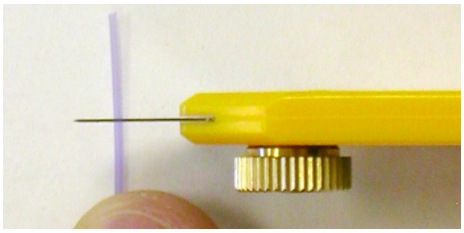
Technical Bulletin G0310 - FEP Tubing Fluidic Tutorial

Teflon fluorinated ethylene propylene (FEP) tubing is now commercially available in 1/32" outer diameter (O.D.) and inner diameter (I.D.) from 75 µm to 230 µm. This tubing is much easier to work with, does not pose any surface adsorption concerns, or crack and produce dangerous particulates like fused silica. Tubing with 75 µm I.D. is recommended for the sample fluidic pathway as longitudinal diffusion does not occur. Larger I.D. are good to use for solvent reservoir lines as there is less resistance but be sure to check that the through-hole cannot collapse as the wall thickness isn't as wide.

Cutting FEP tubing

FEP tubing is much easier to cut and maintain then fused silica capillary. In order to cut FEP tubing, we suggest the Technic Knife by Olfa (part # TEC-1). Roll the rounded blade over the tubing for a clean cut. The tips should still be examined with a magnifying glass to ensure a good cut, clear through-hole, and debit free surface.



Filtration

Inline filters should always be used on the CapNMR™ probe.

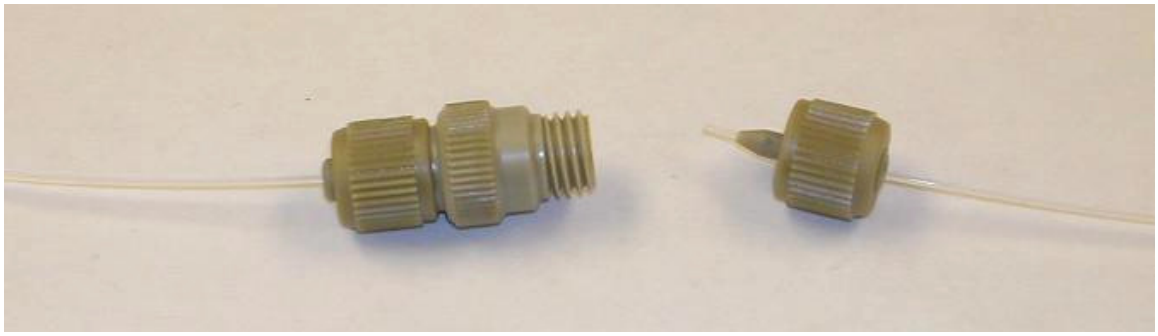
M-542 filter

Threaded Nuts – P-416	Stainless Steel 2 µm filter Cartridges – M-132
Ferrules – F-112	Titanium 1 µm filter Cartridges – M-134

The M-542 is the recommended inline filter for 1/32" FEP tubing. The filter consists of a body housing and a filter cartridge that come in different styles (note the two filter cartridges above have different colors and markings but they are the same part number and filter porosity). There is an alternate filter cartridge that has a titanium 1 µm frit for added chemical resistivity.

The filter has a ledge on one end, which holds the filter cartridge.

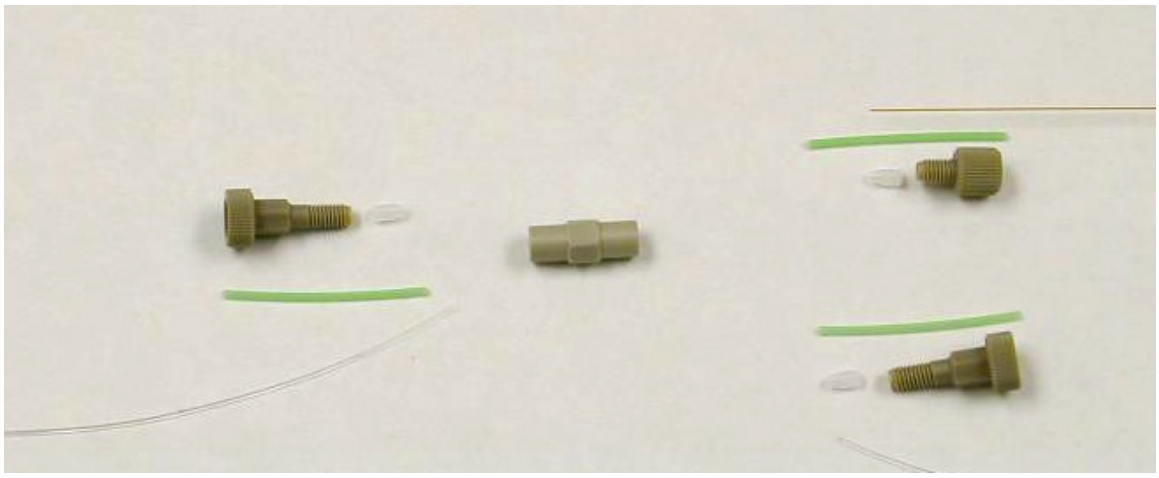
The filter on the left has the filter installed properly and is recessed into the filter. On the right, the filter is in the wrong end causing the cartridge to protrude out of the filter housing.



To assemble the M-542 filter, insert the 1/32" tubing through the nut and ferrule fitting. Ensure the tubing is pushed into the fittings as the nut is tightened down. This helps the zero-dead volume connection between the filter cartridge and the tip of the tubing.

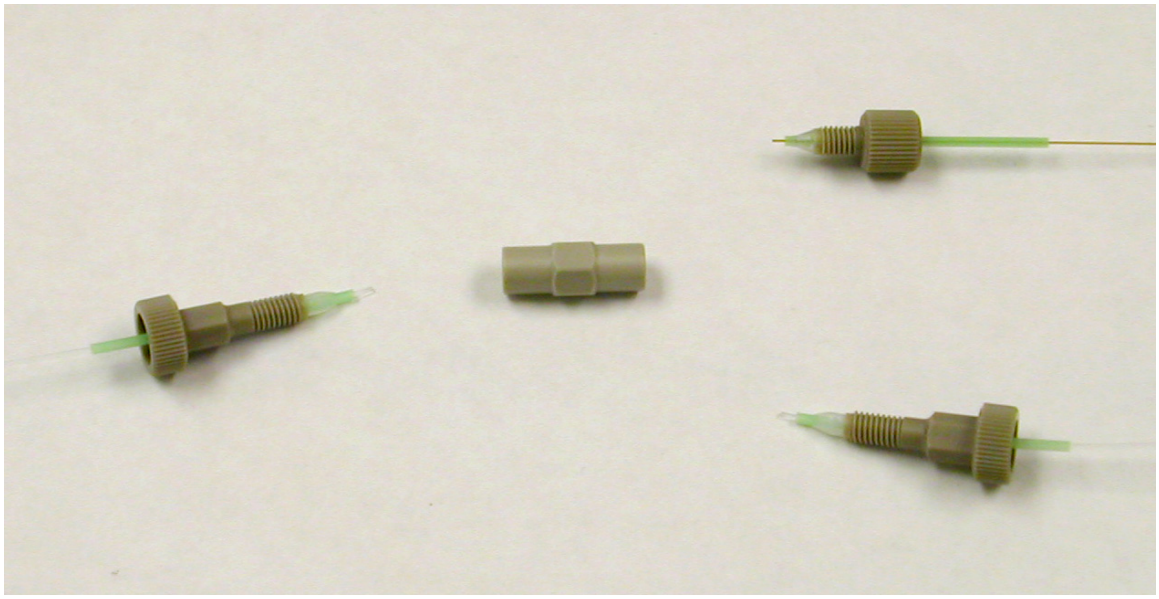
Connecting

FEP tubing can be connected to fused silica capillary or more FEP tubing using a P-779-01 union, which has an 8-nanoliter dead volume.



FEP Connection:	Union:	Fused Silica Connection:
(left & bottom right)	*(middle)*	*(top right)*
Sleeve – F-247	P-779-01	Sleeve – F-242
Nut & ferrule – F-334N		Nut & ferrule – F-334N

To assemble, insert the tubing or capillary through the sleeve and then place the tubing/sleeve through the nut and ferrule (the tapered end of the ferrule always points toward the union).



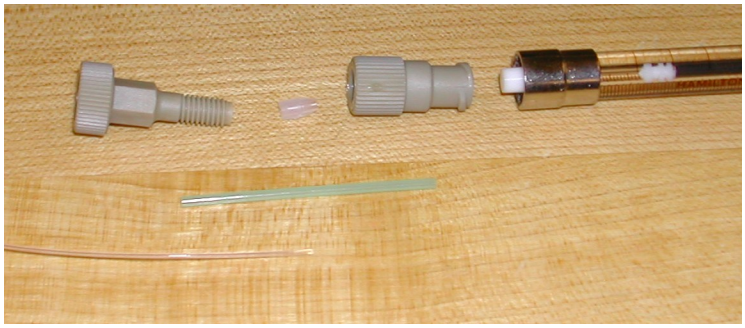
The figure above shows the assembled fittings. The fittings on the left and bottom right show the 1/32" FEP tubing while the top right is a fused silica capillary. To assemble, push the tubing and fittings into the union and brush your fingers along the tubing to ensure it is pushed against the inside of the union while tightening the nut and ferrule.

FEP (1/32") to FEP (1/32")

FEP (1/32") to Fused Silica Capillary (360 μm o.d.)

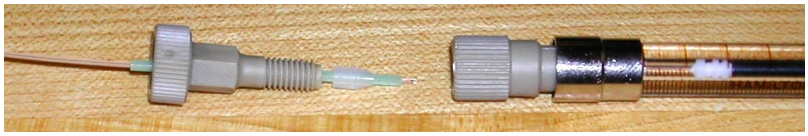
Maintenance Note: The P-779-01 has a through-hole, which can be deformed and warped over time or with excess over-tightening. Examine the through-hole by holding it up to a light source and noting the amount of light coming through the center. (Use a new union for reference.)

Connecting to a Large Volume Syringe

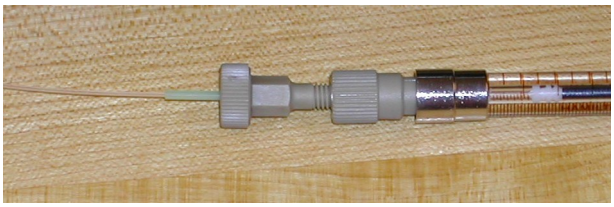


FEP Fitting:		Syringe and Luer Lock
Sleeve –	F-247	250 uL Gastight Hamilton
Nut & ferrule –	F-334N	Luer-lock adapter – P-659

To assemble, insert the tubing or capillary through the sleeve and then place the tubing/sleeve through the nut and ferrule (the tapered end of the ferrule always points toward the union). The luer-lock adapter is a quick release fitting that simply twists onto the luer lock syringe.

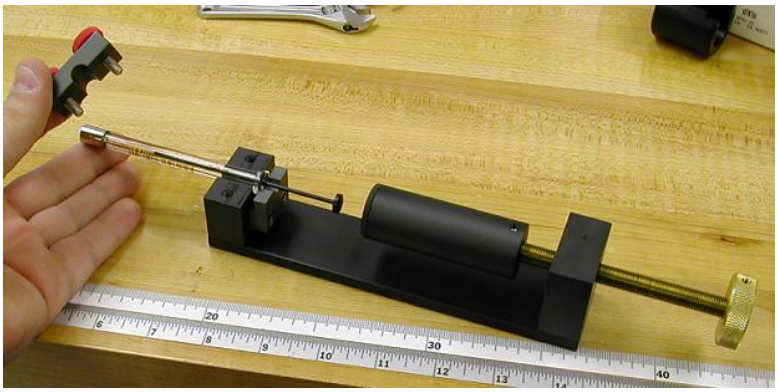


When making the final connection, the tubing should be sticking out or just at the surface of the green sleeve but if sticking out too large, can protrude up into the syringe, which is inadvisable.

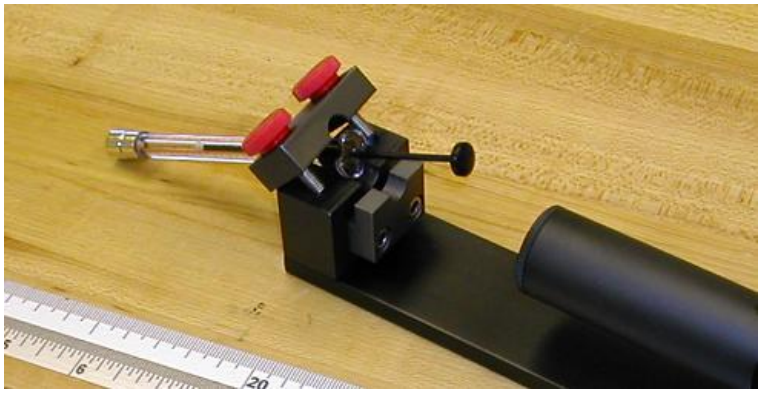


Using the Syringe Clamp and Vice

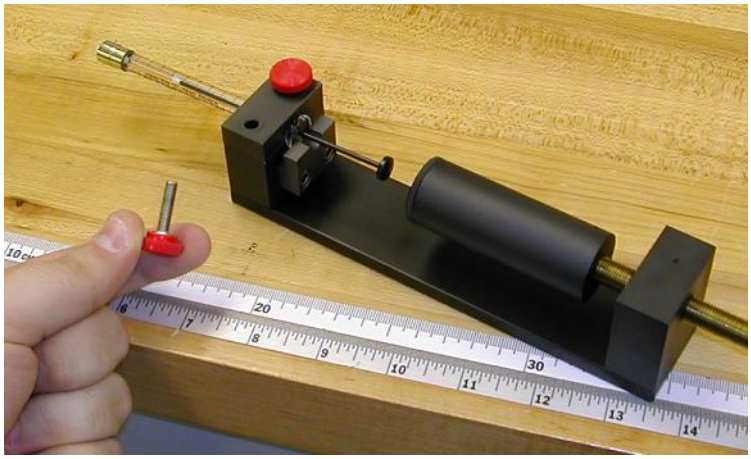
You now have a few custom designed apparatuses that are used for pushing solvent through the probe and for air pushes. The syringe vise was designed with a captured spring that can be used to apply the pressure to push solvent, or cleaning solution through the probe.



The syringe vise can work with 100 µL, 250 µL, 500 µL Hamilton gastight syringes. Just fill the syringe with the desired volume of solvent and place into the grove.

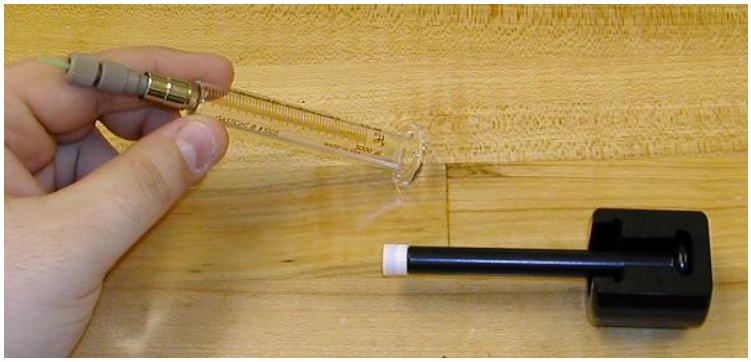


There are two screws and a bar with can get screws down on top of the syringe to keep it in place. Make sure that the little lip on the syringe is on the inside of the outer lip of the restraining lip to keep the syringe from moving in any directions.



Once the syringe is lined up, just screw the two screws in. Do not use a syringe larger then 500 uL, as the syringe body is too big.

The syringe clamp can ONLY be used with the Hamilton gastight 5 mL syringe. This is used exclusively for the air push. Start by attaching the adapter with the tubing for the probe onto the syringe.



Place the end of the syringe plunger onto the clamp. It may need to be pushed in as the clamp is designed to hold the plunger. Once in the clamp, push the syringe body onto the plunger and push all the way on.

Twist lip of the syringe to rotate the large base of the syringe so the clamp actually holds the syringe tight while still applying force to the contents. This allows for an easy air push. The waste tubing from the probe should be examined to make sure that air actually is indeed being pushed through.

Rinsing Before Switching Solvent or Samples

When changing solvents, it is always a good idea to rinse with the same solvent as the sample is dissolved then an air push. Follow this by ~50 µL of acetone and another air push. This prevents any problems from some solvents being immiscible. If two immiscible solvents are pushed into the flowcell, just like oil and water, one of the solvents will form a droplet that will stay inside the flowcell until a miscible solvent gets pushed through, dissolves the solvent droplet and gets push out again.