 165°F (–60 to 74°C)	FDA	61 (A)	Opaque	A	B	A†	A†	C†	A†	✔	✔	✔	745	—	135	45
Norprene food-grade	–60 to 275°F (–51 to 135°C)	FDA, NSF, GMP	61 (A)	Opaque	A	B	A	C	A	B			✔	1200	—	80	200
Norprene pressure	–60 to 275°F (–51 to 135°C)	FDA, 3A, NSF	61 (A)	Opaque	A	B	A	C	A	B			✔	1200	—	80	200
PharmaPure®	–89 to 275°F (–67 to 135°C)	USP, FDA	65 (A)	Opaque	B	B	B	B	B	B	✔	✔	✔	1200	—	200	80
PharMed® BPT	–75 to 275°F (–59 to 135°C)	FDA, USP, NSF, GMP	64 (A)	Opaque	A	B	A	C	A	B	✔	✔	✔	1200	—	80	200
Polyurethane (aqua tint)	–40 to 180°F (–40 to 82°C)	None	85 (A)	Translucent	B	D	B	B	A	—	✔			395	66‡	10.5	17.1
Polyurethane (red/green/blue/black)	–70 to 185°F (–57 to 85°C)	None	85 (A)	Opaque	B	D	B	B	A	—	✔			395	66‡	10.5	17.1
Polyurethane, ester-based	–70 to 185°F (–56 to 85°C)	None	82 (A)	Translucent	C	A	D	C	D	D	✔			168	—	18	6
Polyurethane, ether-based	–40 to 185°F (–40 to 85°C)	None	85 (A)	Translucent	B	D	B	B	A	—	✔			—	—	—	—
Puri-Flex™	–58 to 275°F (–50 to 135°C)	FDA, USP	62 (A)	Translucent	A	B	B	A	B	A	✔	✔	✔	1200	—	80	200
PVC	–41 to 185°F (–41 to 74°C)	FDA, USP, USDA, 3A	68 (A)	Translucent	A	A	B	A	A	A	✔		✔	—	—	—	—
PVC, reinforced	–60 to 460°F (–51 to 238°C)	FDA, USP, GMP	50 (A)	Translucent	B	D	A	A	A	—	✔			20,132	6579	7961	2763
Rubber, nitrile/nitrile reinforced (hose only)	–20 to 212°F (–29 to 100°C)	None	—	Opaque	B	D	D	D	D	C				—	—	—	—
SaniPure™	–87 to 275°F (–66 to 135°C)	EP, USP, FDA	50 (A)	Clear	A	A	A	A	—	B	✔	✔	✔	—	—	150	—
Silicone, colored	–58 to 446°F (–50 to 230°C)	None	60 (A)	Translucent	B	D	A	A	A	—		✔	✔	—	—	—	—
Silicone, peroxide-cured	–60 to 460°F (–51 to 238°C)	FDA, USP, USDA, GMP	50 (A)	Translucent	B	D	A	A	A	—		✔	✔	20,132	6579	7961	2763
Silicone, platinum-cured	–60 to 400°F (–51 to 204°C)	FDA, USP, GMP	60 (A)	Translucent	B	D	A	A	A	—		✔	✔	20,132	6579	7961	2763
Silicone, reinforced, peroxide-cured	–60 to 460°F (–51 to 238°C)	FDA, USP, USDA, GMP	50 (A)	Translucent	B	D	A	A	A	—		✔	✔	20,132	6579	7961	2763
Silicone, reinforced, platinum-cured	–112 to 320°F (–80 to 160°C)	FDA, USP, 3A, GMP	71 (A)	Translucent	A	A	A	A	D	D	✔	✔	✔	353	—	661	32
Thermo Scientific Nalgene 180 PVC	–26 to 160°F (–32 to 71°C)	FDA, USP, USDA	55 (A)	Translucent	A	A	A	B	—	—	✔		✔	—	—	—	—
Tygon® Chemical (2001)	–108 to 135°F (–78 to 57°C)	FDA	69 (A)	Clear	A	A	A	A	A	A	✔	✔		—	—	—	—
Tygon (SE-200) non-DEHP	–49 to 165°F (–45 to 74°C)	FDA	66 (A)	Clear	C	A	A	A	A	A	✔			5.9†	1.3†	14†	2.0†
Tygon (B-44-3) non-DEHP	–49 to 165°F (–45 to 74°C)	FDA, NSF-51, 3A	66 (A)	Clear	C	B	B	A	B	A	✔		✔	—	—	—	—
Tygon (F-4040-A) fuel and lubricant	–35 to 165°F (–37 to 74°C)	NSF, 3A	63 (A)	Translucent	A	B	A	B	B	D				270	—	30	60
Tygon (2475) high-purity	–94 to 125°F (–70 to 52°C)	FDA, NSF, GMP, USDA	72 (A)	Translucent	A	C	A	A	B	B	✔	✔		745	—	135	45
Tygon (2475 I.B.) high-purity reinforced	–103 to 130°F (–75 to 54°C)	FDA, USP, EP	75 (A)	Translucent	B	B	A	A	B	A	✔	✔		745	—	135	45
Tygon E-Lab (E-3603) non-DEHP	–46 to 74°C (–51 to 165°F)	FDA, NSF-51, USP Class VI	56 (A)	Translucent	C	B	B	A	C	A	✔		✔	—	—	—	—
Tygon (E-3603) vacuum non-DEHP	–51 to 165°F (–46 to 74°C)	FDA, NSF-51, USP Class VI	56 (A)	Clear	C	B	B	A	C	A	✔		✔	—	—	—	—
Tygon E-LFL pump/E-LFL microbore	–58 to 165°F (–50 to 74°C)	USP, FDA, EP	56 (A)	Translucent	—	A	B	B	B	B	✔		✔	563	—	124	67
Tygon (ND-100-80) microbore	–31 to 185°F (–35 to 85°C)	USP, GMP	80 (A)	Translucent	A	A	A	A	C	A	✔	✔	✔	—	—	—	—
Tygon E-Food (B-44-4X) non-DEHP	–32 to 165°F (–36 to 74°C)	FDA, NSF-51, 3A	66 (A)	Translucent	C	B	B	A	B	A	✔		✔	—	—	—	—
Tygon (B-44-4X) non-DEHP	–49 to 165°F (–45 to 74°C)	FDA, NSF-51, 3A	66 (A)	Translucent	C	B	B	A	B	A	✔		✔	—	—	—	—
Tygon (B-44-4X-I.B.) non-DEHP	–49 to 165°F (–45 to 74°C)	FDA, NSF-51, 3A	66 (A)	Clear	C	B	B	A	B	A	✔		✔	—	—	—	—
Tygon ND-100-65	–55 to 165°F (–48 to 74°C)	USP	65 (A)	Clear	—	A	A	A	A	A	✔	✔	✔	—	—	—	—
Tygon (2375) ultra chemical-resistant	–108 to 130°F (–78 to 54°C)	FDA, NSF-51	75 (A)	Translucent	B	B	A	A	B	A	✔	✔		4840	—	980	350
Tygon (E-1000) ultra soft non-DEHP	–67 to 125°F (–55 to 52°C)	FDA, NSF-51	40 (A)	Translucent	C	B	B	A	C	A	✔			—	—	—	—
Tygon (R-3400) UV-resistant	–5 to 165°F (–21 to 74°C)	None	64 (A)	Opaque	A	A	A	A	B	A	✔			—	—	—	—
Tygoprene® (XL-60)	–87 to 250°F (–66 to 121°C)	FDA, NSF	60 (A)	Translucent	A	A	B	A	B	A	✔	✔	✔	1116	—	62	186
Tygothane® (C-544-A-I.B.) pressure	–45 to 180°F (–43 to 82°C)	FDA, NSF-61	67 (A)	Translucent	A	D	A	A	C	D				360	—	40	80
Vinyl	–25 to 400°F (–32 to 204°C)	GMP	75 (A)	Translucent	A	A	C	D	A	A	✔			79	—	15	4.3
Viton	–25 to 400°F (–32 to 204°C)	GMP, FDA††	75 (A)	Opaque	A	A	C	D	A	A				79	—	15	4.3

†Based on liner ‡At 100°F (38°C) ††FDA-approved material available

Free Certificate of Compliance

Cole-Parmer will provide a certificate of resin or elastomer compliance FREE at your request with each order of fittings or tubing. Certificates list catalog number, formulation, compound number, lot number (where applicable), and the regulations and agencies the tubing or fitting complies with, including FDA, USP, USDA, National Formulary, NSF International, GMP, and 3A. Look for the blue "check" icon to identify when a certificate of compliance is available.

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