

# Pump Tubing Compatibility Charts

## Don't risk it!

- Check chemical compatibility before selecting tubing to ensure best performance
- For use with all Masterflex tubing sizes
- All ratings indicate tubing condition after exposure to the chemical at 21°C (70°F)

### Ratings & Materials Legend

#### Ratings

- A: No effect; little noticeable change  
 B: Minor effect; slight corrosion or discoloration  
 C: Moderate effect; not recommended for continuous use; softening, loss of strength, swelling and/or shrinkage  
 D: Severe effect; not recommended for use; severe softening, swelling and/or shrinkage  
 — No data available

#### Tubing formulations

- PN: PharMed® BPT, High-Pressure PharMed® BPT, PharmaPure®, Norprene®, Norprene® Food, Puri-Flex™  
 CF: C-Flex® and C-Flex® ULTRA  
 S: Silicone (peroxide/platinum-cured), BioPharm, BioPharm Plus, GORE® STA-PURE® PCS  
 T: Tygon® E-Lab, Tygon® E-LFL, Tygon® E-Food  
 TU: Tygon® Fuel & Lubricant  
 TC: Tygon® Chemical  
 CD: Chem-Durance® Bio  
 PFL: Solve-Flex®, GORE® STA-PURE® PFL  
 V: Viton®  
 FP: Polytetrafluoroethylene (PTFE)

#### Pump head materials

- PSF: Polysulfone  
 PC: Polycarbonate  
 PPS: Polyphenylene sulfide  
 SS: Stainless steel  
 PP: Polypropylene

Fluid	Tubing formulation											Pump head material				
	PN	CF	S	T	TU	TC	CD	PFL	V	FP	PSF	PC	PPS	SS	PP	
Acetaldehyde	D	A	B	D	D	C	D	A	—	A	D	—	A	A	A	
Acetate LMW	A	A	—	D	D	C	D	—	—	A	D	—	A	A	D	
Acetic acid <5%	A	A	A	A	A	B	A	A	—	A	A	A	A	B	B	
Acetic acid >5%	A	A	A	B	A	B	A	A	B	A	A	C	A	B	A	
Acetic anhydride	A	B	C	D	D	A	A	A	D	A	D	D	A	B	C	
Acetone	D	C	C	D	D	C	B	A	D	A	D	D	A	A	A	
Acetonitrile	B	A	—	D	D	B	B	—	D	A	D	D	A	A	—	
Acetyl bromide	C	A	—	D	D	C	D	—	—	A	—	—	—	—	—	
Acetyl chloride	C	A	C	D	D	C	D	A	A	A	D	D	A	A	D	
Air	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Aliphatic hydrocarbons	D	D	—	D	B	D	D	—	—	—	—	—	—	B	—	
Aluminum chloride	A	A	B	A	A	A	A	—	A	A	A	A	A	D	A	
Aluminum sulfate	A	A	A	A	A	A	A	—	A	A	A	A	A	B	A	
Alums	A	A	A	A	A	A	A	—	A	A	—	—	—	—	A	
Ammonia, gas / liquid	A	A	C	B	B	B	B	—	D	A	A	D	A	B	A	
Ammonium acetate	A	A	—	A	A	A	A	A	D	A	—	A	—	B	A	
Ammonium carbonate	A	A	C	A	A	A	A	A	A	A	A	—	A	B	A	
Ammonium chloride	A	A	C	A	A	A	A	A	A	A	A	—	A	C	A	
Ammonium hydroxide	A	A	A	B	C	A	A	A	B	A	A	D	A	A	A	
Ammonium nitrate	A	A	C	A	A	A	A	A	A	A	A	—	A	A	A	
Ammonium phosphate	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	
Ammonium sulfate	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	
Amyl acetate	B	D	D	D	D	D	D	B	D	A	D	D	A	A	D	
Amyl alcohol	D	D	D	D	A	A	A	A	A	A	—	—	—	A	A	
Amyl chloride	C	D	D	D	D	D	D	—	A	A	D	D	D	A	D	
Aniline	C	B	D	D	D	D	D	A	B	A	D	D	A	A	A	
Aniline hydrochloride	C	B	D	D	D	D	D	A	B	A	—	D	—	D	D	
Aqua regia (80% HCl, 20% H)	D	—	D	D	D	A	A	—	B	A	D	D	D	D	B	
Aromatic hydrocarbons	D	D	—	D	D	D	D	—	A	—	—	—	—	B	—	
Arsenic salts	A	—	—	A	A	A	A	—	D	—	—	—	—	—	—	
Barium salts	A	A	A	A	A	A	A	A	A	A	A	—	A	B	B	
Benzaldehyde	D	D	B	D	D	C	C	A	D	A	C	C	A	B	C	
Benzenesulfonic acid	D	A	D	D	D	D	D	A	A	A	D	D	A	B	D	
Bleaching liquors	A	B	B	A	A	A	A	—	A	A	—	—	—	—	B	
Boric acid	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	
Bromine	D	A	D	D	D	D	D	—	A	A	—	D	D	D	C	
Butane	A	D	D	A	A	B	B	B	A	A	—	—	A	A	B	
Butanol (butyl alcohol)	D	B	B	D	A	A	A	A	A	A	A	C	A	A	B	
Butyl acetate	B	D	D	D	D	D	D	B	D	A	D	D	A	A	B	
Butyric acid	B	A	D	D	C	D	D	A	B	A	—	—	A	B	C	
Calcium oxide	A	—	A	A	A	A	A	—	A	A	—	—	—	A	A	
Calcium salts	A	A	B	A	A	A	A	A	A	A	—	—	A	B	A	
Carbon bisulfide	D	D	D	D	D	D	D	—	—	A	—	—	—	A	C	
Carbon dioxide	A	A	B	A	A	A	A	A	A	A	—	A	A	A	A	
Carbon tetrachloride	D	B	D	D	D	D	D	B	A	A	A	D	A	B	D	
Chlorine, dry	C	A	D	A	A	C	C	—	A	A	D	—	D	A	D	
Chlorine, wet	D	A	D	C	A	C	C	—	B	A	D	—	D	C	D	
Chloroacetic acid	B	A	—	A	D	A	A	B	D	A	D	D	A	B	D	
Chlorobenzene	D	D	D	D	D	D	D	A	A	B	D	D	A	A	D	
Chlorobromomethane	B	D	D	D	D	—	D	—	A	A	D	—	—	—	A	
Chloroform	C	D	D	D	D	D	D	B	A	A	D	D	A	A	D	
Chlorosulfonic acid	D	A	D	D	D	D	D	A	D	A	D	—	—	D	D	
Chromic acid, 30%	A	A	C	C	C	B	B	—	A	A	D	D	A	B	A	
Chromium salts	A	A	—	A	A	A	A	—	—	—	—	—	—	—	—	
Copper salts	A	A	A	A	A	A	A	—	A	A	—	—	A	B	A	
Cresol	D	D	D	B	C	A	A	A	A	A	D	D	A	A	C	
Cyclohexane	D	D	D	D	C	D	D	B	A	A	A	D	B	A	A	
Cyclohexanone	D	D	D	D	D	C	C	—	D	A	D	D	A	A	D	
Diacetone alcohol	A	A	B	D	D	A	A	A	D	A	—	D	—	B	C	
Dimethyl formamide	B	B	B	D	D	A	A	A	D	A	D	D	A	A	A	
Dimethyl Sulfoxide (DMSO)	A	—	—	—	—	—	—	—	—	A	A	C	A	A	A	
Essential oils	D	B	C	D	C	D	D	—	—	—	—	—	—	—	—	
Ethanol (ethyl alcohol)	C	B	A	D	B	A	A	A	A	A	B	B	A	A	A	
Ether	C	D	D	D	C	D	D	B	D	A	D	D	A	A	B	
Ethyl acetate	B	D	B	D	D	D	D	A	D	A	A	D	A	B	A	
Ethyl bromide	D	A	D	D	D	C	D	—	A	A	—	—	—	—	D	
Ethyl chloride	C	A	D	D	D	D	D	—	A	A	D	D	—	A	D	
Ethylamine	D	A	C	D	D	B	B	B	D	—	—	—	—	—	—	
Ethylene chlorohydrin	A	A	C	D	B	A	A	—	A	A	D	D	A	B	D	
Ethylene dichloride	C	A	D	D	D	D	D	B	A	A	D	D	A	B	A	
Ethylene glycol	A	B	A	A	A	A	A	A	A	A	A	C	A	B	A	
Ethylene oxide	A	A	D	A	A	A	A	B	D	A	A	D	D	B	D	
Fatty acids	C	B	C	B	B	C	C	A	A	A	—	C	—	B	A	
Ferric chloride	A	A	B	A	A	A	A	—	A	A	A	—	A	D	A	
Ferric sulfate	A	A	B	A	A	A	A	A	A	A	—	—	A	B	A	
Ferrous chloride	A	A	C	A	A	A	A	—	A	A	A	D	A	D	A	
Ferrous sulfate	A	A	C	A	A	A	A	A	A	A	A	A	A	B	A	
Fluoboric acid	D	A	A	C	D	A	A	—	—	A	—	—	—	B	A	
Fluoroborate salts	A	A	—	A	A	A	A	—	—	—	—	—	—	—	—	
Fluosilicic acid	C	A	D	A	A	A	A	—	A	A	A	—	A	C	A	
Formaldehyde	D	A	B	D	D	C	C	A	D	A	A	A	A	C	A	
Formic acid, 25%	A	A	B	B	C	A	A	A	D	A	C	D	A	B	A	
Gasoline, high-aromatic	D	D	D	D	B	D	D	B	A	B	A	C	A	A	D	
Gasoline, nonaromatic	D	D	D	D	B	D	D	B	A	A	A	A	A	—	C	
Glucose	A	A	A	A	A	A	A	A	A	A	—	A	—	A	A	
Glue, PVA	A	A	A	A	A	—	A	—	A	A	—	—	—	A	C	
Glycerin	A	B	A	A	A	A	A	—	A	A	A	A	A	A	A	
Hydriodic acid	D	A	—	A	A	A	A	—	A	—	—	—	—	—	—	
Hydrobromic acid, 30%	D	A	D	B	A	A	A	—	A	A	B	D	A	D	A	
Hydrochloric acid (dil)	A	A	D	A	A	A	A	A	A	A	A	A	A	D	A	
Hydrochloric acid (med)	B	A	D	C	D	A	A	A	A	A	A	D	D	D	A	
Hydrochloric acid (conc)	—	B	D	C	D	A	A	A	A	A	A	B	D	D	A	
Hydrocyanic acid	A	A	C	A	A	A	A	A	A	A	—	—	—	B	A	
Hydrocyanic acid, gas, 10%	A	A	C	A	A	A	A	—	A	A	—	—	—	—	C	
Hydrofluoric acid, 50%	D	A	C	D	A	A	A	D	D	A	—	D	A	D	A	
Hydrofluoric acid, 75%	—	A	D	D	D	—	C	D	D	A	—	D	A	D	C	

†Do not use the L/S® PTFE-tubing pump head with gases due to excessive heat buildup.

### Tubing Test Procedure

1. Measure and weigh a sample of tubing.
2. Immerse the sample in the fluid for 72 hours in a closed vessel.
3. Dry sample, then measure and weigh it. Inspect carefully for signs of deterioration such as swelling, embrittlement, cracking, softness, or change of size or weight.
4. If there is no sign of deterioration, test a sample in pump under the conditions of your application.



# Choosing the Right MASTERFLEX® Tubing

Fluid	Tubing formulation										Pump head material				
	PN	CF	S	T	TU	TC	CD	PFL	V	FP	PSF	PC	PPS	SS	PP
Hydrogen peroxide (dil)	A	A	A	A	A	A	A	A	A	A	A	A	—	B	A
Hydrogen peroxide, 90%	B	D	A	D	D	A	A	A	A	A	A	A	—	B	A
Hypochlorous acid	A	A	D	A	A	A	A	A	A	A	—	—	—	—	—
Iodine solutions	A	C	C	A	A	A	A	—	A	A	—	D	D	D	A
Iodoform	—	—	—	—	—	—	D	—	C	—	—	—	—	A	A
Kerosene	D	D	D	D	B	D	D	A	A	A	A	A	A	A	A
Ketones	D	B	—	D	D	C	C	—	—	A	D	D	A	A	A
Lacquer solvents	B	D	D	D	D	D	D	A	D	A	—	D	—	A	D
Lactic acid, 3–10%	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Lead acetate	A	A	D	A	A	A	A	—	D	A	A	—	A	B	A
Linseed oil	C	D	A	D	A	B	A	A	A	A	A	A	A	A	A
Lithium hydroxide	B	A	D	A	A	—	B	—	C	—	—	D	A	B	—
Magnesium chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Magnesium sulfate	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Malic acid	A	A	B	A	A	A	A	A	A	A	—	—	—	A	B
Manganese salts	A	A	B	A	A	A	A	—	A	A	—	—	—	D	—
Mercury salts	A	A	—	A	A	A	A	—	A	A	—	—	—	B	A
Methane	A	D	D	A	A	A	A	B	A	A <sup>†</sup>	—	—	—	A	B
Methanol (methyl alcohol)	A	—	A	C	C	A	A	A	B	A	D	B	A	A	A
Methyl chloride	C	A	D	D	D	D	D	B	B	A	D	D	A	A	D
Methyl ethyl ketone (MEK)	D	—	D	D	D	C	C	B	D	A	D	D	A	A	A
Mixed acid (40% H <sub>2</sub> SO <sub>4</sub> , 15% HNO <sub>3</sub> )	B	—	—	B	D	—	A	—	—	A	D	—	—	B	A
Molybdenum disulfide	—	A	B	—	—	—	A	—	A	—	—	—	—	—	—
Monoethanolamine	C	B	B	D	D	D	D	—	D	A	A	—	A	A	B
Naphtha	D	D	D	D	B	D	D	B	A	B	B	—	A	A	A
Natural gas	A	D	A	A	A	A	A	B	A	A <sup>†</sup>	—	—	—	A	B
Nickel salts	A	A	A	A	A	A	A	A	A	A	A	—	A	B	A
Nitric acid (dil)	A	A	B	A	D	A	A	A	B	A	A	B	A	A	A
Nitric acid (med)	A	—	C	C	D	A	A	A	A	A	C	C	—	A	B
Nitric acid (conc)	D	—	D	D	D	A	A	A	A	A	C	D	D	A	C
Nitrobenzene	D	D	D	D	D	D	D	A	B	A	D	D	A	B	B
Nitrogen oxides	A	A	D	A	A	A	—	D	A	—	—	—	—	—	—
Nitrous acid	A	A	—	A	C	A	A	—	—	A	—	—	—	B	A
Oils, animal	C	B	B	D	B	B	B	—	A	A	—	—	—	A	—
Oils, mineral	D	B	B	C	A	D	D	—	A	A	B	A	A	A	A
Oils, vegetable	C	B	B	D	A	B	B	A	A	A	A	—	A	A	A
Oleic acid	C	A	D	D	B	D	C	A	B	A	A	A	A	B	A
Oxalic acid, cold	B	A	B	C	D	A	A	A	A	A	—	B	A	B	A
Oxygen, gas	A	A	B	A	A	A	A	A	B	A <sup>†</sup>	A	A	—	A	—
Palmitic acid, 100% in ether	C	—	D	D	B	C	C	A	A	A	—	—	—	B	C
Perchloric acid	A	A	D	C	D	A	A	A	A	A	D	D	A	B	C
Perchloroethylene	C	B	D	D	D	D	D	B	A	A	D	D	A	B	D
Phenol (carbolic acid)	A	D	D	B	C	A	A	A	A	A	—	D	—	B	A
Phosphoric acid, 50%	A	A	C	C	A	A	A	A	A	A	A	B	—	A	A
Phthalic acid	A	D	B	D	A	A	A	—	B	A	—	—	—	B	A
Plating solutions	A	A	D	A	D	A	A	—	A	A	—	—	—	—	A
Polyglycol	B	B	A	A	A	—	B	—	A	—	—	—	—	—	—
Potassium carbonate	A	A	—	A	A	A	A	A	A	—	A	—	A	B	A
Potassium chlorate	B	A	B	B	A	—	A	A	A	A	A	—	A	B	A
Potassium hydroxide (med)	A	A	B	B	D	—	A	B	D	A	A	D	A	B	A
Potassium hydroxide (conc)	A	A	C	D	D	—	A	B	D	A	A	D	—	B	B
Potassium iodide	A	A	—	A	A	A	A	—	A	A	—	—	—	A	B
Propanol (propyl alcohol)	C	—	A	D	A	A	A	A	A	A	B	A	A	A	A
Pyridine	C	A	D	D	D	C	C	A	D	A	D	D	A	A	B
Refrigerant	D	C	—	D	D	A	A	D	—	A	—	D	A	—	—
Silicone fluids	A	B	C	B	A	B	A	—	A	A	—	—	A	A	A
Silicone oils	C	B	C	B	A	B	A	—	A	A	—	—	A	A	A
Silver nitrate	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Soap solutions	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sodium bicarbonate	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Sodium bisulfate	A	A	—	A	A	A	A	A	A	A	A	A	A	D	A
Sodium bisulfite	A	A	A	A	A	—	A	A	A	A	—	A	—	B	A
Sodium borate	A	A	A	A	A	—	A	—	A	A	A	A	A	B	B
Sodium carbonate	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sodium chlorate	A	A	C	A	A	A	A	—	A	A	A	A	A	B	A
Sodium chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	C	A
Sodium ferrocyanide	A	A	—	B	B	—	A	—	A	A	—	—	—	B	A
Sodium hydrosulfite	B	A	—	A	A	—	A	—	A	—	—	—	—	—	—
Sodium hydroxide (dil)	A	A	A	A	D	A	A	A	A	A	A	D	A	A	A
Sodium hydroxide, 25%	A	B	B	C	D	A	A	—	A	A	A	D	A	B	A
Sodium hydroxide (conc)	—	C	—	C	D	A	A	—	A	A	—	D	A	C	B
Sodium hypochlorite, <5%	A	A	B	A	A	A	A	A	A	A	A	B	A	A	A
Sodium hypochlorite, >5%	A	A	B	A	A	A	A	A	A	A	A	—	A	C	B
Sodium nitrate	A	A	D	A	A	A	A	A	A	A	—	—	A	B	A
Sodium silicate	A	A	A	A	A	—	A	A	A	A	A	—	A	B	A
Sodium sulfide	A	A	A	A	A	A	A	A	A	A	A	—	A	C	A
Sodium sulfite	A	A	A	A	A	A	A	A	A	A	—	D	—	A	B
Steam, up to 40 psi	C	—	A	D	D	—	D	A	B	A <sup>†</sup>	A	A	A	A	—
Stearic acid	C	A	B	A	B	C	C	A	A	A	C	A	—	B	C
Styrene	D	D	D	D	D	D	D	A	A	A	—	D	—	A	—
Sulfuric acid (dil)	A	A	A	D	A	A	A	A	A	A	A	A	A	D	A
Sulfuric acid (med)	A	A	D	A	B	A	A	—	A	A	B	C	A	D	A
Sulfuric acid (conc)	D	A	D	D	D	D	A	C	A	A	D	D	A	C	B
Sulfurous acid	A	A	D	A	A	A	A	—	B	A	A	—	A	B	A
Tannic acid	B	A	B	C	D	A	A	—	A	A	A	—	A	B	A
Tanning liquors	A	B	—	A	A	A	A	—	A	A	—	—	—	A	B
Tartaric acid	A	A	A	A	A	A	A	A	A	A	A	B	A	C	A
Tin salts	A	A	B	A	A	A	A	—	A	—	—	—	—	A	B
Toluene (toluol)	D	D	D	D	D	D	D	A	A	A	D	D	A	A	B
Trichloroacetic acid	B	A	D	A	D	A	A	—	C	A	—	D	A	D	A
Trichloroethylene	D	D	D	D	D	D	D	B	A	A	C	D	A	B	D
Trisodium phosphate	A	A	—	A	A	A	A	—	A	A	—	—	A	B	A
Turpentine	D	D	D	D	B	D	D	A	A	A	—	—	A	A	B
Urea	A	A	B	A	A	A	A	A	—	A	C	D	A	A	A
Uric acid	A	A	—	A	C	A	A	—	A	—	—	—	—	B	—
Water, fresh	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A
Water, salt	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Xylene	D	D	D	D	D	D	D	A	A	A	D	D	A	A	C
Zinc chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	D	A

<sup>†</sup>Do not use the L/S® PTFE-tubing pump head with gases due to excessive heat buildup.

## Tubing for Food Products

Liquified food products	Norprene® Food	Silicone	Tygon® E-Food	FDA Viton®
Alcohol	B	—	—	A
Beer	B	A	—	A
Brandy	B	—	—	A
Butter	A	B	A	A
Carrot	A	—	A	—
Chocolate syrup	A	—	A	—
Citric acid	A	A	A	A
Coffee	A	A	—	A
Corn oil	—	A	—	A
Corn syrup	—	—	A	A
Fish	—	A	A	—
Fruit juices	A	—	A	—
Liqueurs	B	B	—	A
Mayonnaise	A	—	A	A
Milk	A	A	A	A
Milk of magnesia	A	—	B	—
Molasses	A	—	B	A
Orange syrup	A	B	—	A
Sauerkraut	A	—	B	—
Shortening (Liq)	C	B	—	A
Soft drink concentrate	B	C	—	—
Sugar	A	A	A	A
Tomatoes	A	—	A	A
Vegetable oil	B	B	B	A
Vinegar	A	A	A	A
Whiskey	B	A	B	A
Wines	B	A	B	A

### Caution

The ratings in the charts do not reflect the extent to which extraction or leaching may occur or the extent to which fluids may undergo any physical changes in properties or composition as a result of coming into contact with the wetted materials. It is the user's responsibility to test and ensure the suitability of wetted materials for all intended users, including establishing the compatibility of any fluid with the material through which it is coming into contact.

### Warning

The information in these tables has been supplied to Cole-Parmer by the tubing manufacturers and is to be used ONLY as a guide to select your tubing. Test fluids and tubing using the tubing test procedure on page 682. Cole-Parmer does not warrant (neither express or implied) that the information in these tables is accurate or complete or that any material is suitable for any purpose.

### Danger

Even if tubing passes the immersion test, variations in temperature, pressure, or concentration may cause tubing failure.

**SERIOUS INJURY MAY RESULT.**

Use suitable guards and/or personal protection when pumping chemicals.