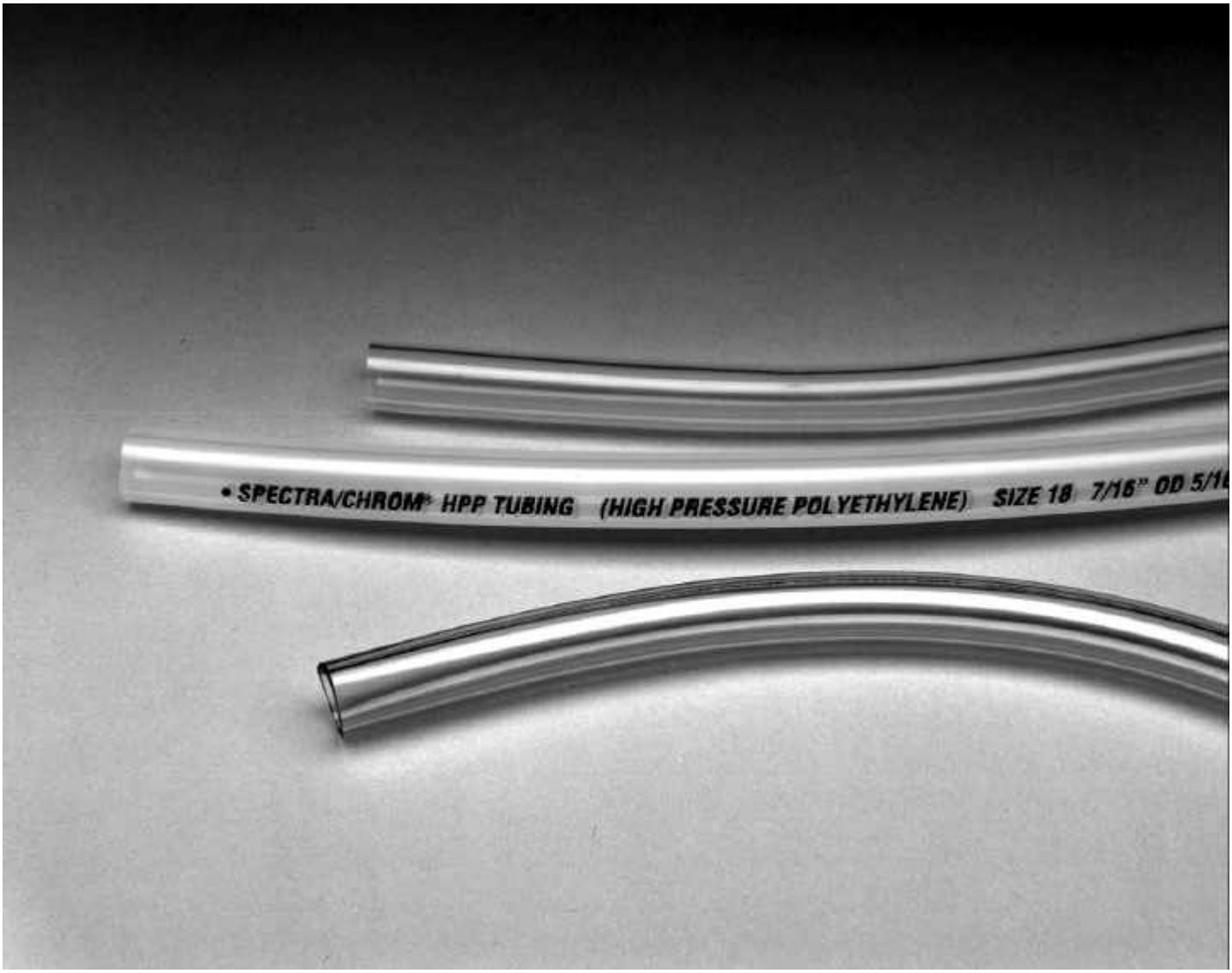
Laboratory and Peristaltic Pump Tubing
from
Spectrum Chromatography



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Spectra/Chrom® Peristaltic Pump Tubing

Due to the nature of its application, peristaltic pump tubing has a limited life, especially when compared to laboratory tubing used simply to carry fluid. The constant compression and expansion of the tubing as the pump runs fatigues the wall of the tubing. This leads to a decreasing flow rate as the tubing ages.

Eventually, usually after the flow rate has significantly decreased, the tubing wall will wear through and the tubing will leak inside the pump head. Depending upon the pump head and the fluid being used, this may destroy the pump head and it certainly will not aid your experiment. Therefore, it is important that only specially manufactured long-life tubing be used in peristaltic pumps.

A side effect of the mechanical wear put on the tubing by the pump head is an increase in the susceptibility of the tubing to chemical attack. The mechanical wear generally increases the rate of solvent attack on the tubing in the pump head. Tubing which may be acceptable as connecting tubing may readily deteriorate inside a peristaltic pump head when challenged with even mild conditions. Again, choosing specially manufactured long-life peristaltic pump tubing can minimize this attack.

For most applications, silicone tubing is the tubing of choice for use in peristaltic pumps. It has a longer service life and is generally more chemically inert than vinyl tubing. Vinyl may appear to be an inexpensive alternative, but its shorter life can make it more expensive in long term applications.

Occasionally, for example when using chlorinated solvents, silicone tubing may not be sufficiently inert. Under these conditions a tubing made of a flexible fluoroplastic (a fluoroelastomer) must be used. Fluoroelastomer tubing offers excellent chemical compatibility; unfortunately it also has a limited service life and a high cost. Because of the nature of the fluids pumped using the fluoroelastomer tubing and the limited lifetime it is usually important to inspect the pump frequently to prevent the tubing from wearing through.

Tubing Sizes

In a peristaltic pump, flow rate is determined by both the speed of the pump and the inner diameter of the tubing. Some older peristaltic pumps had separate pump heads for each tubing diameter; newer pump heads (like Spectrum®'s Fast Load pump head) adapt to many different sizes of tubing having the same wall thickness. This allows an enormous flow rate range to be covered by a single pump and pump head.

Six different sizes of peristaltic pump tubing are available. Five of these have a wall thickness of 1/16 inch; the other has a wall thickness of 3/32 inch. For historical reasons, these six sizes are often referred to by their size number, which ranges from 13 to 18. When used with most common 600 rpm pumps, these tubings cover the flow rate range of about 1/2 ml/min to over 2 l/min. A page describing the available peristaltic pump tubings and the flow rates you can expect with the pumps available from Spectrum Chromatography is included in the booklet.

Silicone Tubing (LPS). This is the most commonly used material for peristaltic pump tubing. It provides the longest service life and good chemical compatibility for aqueous solvents. Its service life is about 150 hr. at 600 rpm and 825 hr. at 100 rpm. It can usually be left running on experiments during weekends without much danger of rupture. Of course a fresh section of tubing should be pulled though the pump rollers before any running peristaltic pump is left unattended for an appreciable length of time. Silicone tubing can also be autoclaved a single time on a wet cycle without a significant reduction in its life.

Vinyl Tubing (LPV). Vinyl tubing has the lowest per-foot cost of the available peristaltic pump tubings. It generally has only fair compatibility for most aqueous solvents and does not have a good tolerance for organic solvents. It has only about a third of the service life of vinyl tubing, 50 hr. at 600 rpm and 275 hr. at 100 rpm. It is not recommended that a peristaltic pump using vinyl tubing be left unattended. If it must be left unattended, a fresh section of tubing should be pulled though the pump rollers immediately prior to leaving. Vinyl tubing cannot be autoclaved and should not be exposed to temperatures above 80ºC.

Fluoroelastomer Tubing (LPF). Fluoroelastomer tubing is both the most chemically inert peristaltic pump tubing and the shortest lived. It can withstand even halogenated solvents for a limited time. Its service life is only 30 hr. at 600 rpm and 165 hr. at 100 rpm. Because of its short life we do not recommended that a peristaltic pump using fluoroelastomer tubing be left unattended. If it must be left unattended, a fresh section of tubing should be pulled though the pump rollers immediately prior to leaving. Like silicone tubing, fluoroelastomer tubing can be autoclaved a single time on a wet cycle without a significant reduction in its life.

PACKAGING

Spectrum packages it peristaltic pump tubing in easy to use dispenser boxes. All lengths of more than 3 meters are spooled in side access dispenser boxes to minimize your shelf space requirements. They also include a Spectra/Chrom tubing cutter which easily makes square, even, tubing cuts.

Spectra/Chrom® Laboratory Tubing

In addition to the specially manufactured peristaltic pump tubings, Spectrum Chromatography also provides tubing for general laboratory applications. Both semirigid tubing, made of Teflon® or polyethylene, and flexible tubing, made of vinyl, silicone, or fluoroelastomers, are available.

The same features which make Spectra/Chrom peristaltic pump tubing the premier tubing for use in peristaltic pumps make it ideal for general laboratory use. The extra spring in the walls and the mechanical fatigue resistance provide a longer life in most general laboratory applications, as well as in peristaltic pumps.

The semirigid Teflon and polyethylene tubing, while not suited for use in peristaltic pumps, have many general lab applications. Teflon provides unparalleled solvent resistance; nearly any solvent can be used with Teflon tubing. Polyethylene tubing provides a reasonable degree of solvent resistance as well as an increase in the pressure limit of the tubing.

All of Spectrum's laboratory tubing exhibit some gas permeability. In general, silicone is the most permeable to gases and polyethylene and Teflon the least permeable.

Although all of Spectrum's tubing is designed to provide long life, it is also designed only for general laboratory applications. It is not meant to be permanently installed nor is it meant to be placed where it cannot be routinely observed. The flexible tubings will generally contain plasticizers to make them flexible. These will leach out of the tubing in time, making it more brittle, subject to easy breakage, and reducing its tolerance to pressure.

Teflon Tubing. Teflon is the most inert of all the tubing supplied by Spectrum. It can withstand nearly any solvent used in a modern laboratory, from distilled water to methylene chloride. It's excellent thermal characteristics allow it to be repeatedly autoclaved. However, it should not be used for fluid transport until it has cooled.

Polyethylene Tubing. Spectrum's polyethylene tubing is an inexpensive alternative to Teflon. Like Teflon tubing, polyethylene tubing can handle pressures significantly higher than any of the flexible tubings can. Polyethylene does not have the thermal stability of Teflon, so it should not be autoclaved, although it can be ethylene oxide sterilized.

Spectrum Tubing Cutter

The Spectrum Tubing Cutter is designed to cut all types of polymer tubing leaving an even, flat edge. The special "V" shape of the tubing holder keeps the tubing perpendicular to the blade. The steel blade remains sharp for many cuts, but it can be easily replaced.

The Spectrum Tubing Cutter can be used on most types of tubing up to 1/2" (13 mm) OD. It is not for use on metallic tubing.

Ordering information:

Part No.	Description
123367	Spectrum Tubing Cutter
123368	Replacement Tubing Cutter Blades, 5/pk

Also Available from Spectrum Chromatography

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Spectra/Chrom® Laboratory Tubing Selection Guide
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OD ID length⇒	Wall	Vinyl 3m 30m	Silicone 3m 15m	LPF 3m	Polyethylene 3m 30m	Teflon® 3m 30m
1/16" **0.010**" 1.6mm 0.25mm	**0.025**" 0.6mm					123798 123800 1000 psi
1/16" **0.021**" 1.6mm 0.53mm	**0.020**" 0.5mm					123802 123804 1000 psi
1/16" **1/32**" 1.6mm 0.8mm	**1/64**" 0.4mm					123806 123808 1000 psi
1/16" **0.038**" 1.6mm 1mm	**0.012**" 0.3mm					123810 123812
0.085" **0.02**" 2.16mm 0.5mm	**0.045**" 1.15mm	123700 123702	123704 123706	123708	123710 123712	
1/8" **1/32**" 3.2mm 0.8mm	**3/64**" 1.2mm					123814 123816 500 psi
1/8" **1/16**" 3.2mm 1.6mm	**1/32**" 0.8mm	123714 123716 40 psi	123718 123720 21 psi	123722 21 psi	123724 123726	123818 123820 500 psi
1/8" **0.085**" 3.2mm 2.2mm	**0.020**" 0.5mm					123822 123824 250 psi
1/8" **0.106**" 3.2mm 2.7mm	**0.010**" 0.24mm					123826 123828 125 psi
5/32" **1/32**" 4mm 0.8mm	**1/16**" 1.6mm	123728 123730	123732 123734	123736	123738 123740	
3/16" **1/16"** 4.8mm 1.6mm	**1/16**" 1.6mm	123742 123744	123746 123748 32 psi	123750 32 psi	123752 123754	
1/4" **1/8**" 6.4mm 3.2mm	**1/16**" 1.6mm	123756 123758 20 psi	123760 123762 18 psi	123764 18 psi	123766 123768 180 psi	123830 123832
1/4" **3/16**" 6.4mm 4.8mm	**1/32**" 0.8mm	123770 123772	123774 123776 10 psi	123778 10 psi	123780 123782	123834 123836 175 psi
3/8" **3/16**" 9.5mm 4.8mm	**3/32**" 2.4mm	123838 123840	123842 123844 25 psi	123846 25 psi	123848 123850	
3/8" **1/4**" 9.5mm 6.4mm	**1/16**" 1.6mm	123852 123854 51 psi	123856 123858 11 psi	123860 11 psi	123862 123864 120 psi	
7/16" **5/16**" 11.1mm 7.9mm	**1/16**" 1.6mm	123784 123786 46 psi	123788 123790 10 psi	123792 10 psi	123794 123796 80 psi	

LPF is an abbreviation for Low-Pressure Fluoroelastomer.
Pressure recommendations are for water at 23ºC. Other fluids and temperatures may have different maximum pressure recommendations.

Spectra/Chrom® Peristaltic Pump Tubing Selection Guide
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Tubing Number	13	14	16	17	18	15
Tubing Size (OD x ID)	5/32” x 1/32” (4 x 0.8 mm)	3/16” x 1/16” (4.8 x 1.6 mm)	1/4” x 1/8” (6.3 x 3 mm)	3/8” x 1/4” (9.5 x 6.3 mm)	7/16” x 5/16” (11 x 8 mm)	3/8” x 3/16” (9.5 x 4.8 mm)
Wall Thickness	1/16” (1.6 mm)	1/16” (1.6 mm)	1/16” (1.6 mm)	1/16” (1.6 mm)	1/16” (1.6 mm)	3/32” (2.4 mm)
Flow Rate with MP-1 Pump (ml/min)	0.03 - 3.6	0.11 - 12.6	0.4 - 48	1.4 - 168	1.9 - 228	0.83 - 100
Flow Rate with MP-2 Pump (ml/min)	0.36 - 36	1.3 - 126	5 - 480	17 - 1680	23 - 2280	10 - 1000
Flow Rate with Macroflow Pump (ml/min)	0.72 - 36	2.5 - 126	20 - 1000	35 - 1680	45 - 2280	20 - 1000
Recommended Pump Head	Fast Load 146924	Fast Load 146924	Fast Load 146924	Fast Load 146924	Fast Load 146924	Quick Release 146812
Optional Pump Head	Standard 146809	Standard 146811	Standard 146813	Standard 146817	Standard 146819	Standard 146815
Part Numbers:						
Silicone, 3m	123732	123746	123760	123856	123788	123842
Silicone, 15m	123734	123748	123762	123858	123790	123844
Vinyl, 3m	123728	123742	123756	123852	123784	123838
Vinyl, 30m	123730	123744	123758	123854	123786	123840
LPF, 3m	123736	123750	123764	123860	123792	123846

LPF is an abbreviation for Low Pressure Fluoroelastomer.

Tubing Compatibility Table

T - Teflon **P** - Polyethylene **V** - Vinyl **S** - Silicone **F** - Fluoroelastomer

+ Satisfactory **?** Use only after testing – Unsatisfactory

Fluid	T	P	V	S	F
Acetates	+	+	?	+	?
Acetic acid (<5%)	+	+	–	+	+
Acetic acid (>5%)	+	+	–	+	+
Acetic anhydride	+	–	–	?	–
Acetone	+	+	–	+	–
Acetyl halides	+	–	?	?	+
Alcohols	+	+	+	+	+
Aliphatic hydrocarbons	+		+	?	–
Ammonia	+	?	+		–
Ammonium salts	+	+	+	?	+
Ammonium hydroxide	+	+	+	+	+
Amyl acetate	+	?	?	–	–
Amyl alcohol	+	+	+	–	+
Amyl chloride	+	–	–	–	+
Aniline	+	+	?	–	?
Aqua regia			–		?
Aromatic hydrocarbons	+	?	–	?	+
Base	+	+	+	?	?
Benzaldehyde	+	+	–	–	–
Benzene	+	?	?	–	+
Benzenesulfonic acid	+		?		+
Benzoic acid	+	+	+	+	+
Benzyl alcohol	+	–	+		+
Boric acid	+	+	+	+	+
Bromine	+	–	?	–	+
Butane	+	?	?	–	+
Butanol	+	+	+	+	+
Butyric acid	+	–	+		+
Calcium oxide (dilute)	+	+	+	?	+
Carbon bisulfide	+		–		+
Carbon tetrachloride	+	+	?	–	+
Chlorobenzene	+	?	–		?
Chloroform	+	?	–	–	+
Chromic acid	+	+	+	?	+
Cresol	+	–	–	–	+
Cyclohexane	+	+	–	–	–
Cyclohexanone	+	–	–	–	+
Dimethylformamide	+	+	–	?	–
Dimethyl Sulfoxide	+	+	–		
Ethers	+	?	–	–	?
Ethyl acetate	+	?	?	+	–
Ethanol	+	+	+	+	+
Ethyl bromide			–	–	+
Ethylamine			–		–
Ethylene chlorhydrin		–	–	?	+
Ethylene dichloride	+	?	–	–	+
Ethylene glycol	+	+	+	+	+
Ethylene oxide	+	?	?	–	–
Fatty acids	+	+	+	?	+
Ferric salts	+	+	+	+	+
Ferrous salts	+	+	+	?	+
Formaldehyde	+	+	+	+	–
Formic acid	+	+	+	+	?
Gasoline			–	–	+
Glucose	+	+	+	+	+
Glycerine	+	+	+	+	+
Hydrochloric acid	+	+	+	?	+
Hydrofluoric acid	+	–	?	–	+
Hydrogen peroxide (conc.)	+	?	+	+	+
Hydrogen sulfide	+	+	+	–	–
Iodine solutions	+	–	–		+
Kerosene	+	?	+	–	+
Ketones	+	?	–	–	–
Lacquer solvents	+	+	?	–	–
Lactic acid	+	+	+	+	+
Lead acetate	+	+	+	–	–
Linseed oil	+	?	+	+	+
Lithium hydroxide (5%)	+			–	+
Malic acid	+	+	+	+	+
Methyl chloride	+	?	–	–	+
Nitrates	+	+	+	+	+
Nitric acid (dilute)	+	+	+	–	+
Nitric acid (conc.)	+	?	–	–	+
Nitrobenzene	+	?	–	–	–
Nitrogen oxides	+		–	?	?
Nitrous acid			+		?
Oils, animal	+		–	?	+
Oils, mineral	+	+	+	?	+
Oils, vegetable	+	+	?	+	+
Oleic acid	+	+	?	–	+
Oxalic acid	+	+	+	+	+
Perchloric acid	+	+	+	–	+
Perchloroethylene	+	–	?	–	+
Phenol	+	+	?	–	+
Phthalic acid	+		+	+	+
Pyridine	?	+	–	–	–
Silicone fluids	+	+	+	+	+
Silver nitrate	+	+	+	+	+
Sodium chlorate	+	+	+		+
Sodium hypochlorite (<5%)	+	+	+	+	+
Sodium hypochlorite (>5%)			?		+
Stearic acid	+	+	+	–	+
Styrene	+		–	–	+
Sulfuric acid	+	+	?	–	+
Tannic acid	+	+	+	+	+
Tartaric acid	+	+	+	+	+
Toluene	+	?	–	–	+
Trichloroacetic acid	+	?	+	–	?
Trichloroethylene	+	?	–	–	+
Turpentine	+	?	+	–	+
Urea	+	+	–	+	+
Uric acid	+	+	+		
Xylene	+	?	–	–	+

DISCLAIMER: This chemical compatibility table is intended for use as a guide, not as a guarantee of chemical compatibility. Variations in temperature, concentration, duration of exposure, as well as other factors, may affect the performance of these materials. To insure performance we recommend that you test these materials under the actual conditions you will employ.

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