

HPLC Connections— Fittings and Flow Path



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HPLC Connections

Some of the most frequently asked questions we see are about HPLC capillaries and fittings. There are so many choices, how do you choose what is best for your instrument and your analysis? Problems with LC connections are often mistaken for column issues and can be a source of frustration and downtime. In this webinar we will discuss your instrument's flow path and cover:

- Standard LC system capillaries
- Fitting types and valve connections
- System volume and dispersion
- Application-specific capillaries, for Bio-inert and PFAS
- Troubleshooting clogs

Stainless Steel vs. Polymeric Fittings

Stainless steel

- Agilent uses Swagelok type fittings with front and back ferrules
- Also available with longer lengths



PEEK (< 400 bar system pressure)

- Connections are changed frequently
- Connecting columns
- Pressure is less critical
- Fits on SS or PEEK tubing

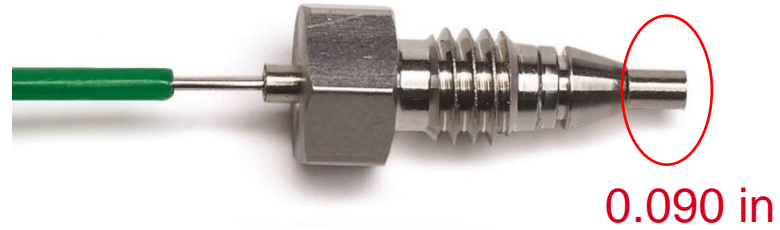


Polyketone

- Easy, hand tightened column connection
- Used up to 600 bar (p/n: 5042-8957)
- Best on SS tubing

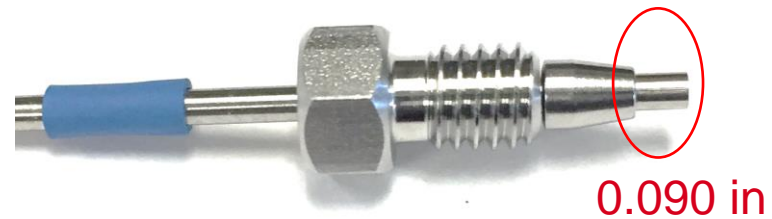


Column Connections



Swagelok

- Two-piece ferrule
- Used on Agilent LCs
- Short nut
- Also available with long nut



Parker

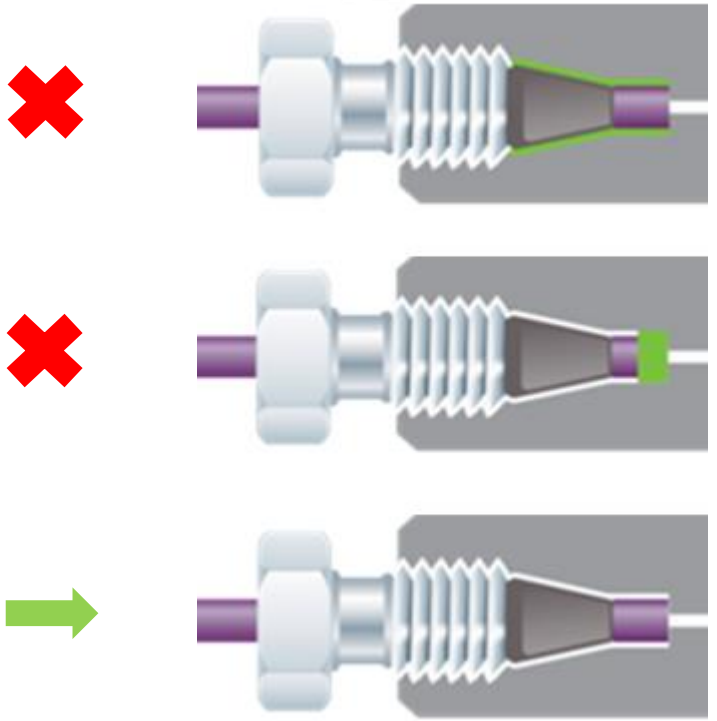
- One-piece ferrule
- Short nut
- Very similar to Swagelok
- Agilent GPC columns
- Waters Acquity systems



Waters

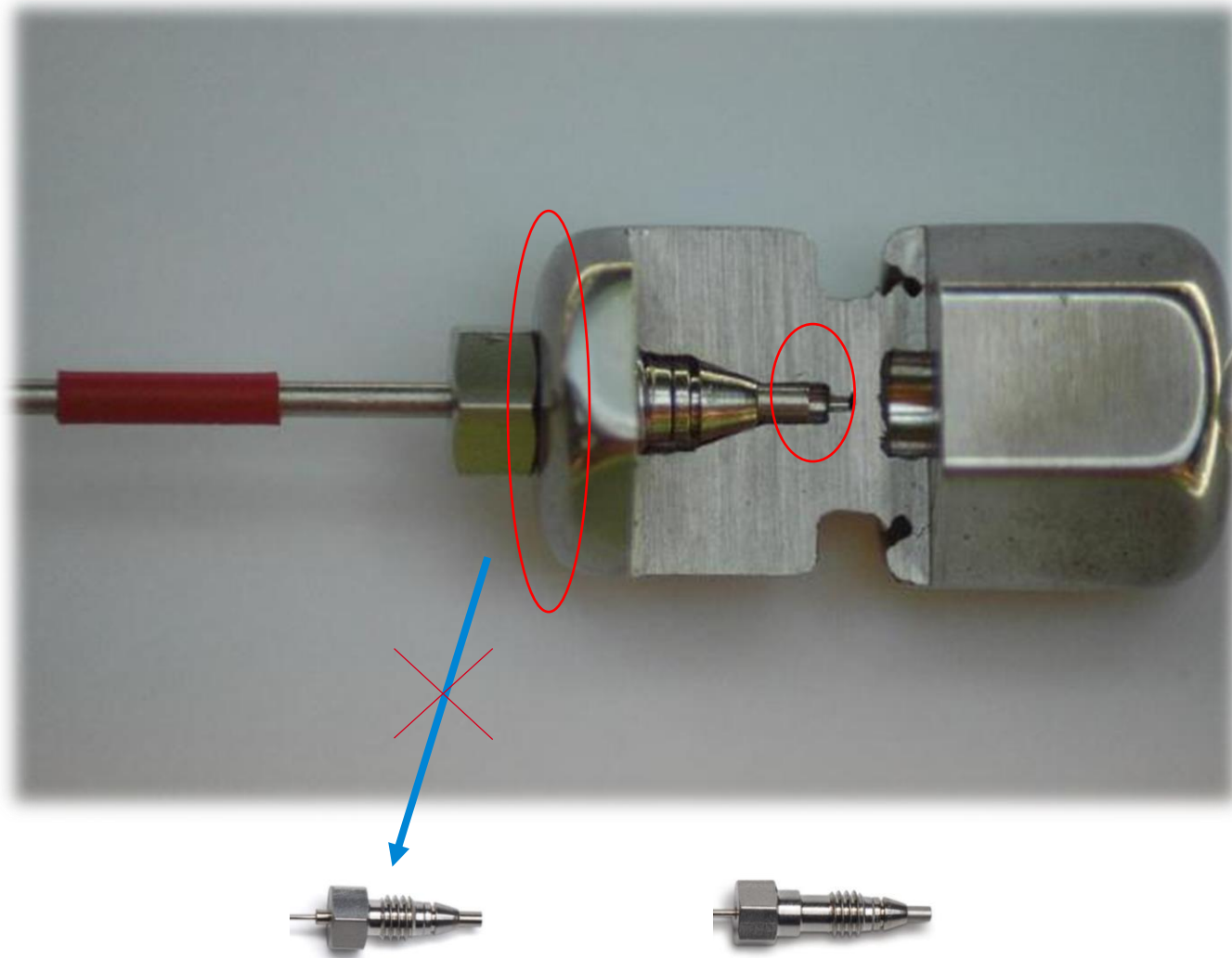
- Longer nut
- Used on Alliance systems
- Non-Acquity columns

Potential Issues with Fittings



- Leak
- Peak shape problem
- No dead volume

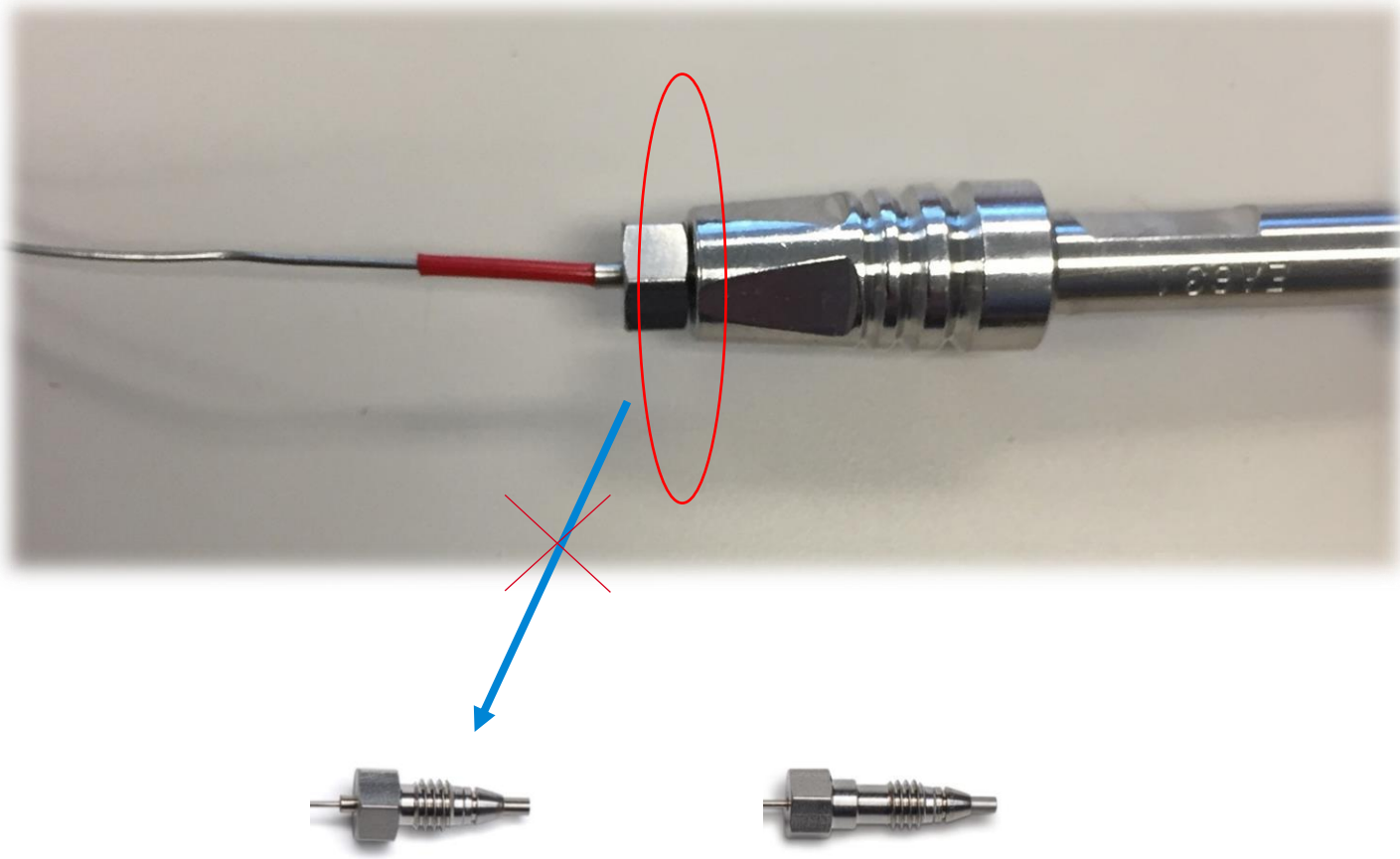
Fitting Mismatch



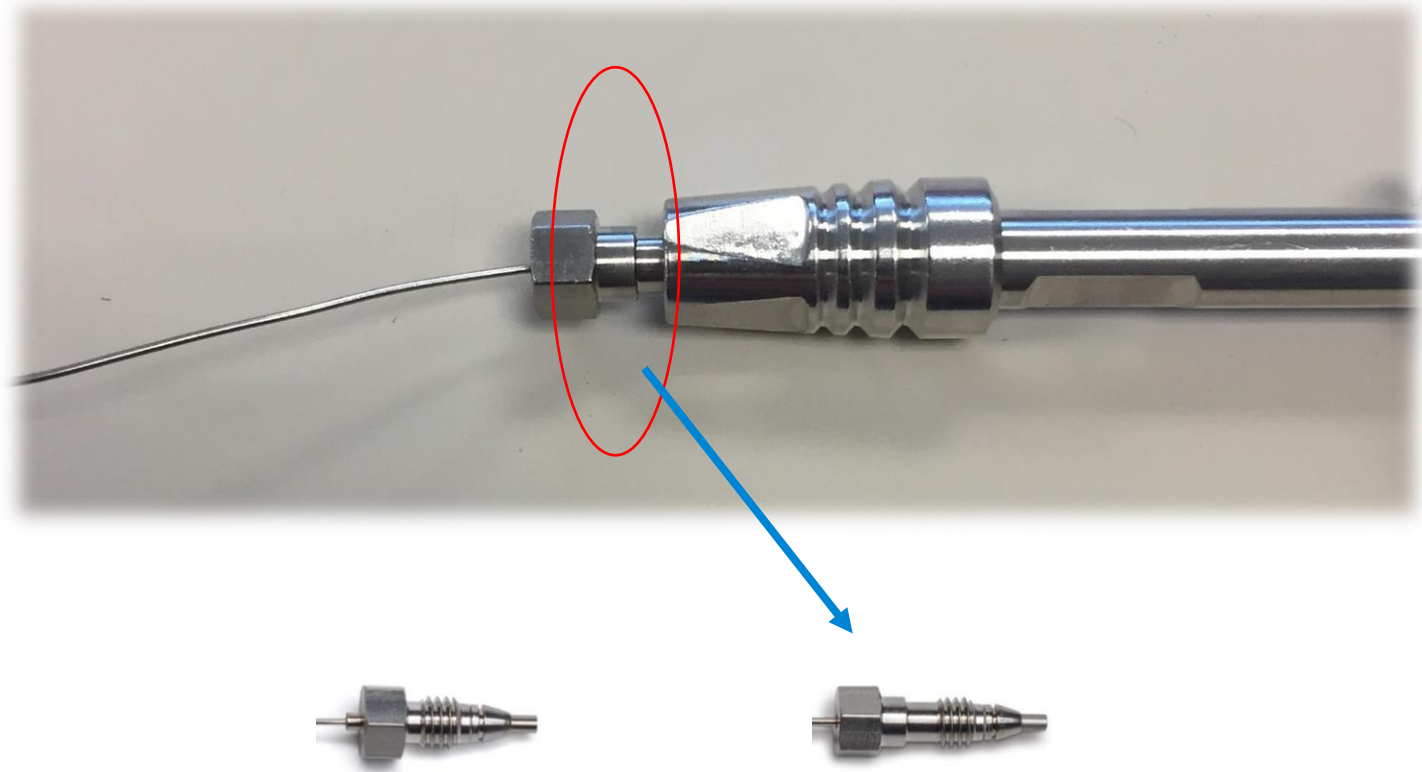
Proper Fit



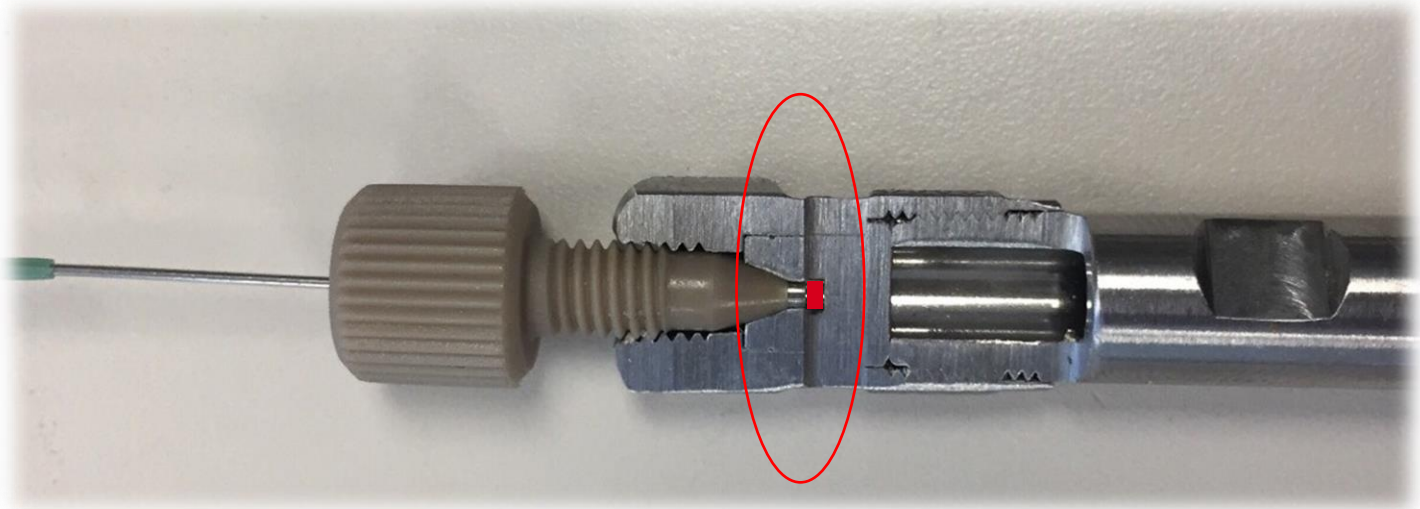
Fitting Mismatch



Proper Fit

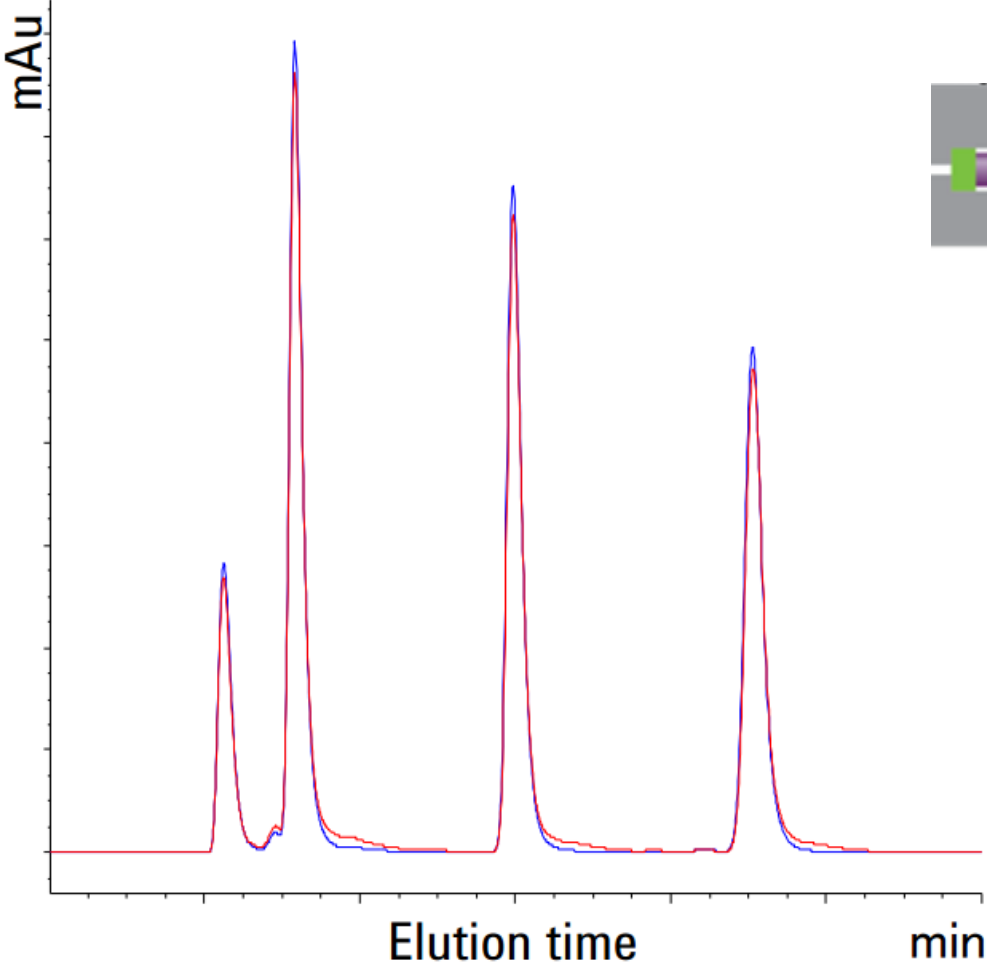


Polymeric Fittings

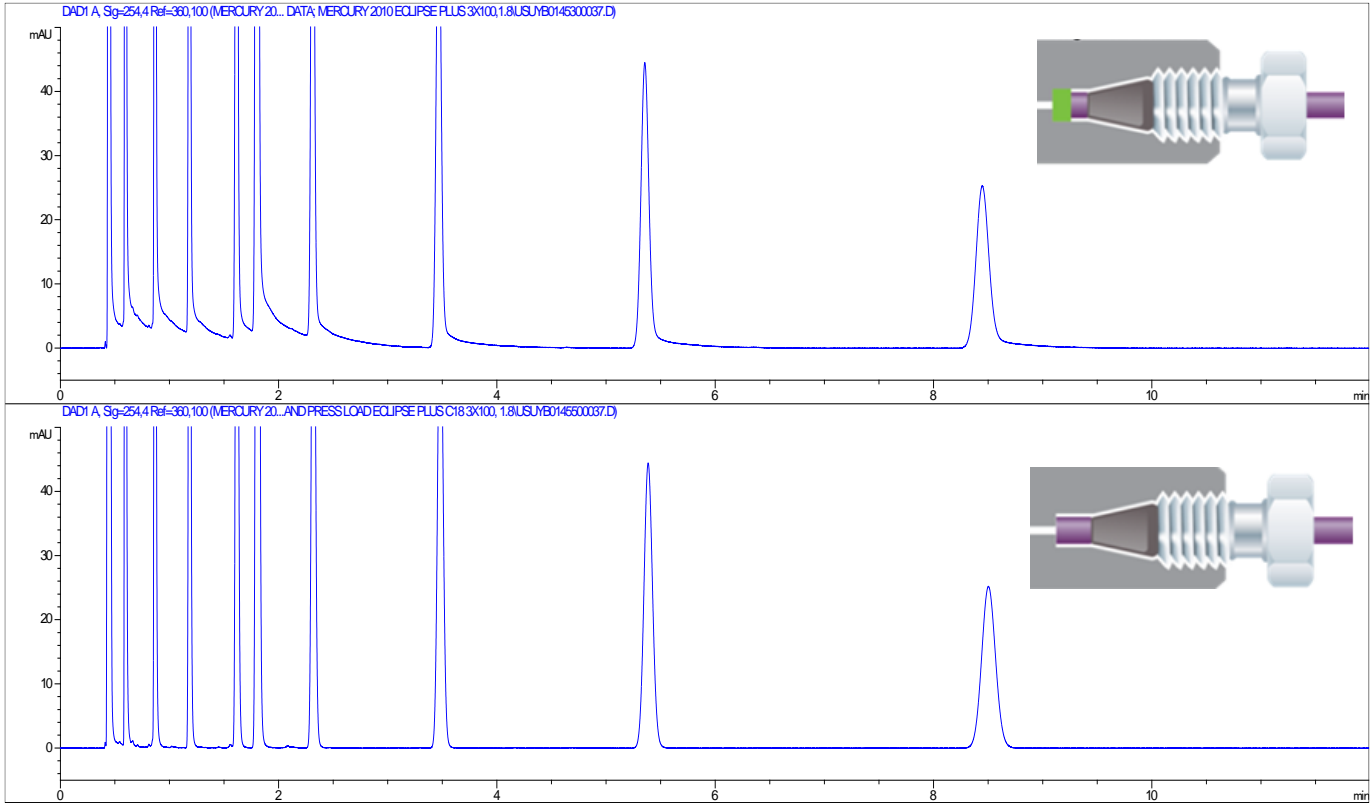


Peak Shape

— Zero-dead-volume fitting connection
— Fitting connection with dead volume



Peak Shape



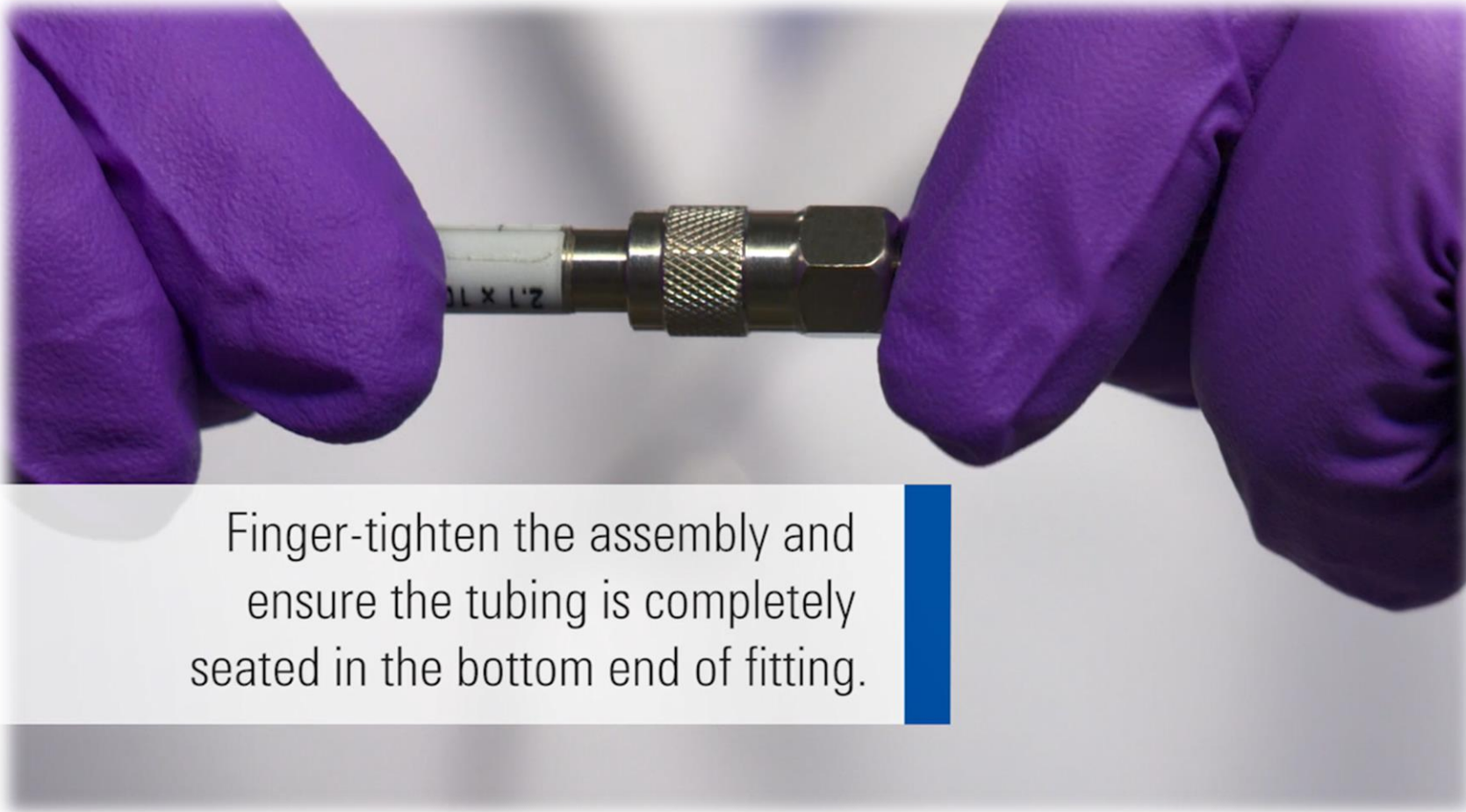
Swaging Fittings



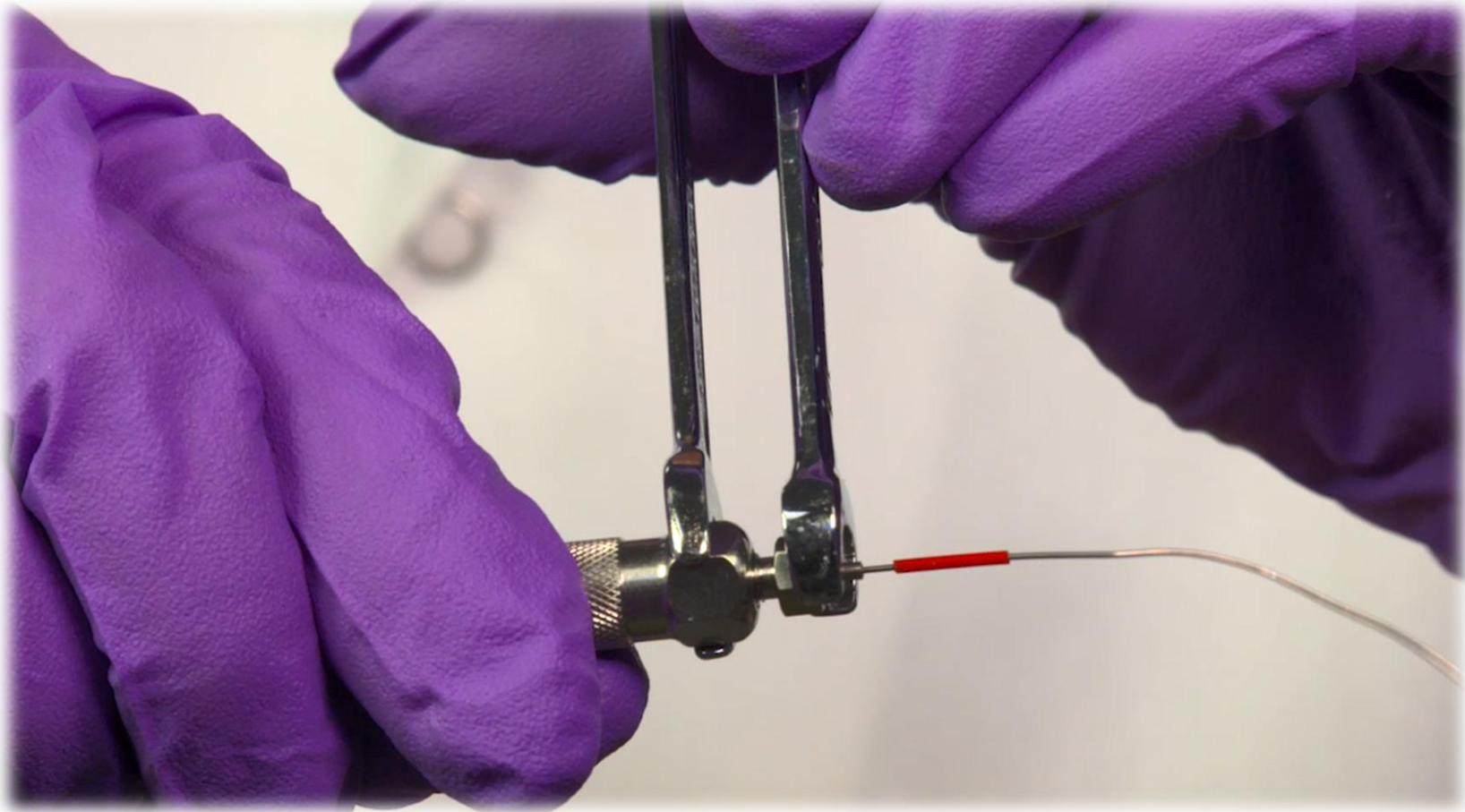
Swaging Fittings



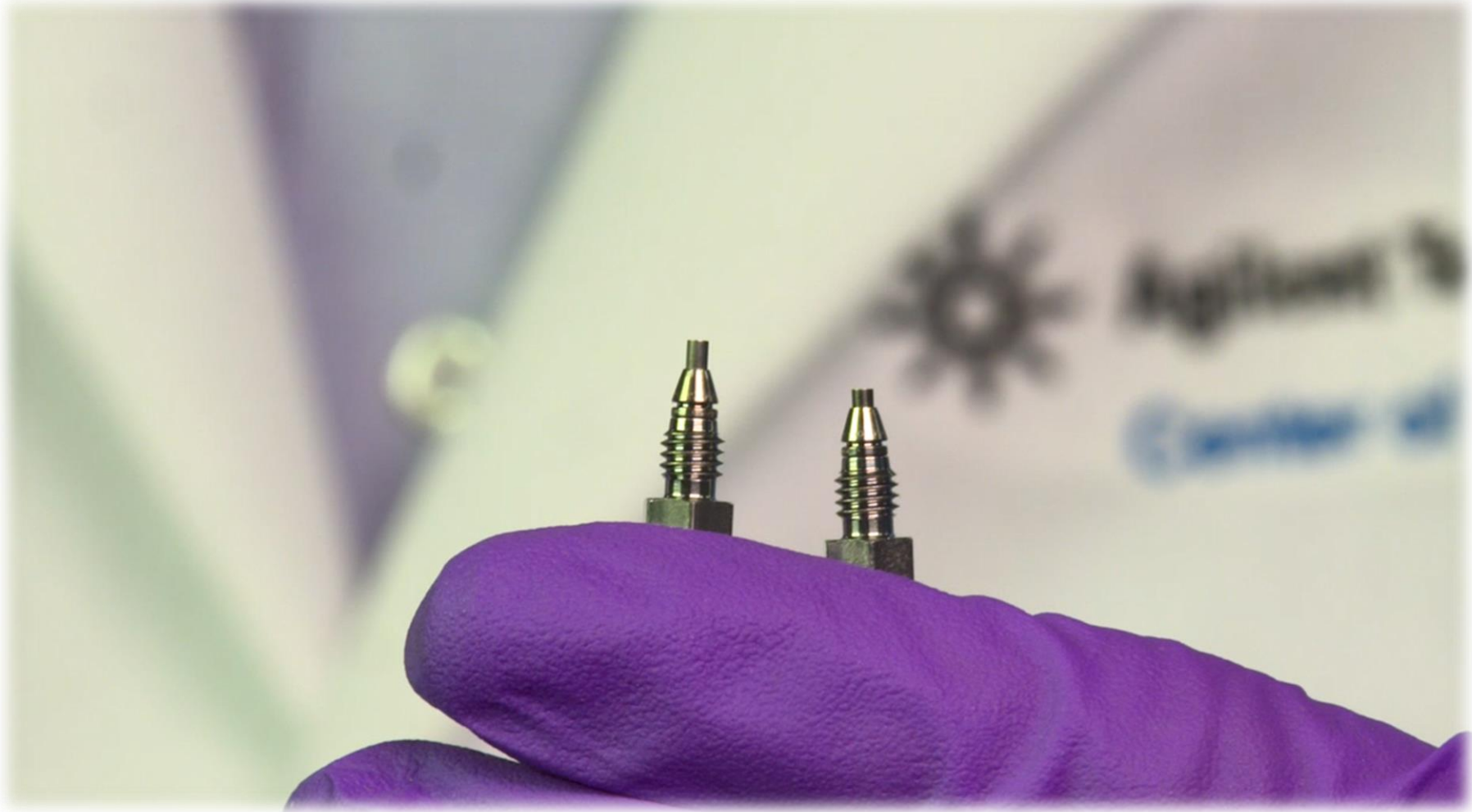
Swaging Fittings



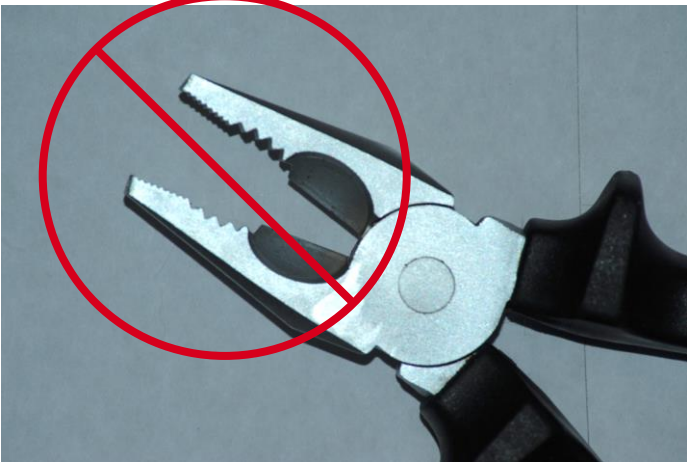
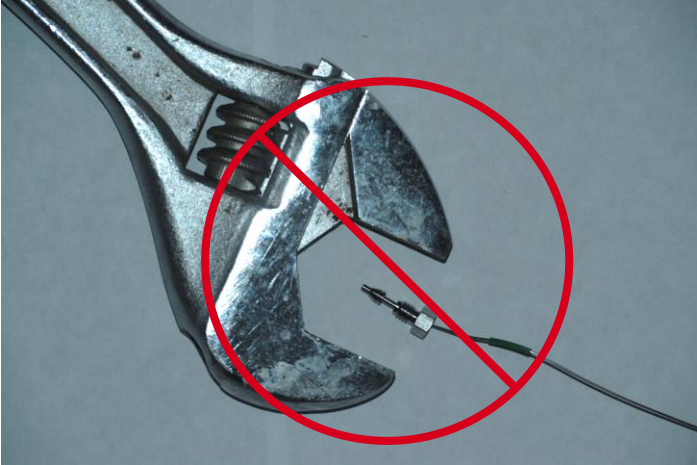
Swaging Fittings



Inspect the Position of the Ferrule



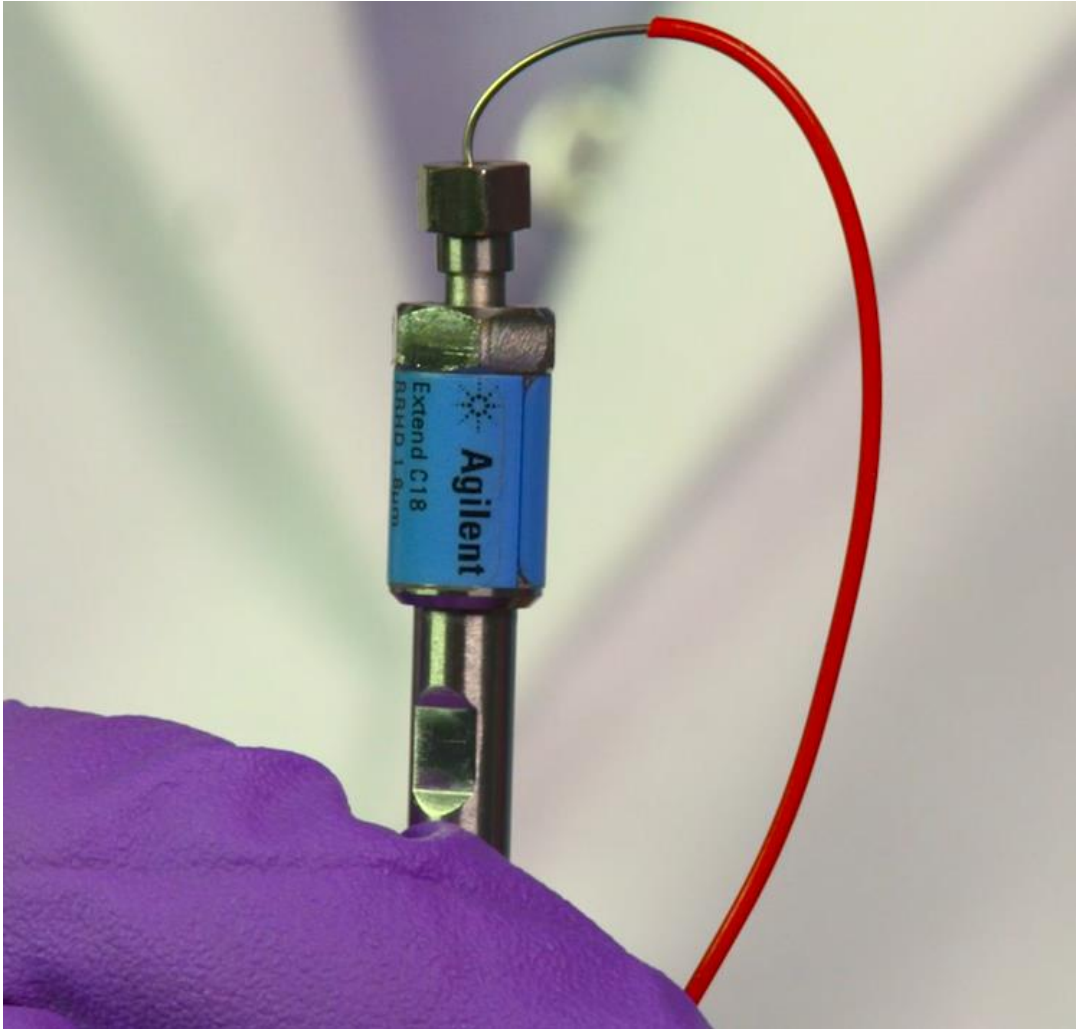
Tools



Tightening Fittings into a Column



Overtightened Fittings



InfinityLab Quick Connect and Quick Turn Fittings

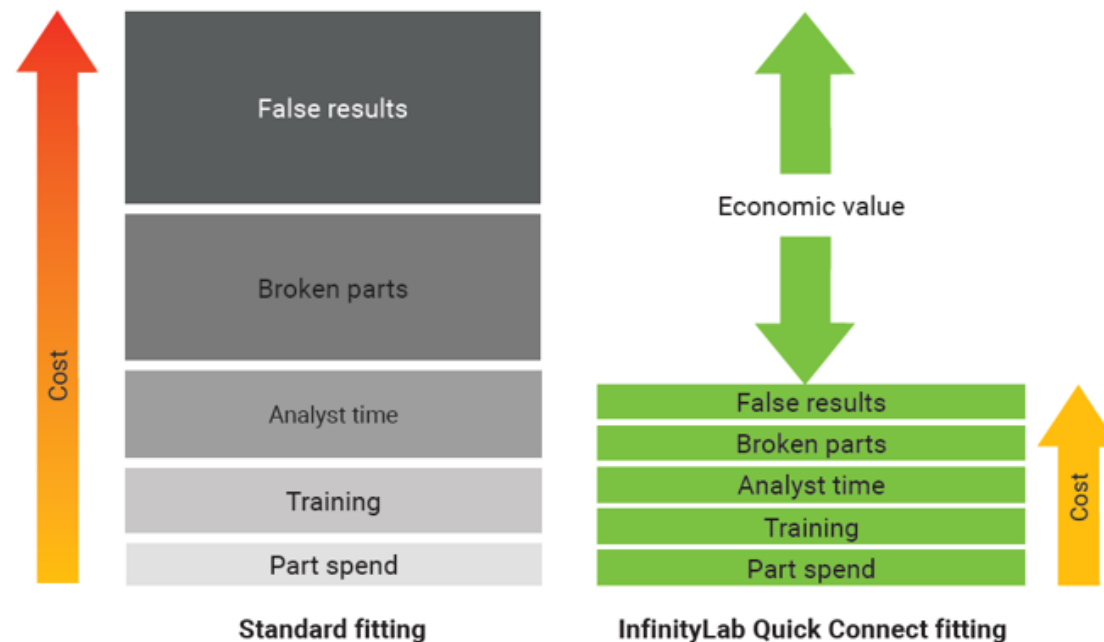


| | Quick Connect fitting | Quick Turn fitting |
|------------------|--|--|
| Connects to | Columns (or inline filters) | Column, Various receiving ports with 10-32 port geometry |
| Maximum pressure | 1300 bar (finger-tight, by turning the lever) | to 400 bar (finger-tight, user dependent) 1300 bar (with mounting tool, 5043-0915) |
| Features | <ul style="list-style-type: none"> • Spring-loaded function for dead volume free connections (special capillaries) • Replaceable ferrule and capillary • Capillaries in various lengths and diameters are available | <ul style="list-style-type: none"> • Spring-loaded function for dead volume free connections • Replaceable ferrule and capillary • Capillaries in various lengths and diameters are available |
| Wetted material | PEEK (ferrule) | PEEK (ferrule) |



Reduce Costs Significantly With Quick Connect and Quick Turn Fittings

- Up to 200 uses compared to only three for traditional fittings
- Less time spent connecting fittings
- Fewer damaged columns
- Reliable chromatographic performance



InfinityLab Quick Connect Fittings

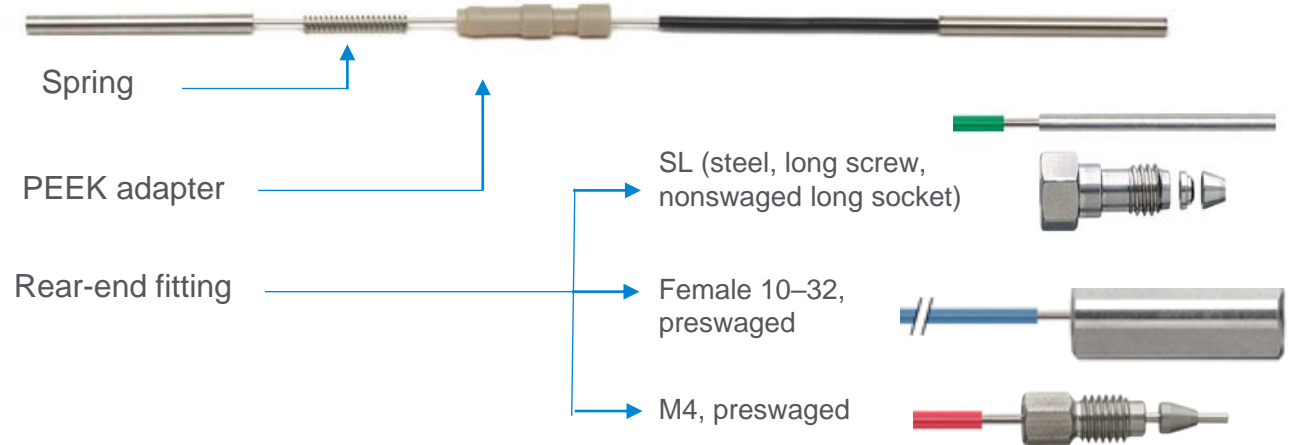
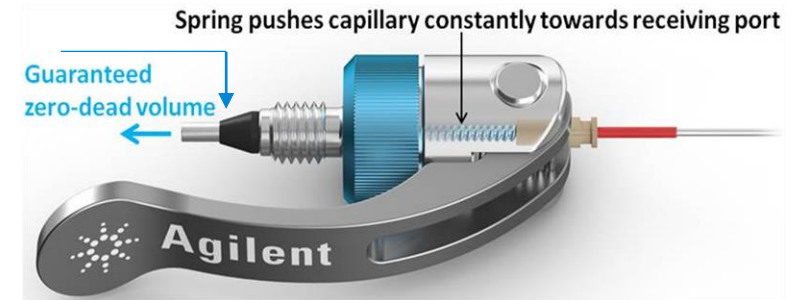
It is important that Quick Connect fittings are only used with capillaries specially designed for them.

Quick Connect assembly

- Quick Connect fitting with premounted Quick Connect capillary

Quick Connect capillary

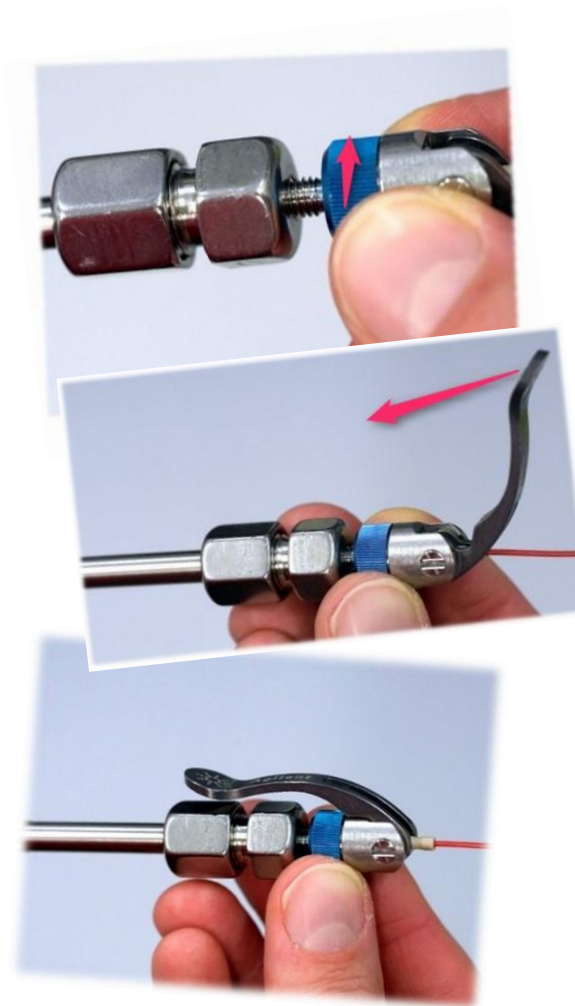
- Available in various combinations (length, id, rear-end fitting)
- Also available as a bio-inert (PEEK/SST) capillary



Quick Connect Fitting

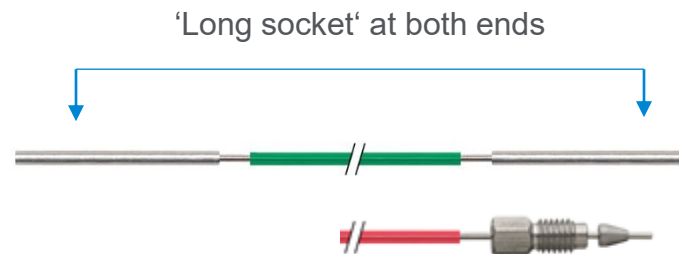
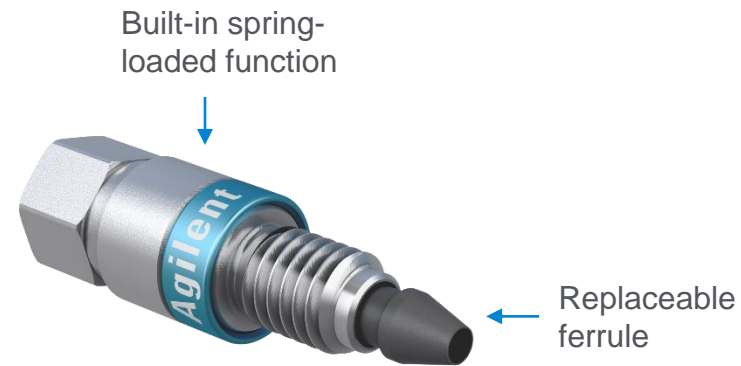
How to use

1. Screw the fitting (blue wheel) with the lever in the 'open' position onto the column.
2. Stop when you can feel the **first resistance** and then close the lever.
3. Finished – in seconds.



Quick Turn Fitting

Component overview



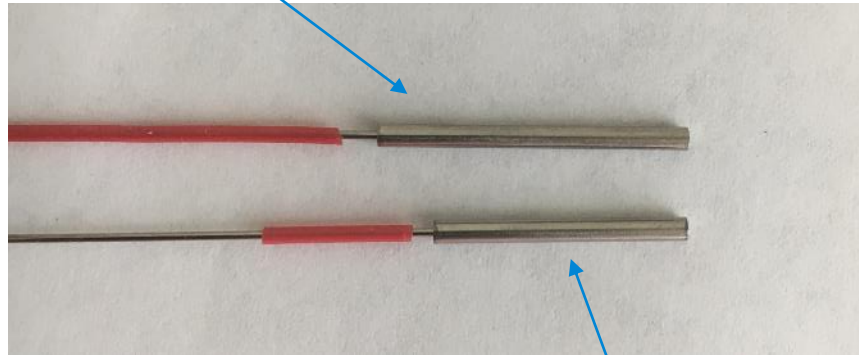
Quick Turn fitting capillary

- Available in various lengths and inside diameters

All capillaries come without any fittings, except the ones with a single preswaged M4 fitting for the opposite end.

Long Socket Capillaries

Long socket for Quick Turn/Quick Connect



Standard capillary

Agilent flexible stainless-steel tubing has a sleeve or “socket” on the ends to bring the od up to the standard 1/16 inch.

Removing the Capillary

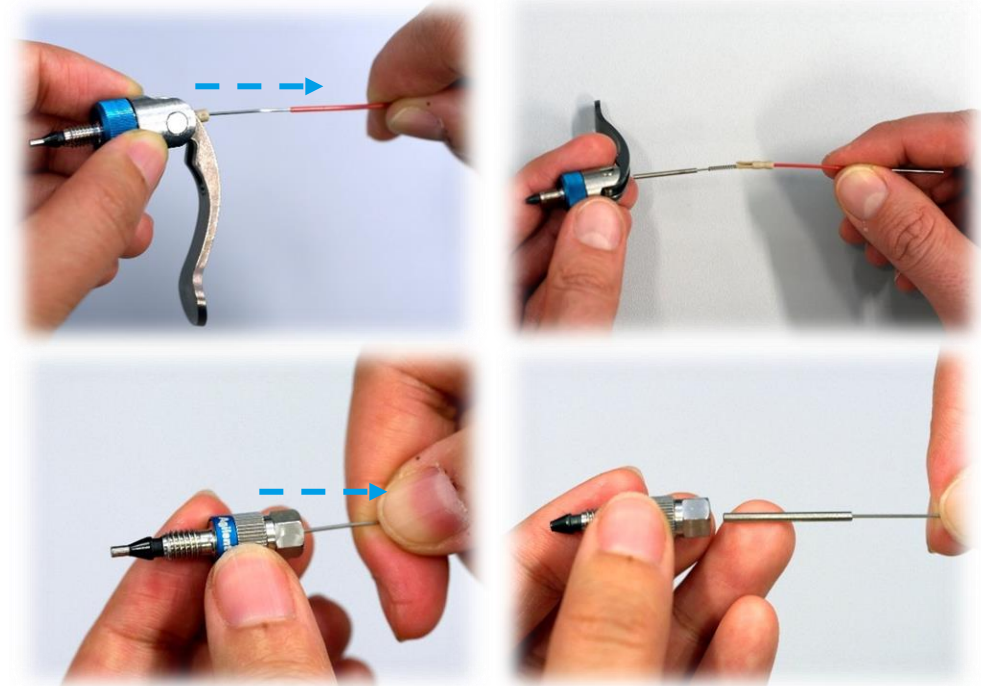
For the Quick Connect fitting:

1. Open the lever
2. Pull the capillary from the fitting

For the Quick Turn fitting:

1. Pull the capillary from the fitting

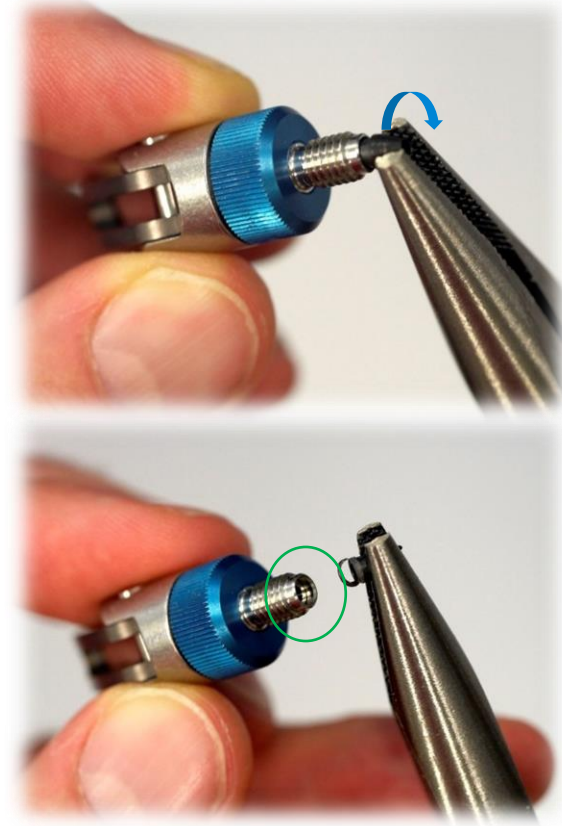
The only part fixing the capillary to the fitting is the brown PEEK adapter. It should be relatively easy to remove the capillary. However, if stronger force is required to remove the capillary, the ferrule is potentially deformed.



Removing the Ferrule

Removing the ferrule requires the same procedure in both Quick Connect and Quick Turn fittings.

1. Uninstall the capillary first and use pliers to twist off the ferrule.
2. Check the fitting for any remaining material and remove it, if necessary, with tweezers before installing the new ferrule.



Installing the Capillary

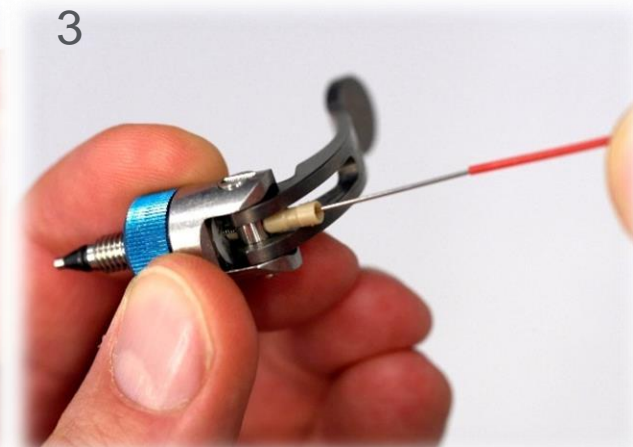
Quick Connect fitting



Insert the Quick Connect capillary into the rear of the Quick Connect fitting. The lever must be in the open position.



Push until the PEEK adapter engages into the bolt holding the lever.

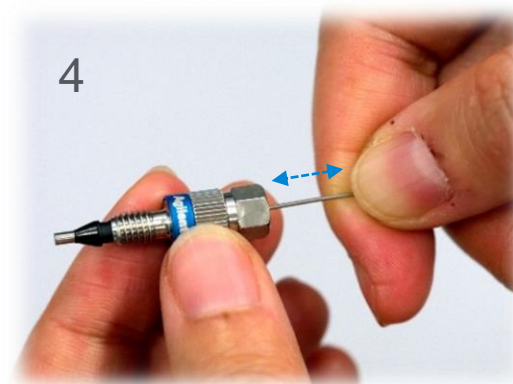
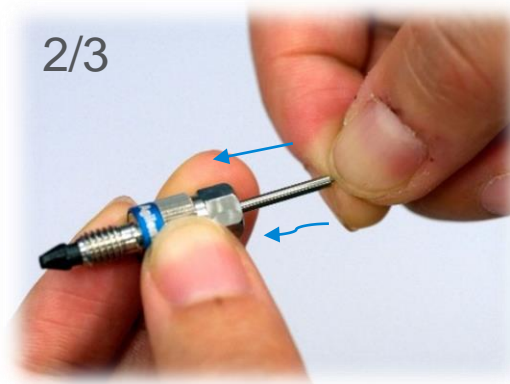
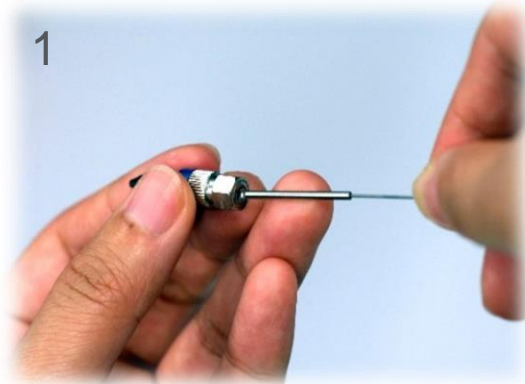


Carefully pull on the capillary to verify it is correctly installed. The PEEK adapter keeps the capillary attached to the fitting, and you can feel the spring-loaded function.

Installing the Capillary

Quick Turn fitting

1. Insert the capillary into the rear of the Quick Turn fitting.
2. During this procedure, the capillary needs to be pushed through the internal clamp ring, which can require a certain amount of force. Careful twisting of both parts against each other can also help to push the capillary through.
3. Continue to push the capillary until the front end is visible (approximately 1 cm without ferrule, 3 mm with ferrule.)
4. Carefully pull on the capillary to verify that the spring-loaded function is engaged.



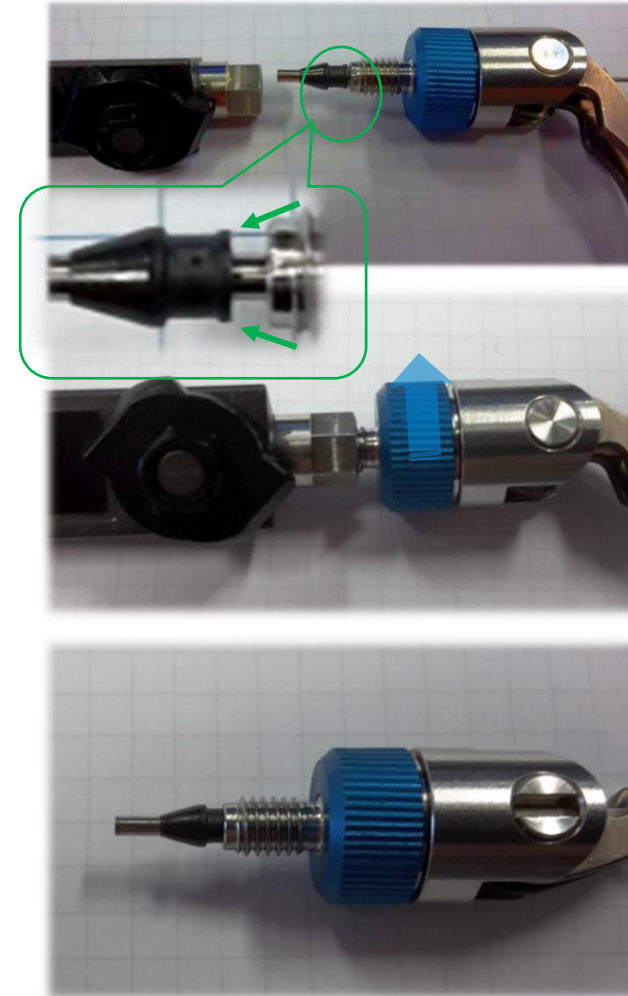
Both procedures for installing the capillary have been shown with the ferrule still installed. However, difficulties can occur during this procedure if the ferrule is squeezed. Check the ferrule for issues first, and replace if necessary.

Installing the Ferrule

This procedure is applicable for both Quick Connect and Quick Turn fittings.

A capillary needs to be installed before installing the ferrule (part number 5043-0924).

1. Slide the ferrule over the tip of the capillary
2. Screw the fitting into a port until it is just finger-tight (column, union, heat exchanger)



Connecting Capillaries for LC Modules

Solvent cabinet

Degasser

Pump

Autosampler

Column compartment

Detector



Classic Infinity

Solvent cabinet

Detector

Column compartment

Autosampler

Pump/degasser



Infinity II

Dispersion Reduces HPLC Performance

What is dispersion?

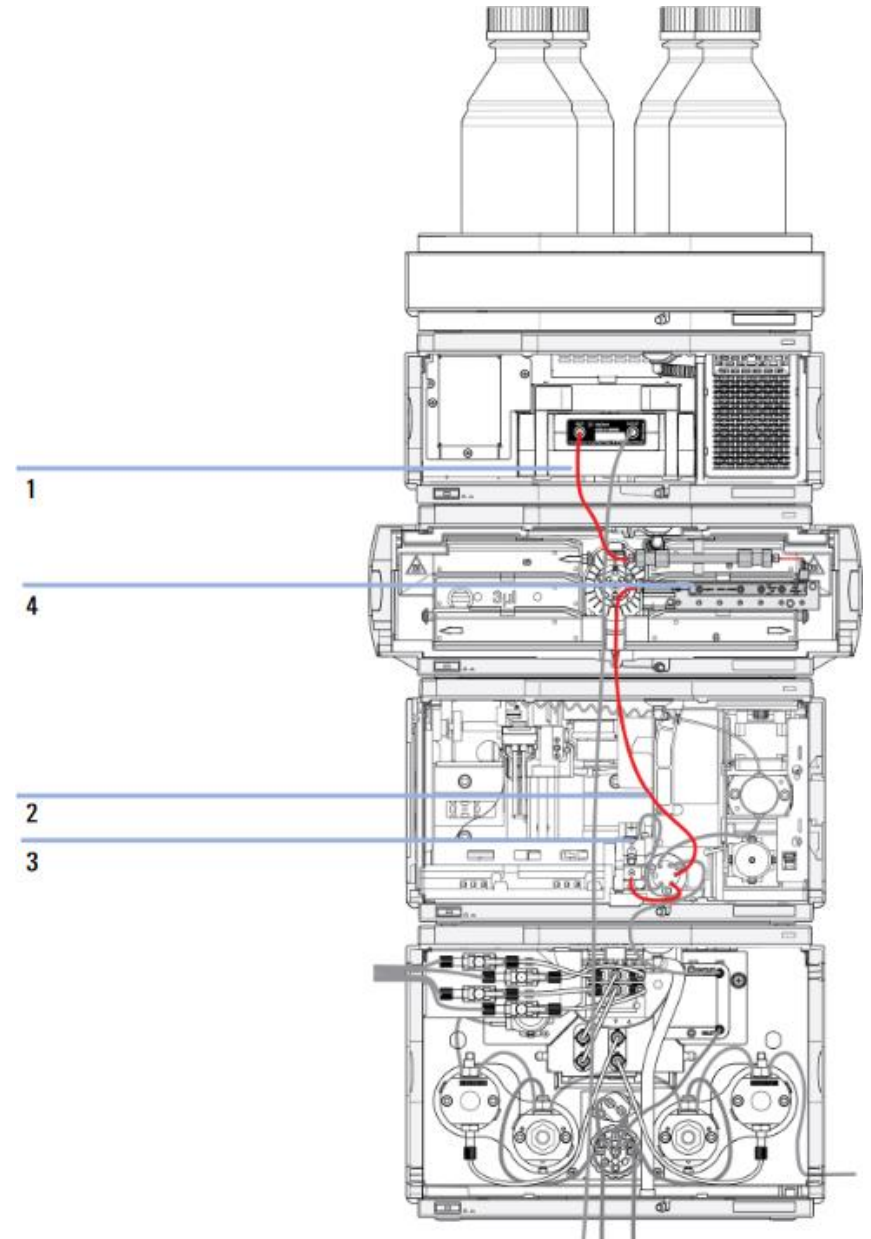
- It is the original sample concentration being diluted as it is carried through the system plumbing (extra-column volume)

What increases dispersion?

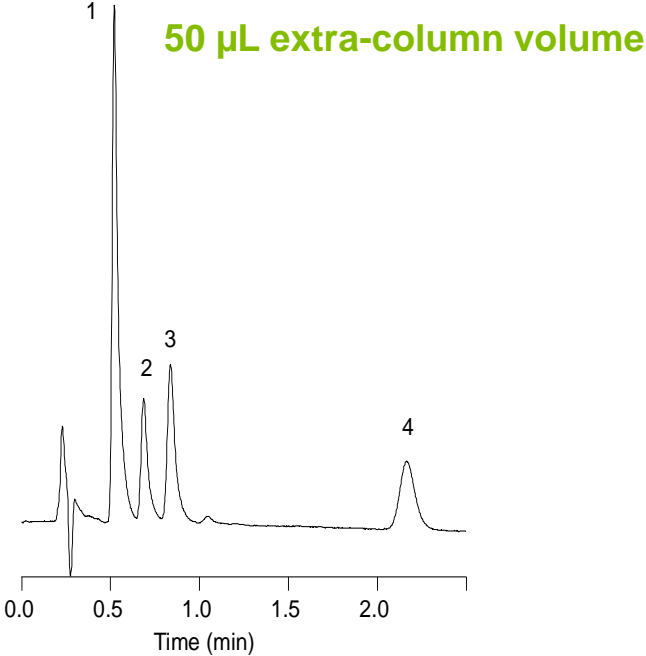
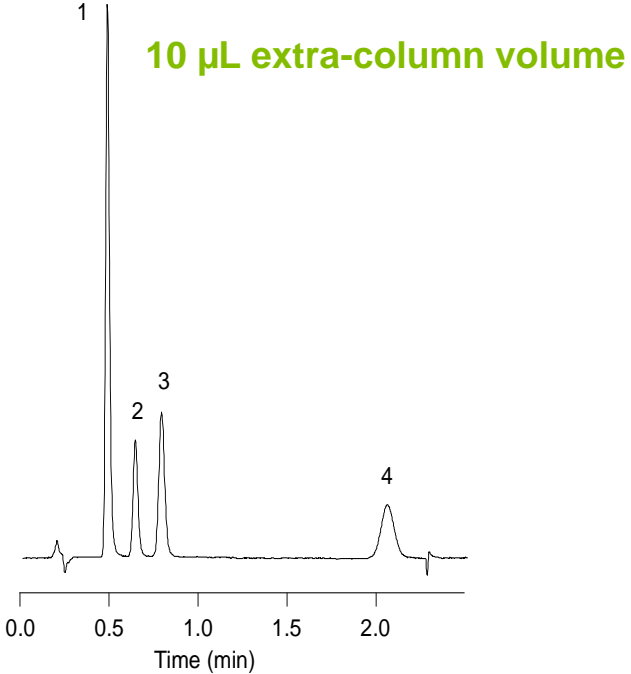
- Connecting tubing that is too long
- Connecting tubing that is too large in diameter
- Connections that have gaps and form small mixing chambers

Extra-Column Volume

- Flow cell
- Heat exchanger
- Switching valve
- Needle seat
- Connecting capillaries



Extra-Column Volume



Column: StableBond SB-C18, 4.6 x 30 mm, 3.5 µm
Temperature: 35 °C Sample: 1. Phenylalanine

Mobile phase: 85% H₂O with 0.1% TFA: 15% ACN Flow rate: 1.0 mL/min
2. 5-benzyl-3,6-dioxo-2-piperazine acetic acid 3. Asp-Phe 4. Aspartame

Aris-Taylor Equation

Peak dispersion in cylindrical tubing

$$\sigma_{v,\text{ext}}^2 = \frac{\pi d^4 L_{cap} u}{96D_m}$$

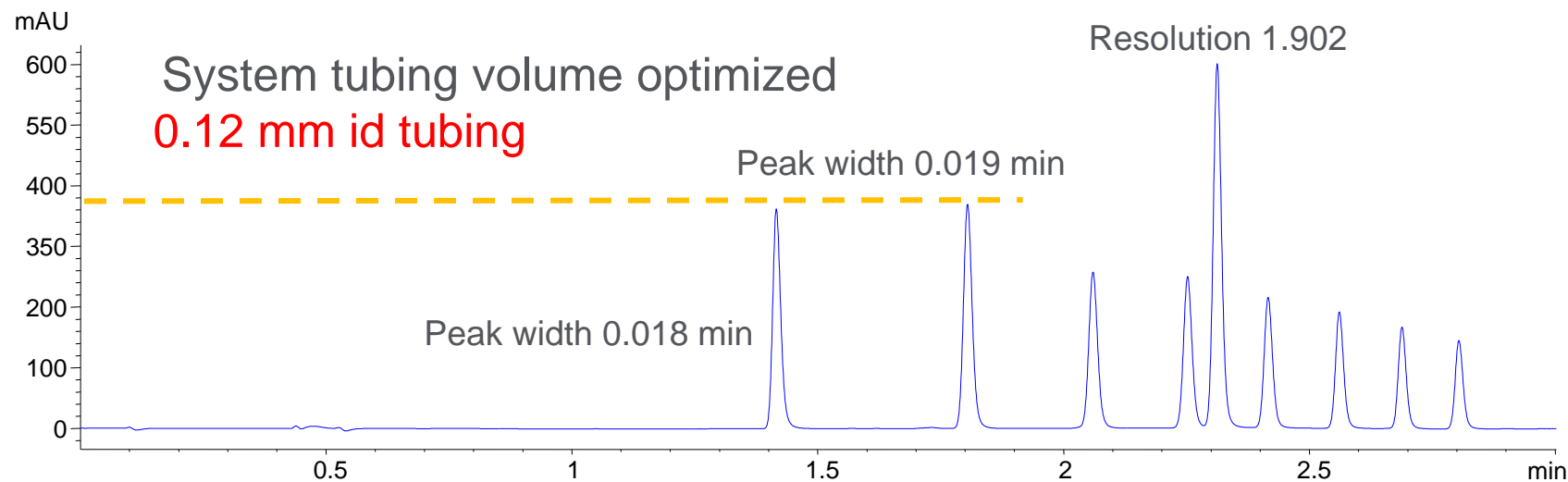
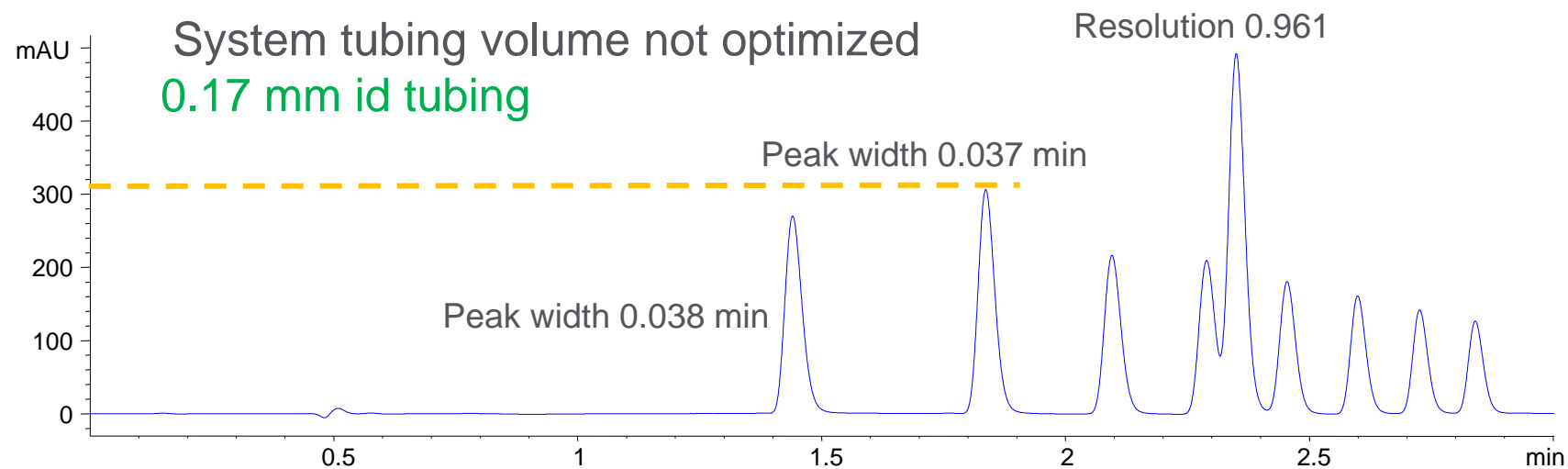
- $\sigma_{v,\text{ext}}^2$ is the volume variance
d is the tubing diameter
L is the tubing length
u is the linear velocity of the liquid
 D_m is the molecular diffusion coefficient

Tubing Volume

| Tubing Length | 10 mm | 50 mm | 100 mm | 150 mm |
|-----------------|---------------|--------------|--------------|--------------|
| Tubing id | Volume | Volume | Volume | Volume |
| 0.17 mm (green) | 0.227 μ L | 1.1 μ L | 2.27 μ L | 3.3 μ L |
| 0.12 mm (red) | 0.113 μ L | 0.55 μ L | 1.13 μ L | 1.65 μ L |



Optimizing Connecting Tubing Volume for UHPLC Columns



1100/1200/1260 Series System

| Connection | p/n | Description |
|---|----------------------------|--|
| Solvent bottle to vacuum degasser | G1311-60003 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| Degasser to pump | G1322-67300 | Tubing kit degasser, 300 mm tubing, 4/pk |
| Pump to autosampler | G1312-87303 | Capillary, 0.17 mm x 400 mm |
| Pump (purge valve) to waste | 5062-2461 | PTFE tube, 5000 mm |
| Autosampler to column compartment | G1313-87305 G1313-87304 | Capillary, 0.17 mm x 180 mm Capillary, 0.12 mm x 180 mm |
| Thermostatted ALS to column compartment | 01090-87309 01090-87610 | Capillary, 0.17 mm x 380 mm Capillary, 0.12 mm x 280 mm |
| Column compartment to column | G1316-87300 01090-87611 | Capillary, 0.17 mm x 90 mm Capillary, 0.12 mm x 105 mm |
| Column to VWD (std flow cell) | 5062-8522 | Inlet tubing assembly PEEK, 0.17 mm 600 mm |
| Column to DAD/MWD | G1315-87311 G1315-87312 | Capillary, 0.17 mm x 380 mm (S/S, ps/ns) Capillary, 0.12 mm x 150 mm |
| VWD to waste | 5062-8535 | Waste accessory kit |
| DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |

| | |
|------------------------|---------------------------|
| 0.17 mm id capillaries | Standard setup |
| 0.12 mm id capillaries | Rapid Resolution LC setup |

Solvent cabinet

Vacuum degasser

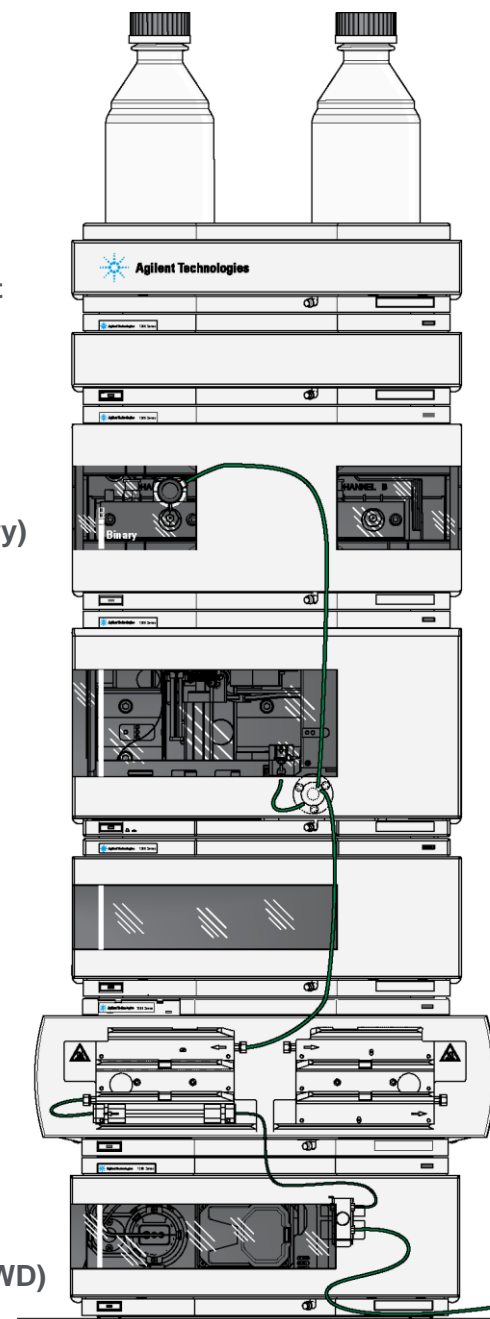
Pump (Iso/Quat/Binary)

Auto-Sampler

Sampler-Thermostat

Column-Compartment

UV-Detector (DAD/MWD/VWD)

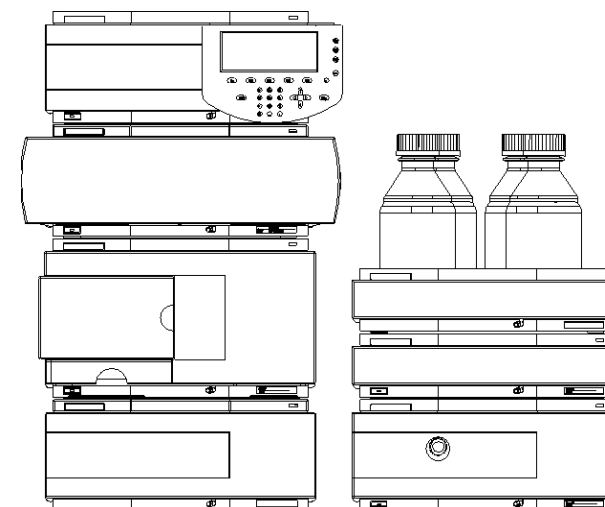


1100/1200/1260 Infinity Series System

Dual – stack configuration with cooled ALS

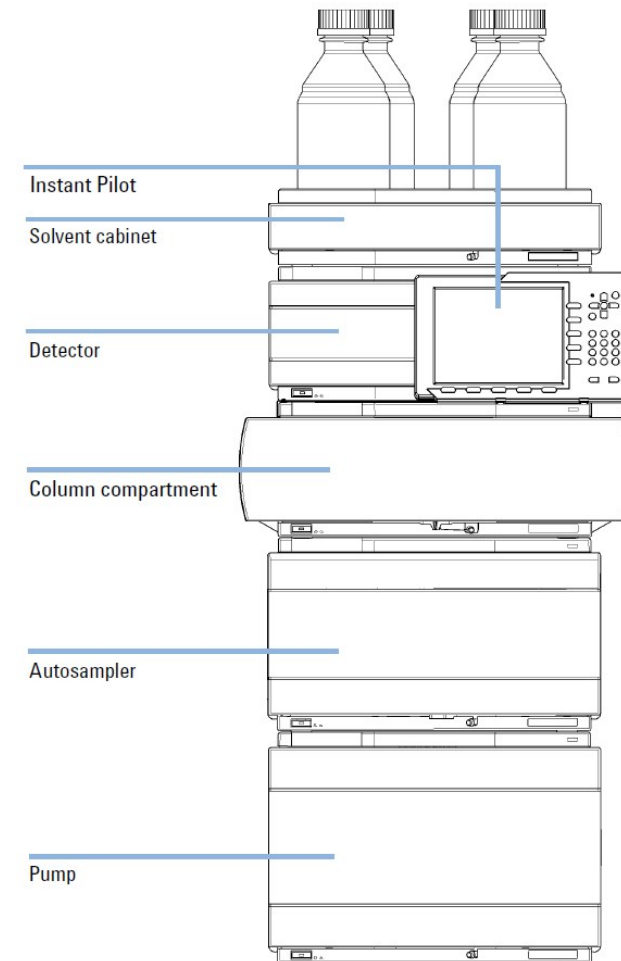
| Connection | p/n | Description |
|---|----------------------------|--|
| Solvent bottle to vacuum degasser | G1311-60003 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| Degasser to pump | G1322-67300 | Tubing kit degasser, 300 mm tubing, 4/pk |
| Pump to autosampler | G1312-87304 | Capillary, 0.17 mm x 700 mm |
| Pump (purge valve) to waste | 5062-2461 | PTFE tube, 5000 mm |
| Thermostatted ALS to column compartment | 01090-87309 01090-87610 | Capillary, 0.17 mm x 380 mm Capillary, 0.12 mm x 280 mm |
| Column compartment to column | G1316-87300 01090-87611 | Capillary, 0.17 mm x 90 mm Capillary, 0.12 mm x 105 mm |
| Column to VWD (std flow cell) | 5062-8522 | Inlet tubing assembly PEEK, 0.17 mm 600 mm |
| Column to DAD/MWD | G1315-87311 G1315-87312 | Capillary, 0.17 mm x 380 mm Capillary, 0.12 mm x 150 mm |
| VWD to waste | 5062-8535 | Waste accessory kit |
| DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |

| | |
|------------------------|---------------------------|
| 0.17 mm id capillaries | Standard setup |
| 0.12 mm id capillaries | Rapid Resolution LC setup |



1290 Infinity Series System

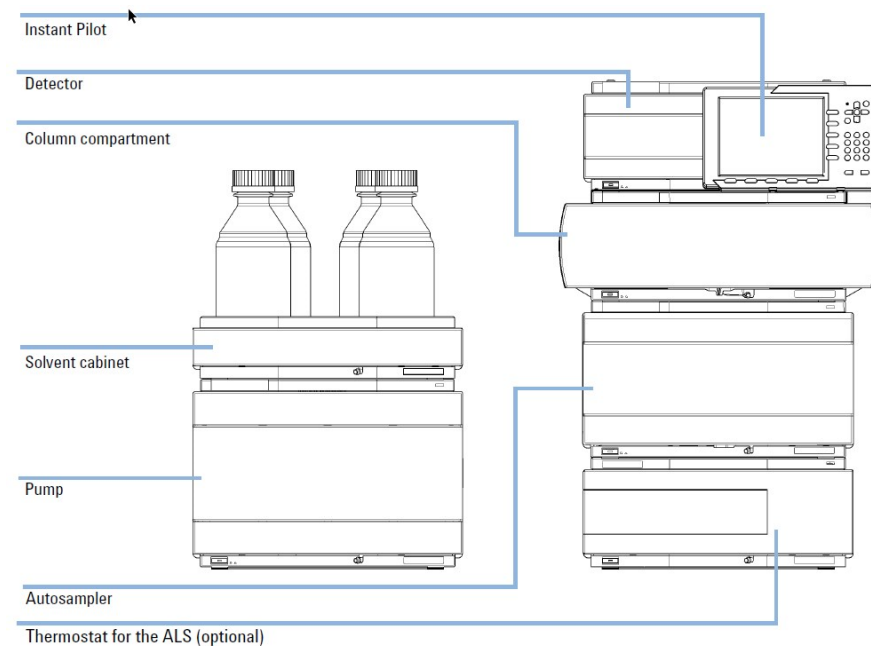
| Connection | p/n | Description |
|-----------------------------------|-------------|---|
| Solvent bottle to pump | G7120-60007 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| Pump to autosampler | 5067-4657 | Capillary, 0.17 mm x 300 mm |
| Autosampler to column compartment | 5067-4659 | Capillary, 0.12 mm x 340 mm |
| Column compartment to column | 5500-1188 | Capillary, 0.12 mm x 105 mm (capillary comes without fittings, use Quick Turn Fittings or stainless steel fittings) |
| Column to DAD | 5067-4660 | Capillary, 0.12 mm x 280 mm |
| DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |



1290 Infinity Series System

Dual – stack configuration with cooled ALS

| Connection | p/n | Description |
|---|-------------|---|
| Solvent bottle to vacuum degasser | G7120-60007 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| Pump to autosampler | 5500-1217 | Capillary, 0.17 mm x 900 mm |
| Autosampler to column compartment | 5067-4659 | Capillary, 0.12 mm x 340 mm |
| Column compartment to column (low dispersion heat exchanger double) | 5500-1188 | Capillary, 0.12 mm x 105 mm (capillary comes without fittings, use Quick Turn Fittings or stainless steel fittings) |
| Column to DAD | 5067-4660 | Capillary, 0.12 mm x 280 mm |
| DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |



1260/1290 Infinity II Series System

Single stack with multisampler and MCT

S



| Connection | p/n | Description |
|------------------------|-------------|--|
| Solvent bottle to pump | G7120-60007 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |

SI



| | | |
|----------------------|-----------|--|
| Pump to multisampler | 5500-1246 | Capillary, 0.17 mm x 500 mm (SI/SI, ps/ps) |
|----------------------|-----------|--|

SL



| | | |
|---------------------|-----------|---|
| Multisampler to MCT | 5500-1157 | Capillary, 0.12 mm x 500 mm, (SI/SI, ps/ns) |
|---------------------|-----------|---|

SX



| | | |
|--------------------------|-----------|---|
| Heat exchanger to column | 5067-5957 | Quick Connect assembly 0.12 mm x 105 mm |
|--------------------------|-----------|---|

M4



| | | |
|---------------|-----------|--|
| Column to DAD | 5500-1173 | Quick Connect capillary 0.12 mm x 105 mm |
| | 5067-5965 | Quick Connect fitting |
| Column to DAD | 5500-1191 | Quick Turn capillary, 0.12 mm x 280 mm (comes without fitting) |
| | 5067-5966 | Quick Turn fitting |

| | | |
|--------------|-----------|---------------------------------------|
| DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |
|--------------|-----------|---------------------------------------|

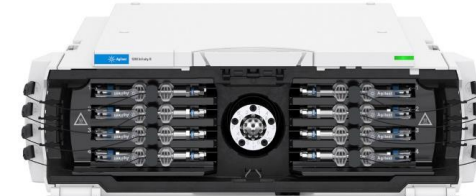
Solvent cabinet



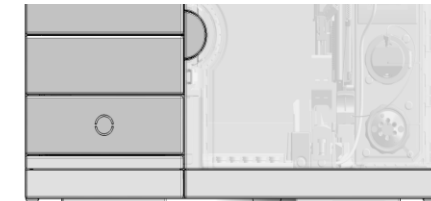
DAD



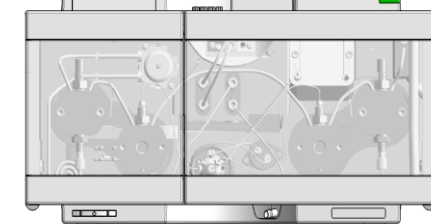
Multi column thermostat (MCT)



Multisampler



Pump (flex/high speed)



1260 Infinity II Series System

Single stack with vialsampler and internal column compartment

| | Connection | p/n | Description |
|----|--------------------------------|-------------|--|
| | Solvent bottle to pump | G7120-60007 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| S | Pump to vialsampler | 5500-1217 | Capillary, 0.17 mm x 900 mm (SI/SX, ps/ps) |
| SI | Sampler to 3 µL heat exchanger | 5500-1249 | Capillary, 0.12 mm x 120 mm, (SL/SL, ps,ns) |
| SL | 6 µL heat exchanger | 5500-1250 | Capillary, 0.17 mm x 120 mm (SL/SL, ps,ns) |
| SL | Heat exchanger to column | | |
| SX | 3 µL heat exchanger | 5500-1238 | Capillary, 0.12 mm x 105 mm (SL/SL, ps,ps) |
| M4 | 6 µL heat exchanger | 5500-1240 | Capillary, 0.17 mm x 105 mm (SL/SL, ps,ps) |
| | Column to DAD | 5500-1191 | Quick Turn capillary, 0.12 mm x 280 mm (comes without fitting) |
| | DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |

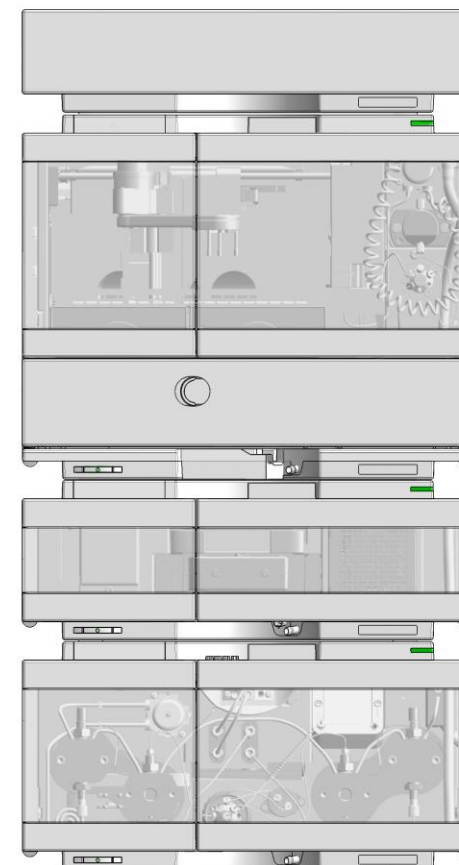
Solvent cabinet

Vial-sampler

Internal column-compartment (ICC)

UV-detector (DAD/MWD/VWD)

Pump (quat/binary)



1260/1290 Infinity II Series System

Single stack with vialsampler and multi column thermostat

| | Connection | p/n | Description |
|----|---------------------------|-------------|--|
| | Solvent bottle to pump | G7120-60007 | Bottle head assembly for screw bottle (GL45), with glass filter 20 µm, (5041-2168) |
| S | Pump to vialsampler | 5500-1245 | Capillary, 0.17 mm x 400 mm (SI/SX, ps/ps) |
| SI | Sampler to heat exchanger | 5500-1157 | Capillary, 0.12 mm x 500 mm, (SL/SL, ps,ns) |
| SL | Heat exchanger to column | 5067-5957 | Quick Connect assembly 0.12 mm x 105 mm |
| SX | | 5500-1173 | Quick Connect capillary 0.12 mm x 105 mm |
| | | 5067-5965 | Quick Connect fitting |
| M4 | Column to DAD | 5500-1191 | Quick Turn capillary, 0.12 mm x 280 mm (comes without fitting) |
| | | 5067-5966 | InfinityLab Quick Turn fitting |
| | DAD to waste | 5062-2462 | PTFE tubing 0.7 mm id, 1.6 mm od, 5 m |

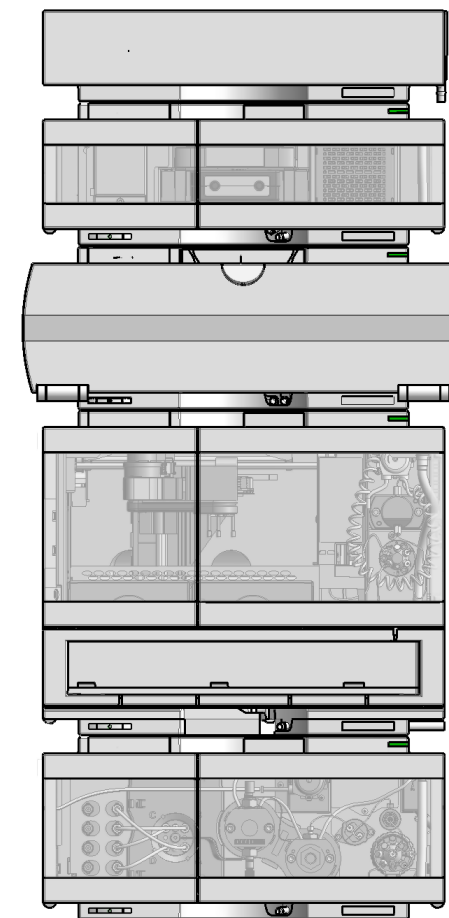
Solvent cabinet

UV-detector (DAD/MWD/VWD)

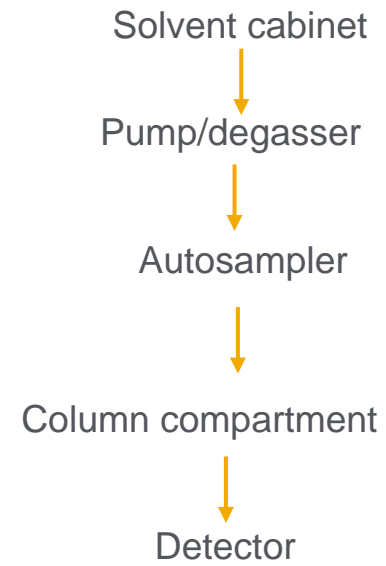
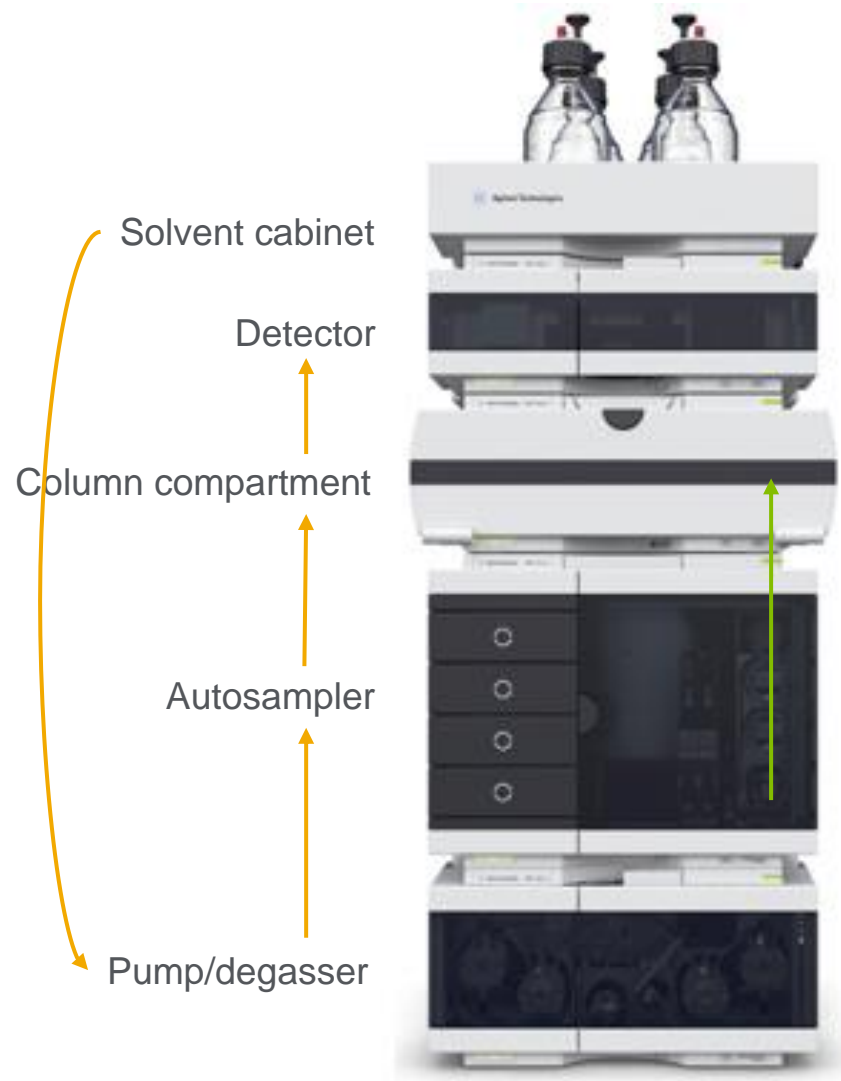
Multi column-compartment

Vialsampler

Pump (flex/high speed)

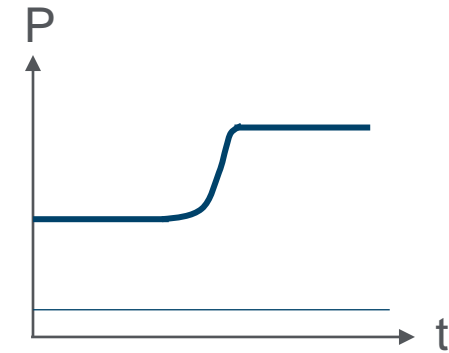


InfinityLab Flex Benches

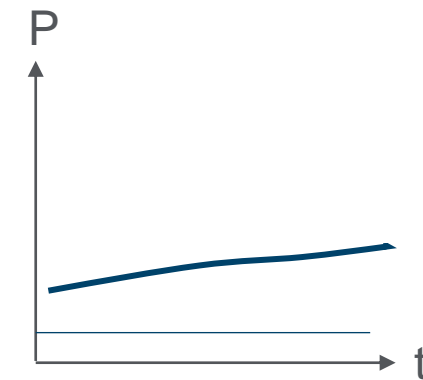


Blockages and Clogging

| Characteristics | |
|--------------------------|--|
| Parts affected | <p>Blockages:</p> <ul style="list-style-type: none"> • Capillaries, needle, and needle seat • Detector flow cells <p>Clogging:</p> <ul style="list-style-type: none"> • Filter frits (inline filter, column filter) |
| Characteristic | ● |
| Identification | <ul style="list-style-type: none"> • Start by disconnecting the capillary at the column inlet • Install test setup with restriction capillary • Continue disconnecting capillaries, one-by-one, moving back toward the pump |
| Possible root cause | <ul style="list-style-type: none"> • Debris from mechanically worn parts (needle seat material, rotor seal at injection valve) • Coring of vial septa material |
| Instant action/first aid | <ul style="list-style-type: none"> • Backflush affected part • Replace part |
| Preventive measures | <ul style="list-style-type: none"> • Replace wear parts in time; apply proper preventive maintenance schedules • Use high quality septa • Install inline filters |



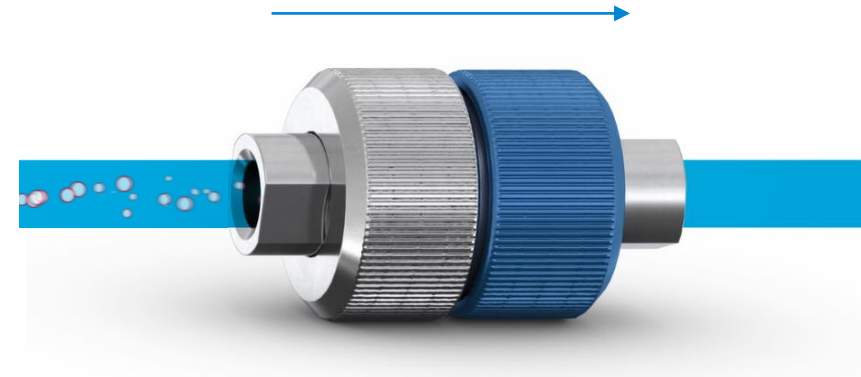
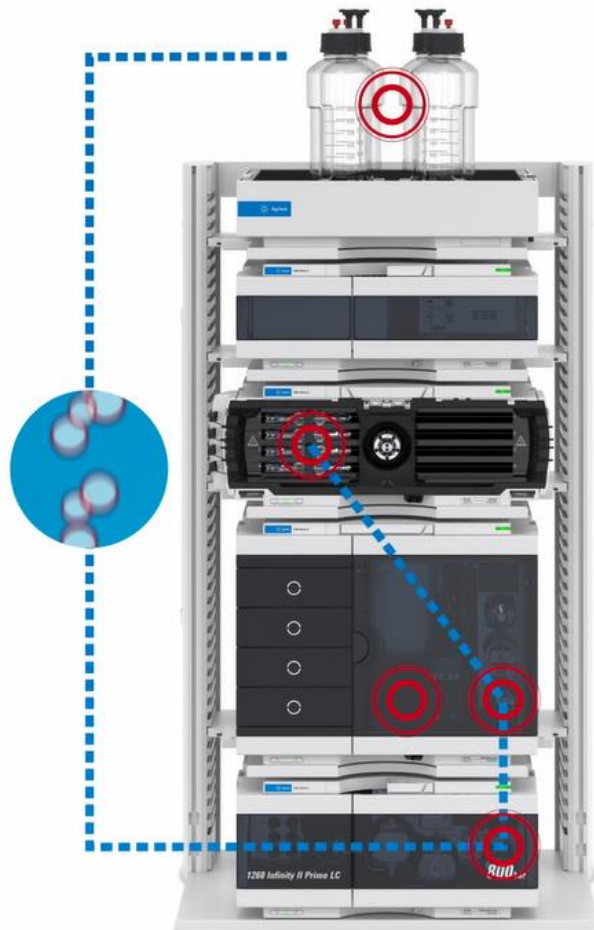
Blockages: instant pressure increase step



Clogging: constant pressure increase over time

Why Use an Inline Filter?

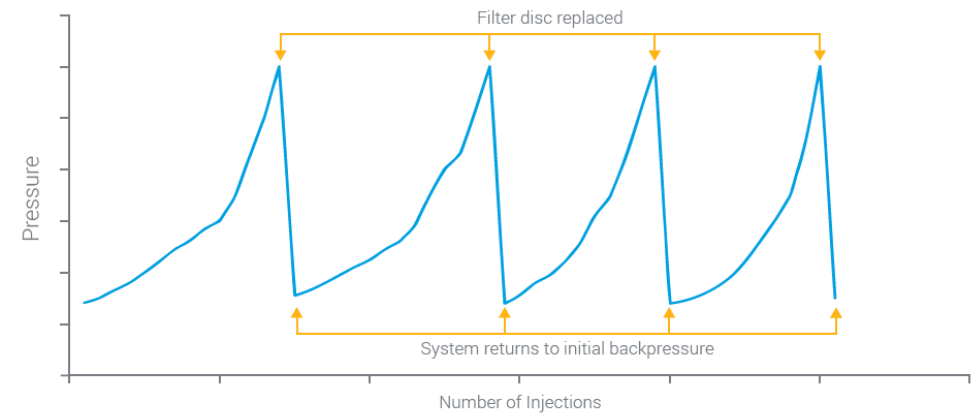
Particles lead to blockage



Filter particles to prevent column clogging



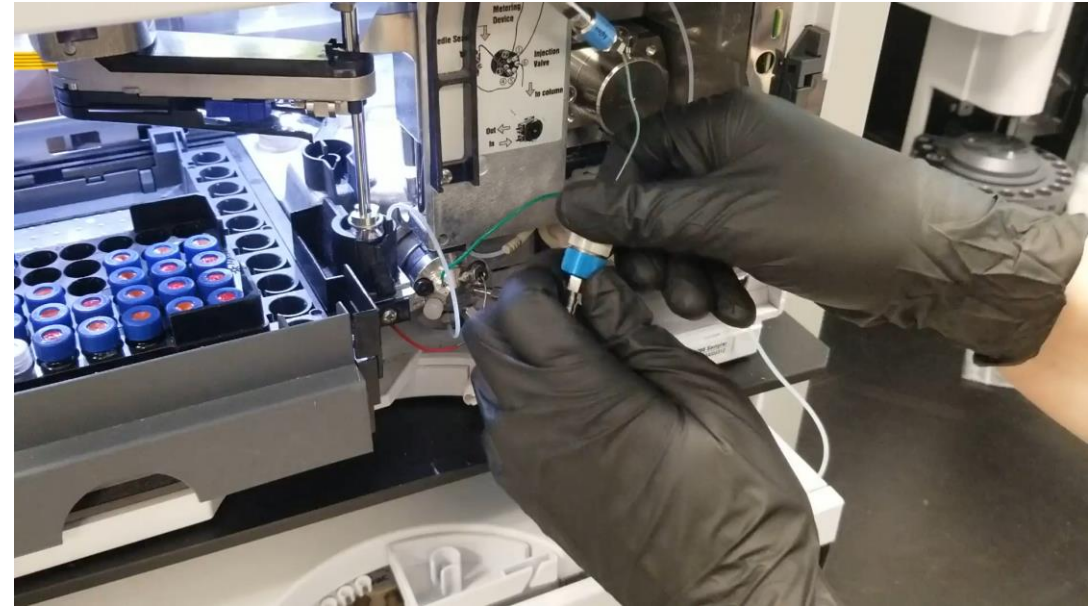
Extend column lifetime and reduce cost per sample



Accelerated lifetime test shows how inline filter removes particles

InfinityLab Quick Change Inline Filter

From



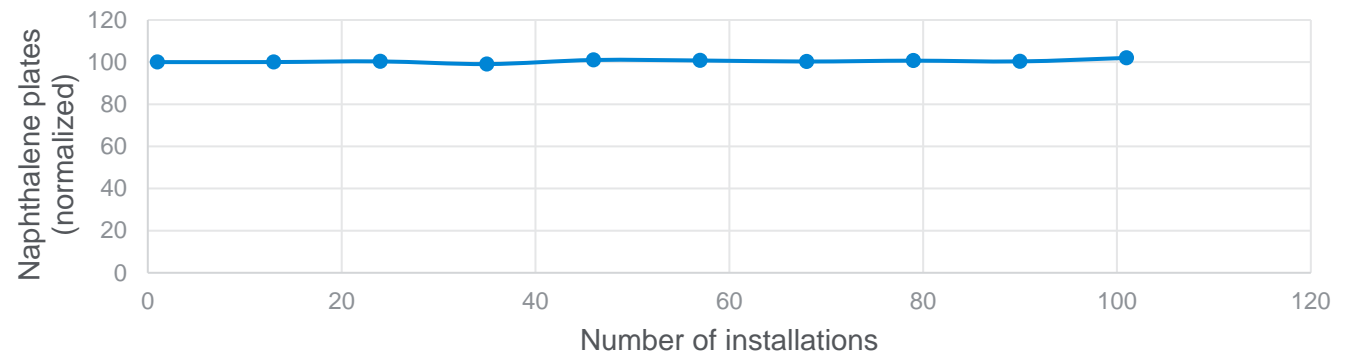
Ultimate ease-of-use

- **Finger-tight, tool-free** replacement of filter disc
- **Click and seal:** a click alerts users when the filter is tight up to 1300 bar, assuring no risk of over- or under-tightening

Robustness for low operational cost

Robust filter housing enables **over 100 replacements** of filter discs without any damage

Plate counts over x100 installations of filter discs into one filter housing



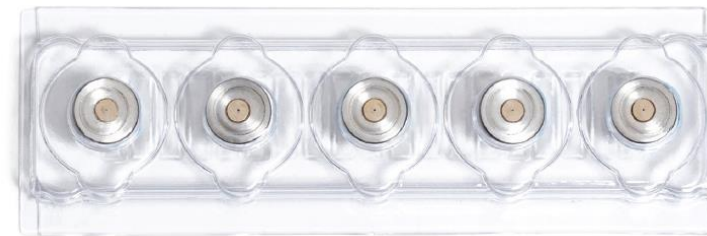
InfinityLab Quick Change Inline Filter – Filter Discs

High efficiency, easy-to-use filter discs

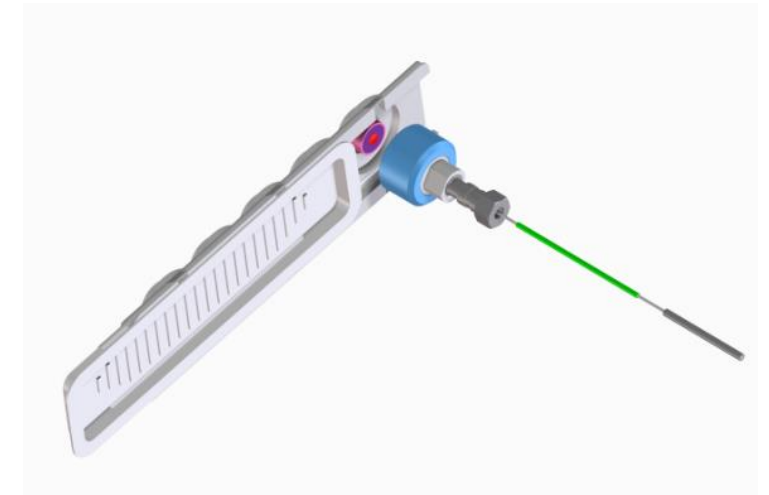
- **Various dimensions and porosities** - filter discs are available in 2.1 mm and 4.6 mm inner diameters with different pore sizes. The filter housing is compatible with all types of filter discs.
- **Touchless packaging to avoid potential contamination** – with specially designed packaging, you're able to insert the filter disc into the filter housing without touching it to avoid potential contamination.
- **In-situ replacement** of filter disc - no need to disconnect the inline filter from the system
- **Smart alert** to remind users when filter discs need replacing (available from May 2021)



Different dimensions and porosities of filter discs



Filter discs in touchless packaging

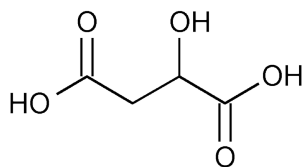


No-touch insertion of filter disc into filter housing

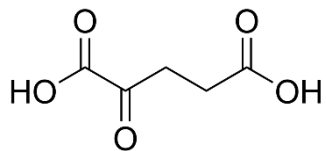
Passivation and Inert Hardware

- Steel has active sites that bind to certain classes of polar molecules
- **Most active molecules:**
 - Phosphorylated metabolites
 - Organophosphates and phosphonic acids
 - Di- and tricarboxylic acids and similar chelating acids
- **Commonly seen in:**
 - Pesticide analysis (glyphosate, AMPA, glufosinate)
 - Fermentation (citric acid cycle, organic acids)
 - Metabolomics (nucleotides, sugar phosphates, citric acid cycle)

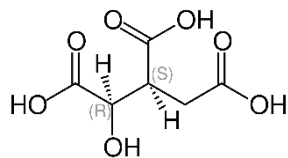
Chelating organic acids



Malic acid

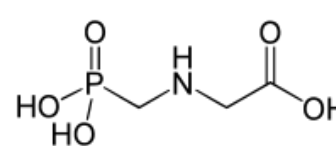


Alpha-ketoglutaric acid

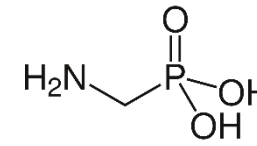


Isocitric acid

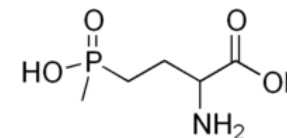
Organophosphates



Glyphosate

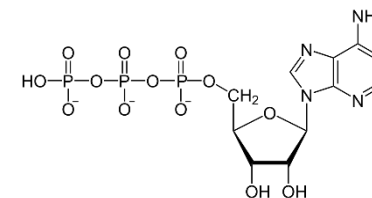


Aminomethylphosphonic acid (AMPA)

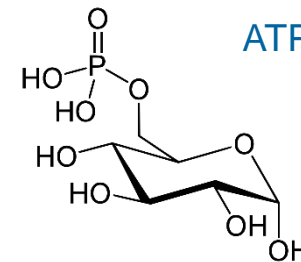


Glufosinate

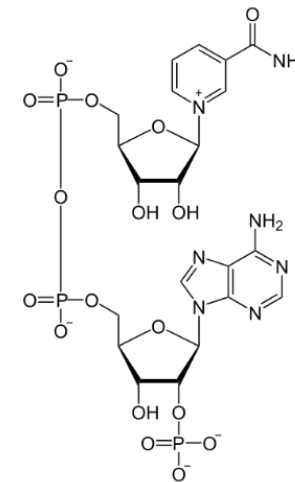
Phosphorylated metabolites



ATP



Glucose phosphates



NADP

Eliminating Sticking with Wash Step and Deactivator Additive

Example analysis conditions

Column: InfinityLab Poroshell 120 HILIC-Z, 2.1 x 50 mm (p/n: 689775-924)

Temperature = 30 °C

Injection volume = 1 µL

Flow rate = 0.25 mL/min

Mobile phase

A = 10 mM ammonium acetate in water at pH 9 + 5 µM deactivator additive

B = 10% 100 mM ammonium acetate in water at pH 9 + 90% acetonitrile + 5 µM deactivator additive

Total ionic strength – 10 mM for both mobile phases

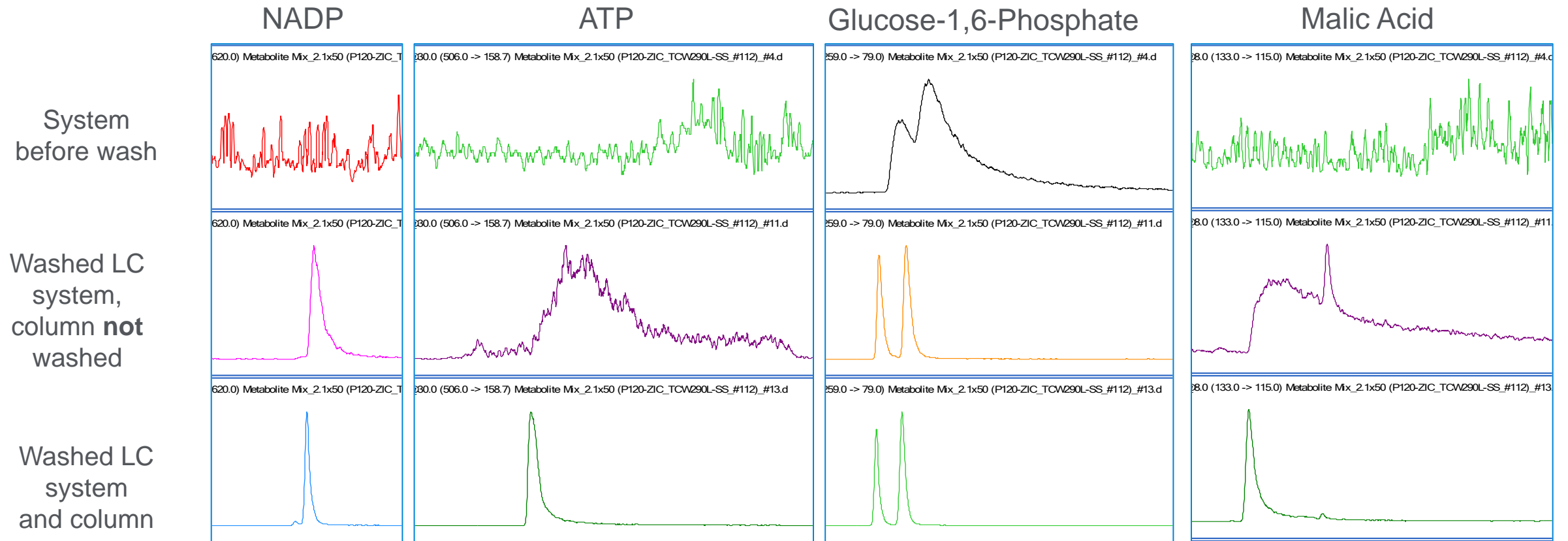
Deactivator additive: 5191-3940

| Time (min) | Percentage A | Percentage B |
|------------|--------------|--------------|
| 0 | 10 | 90 |
| 2 | 10 | 90 |
| 12 | 40 | 60 |
| 13 | 10 | 90 |
| 21 | 10 | 90 |

Wash procedure

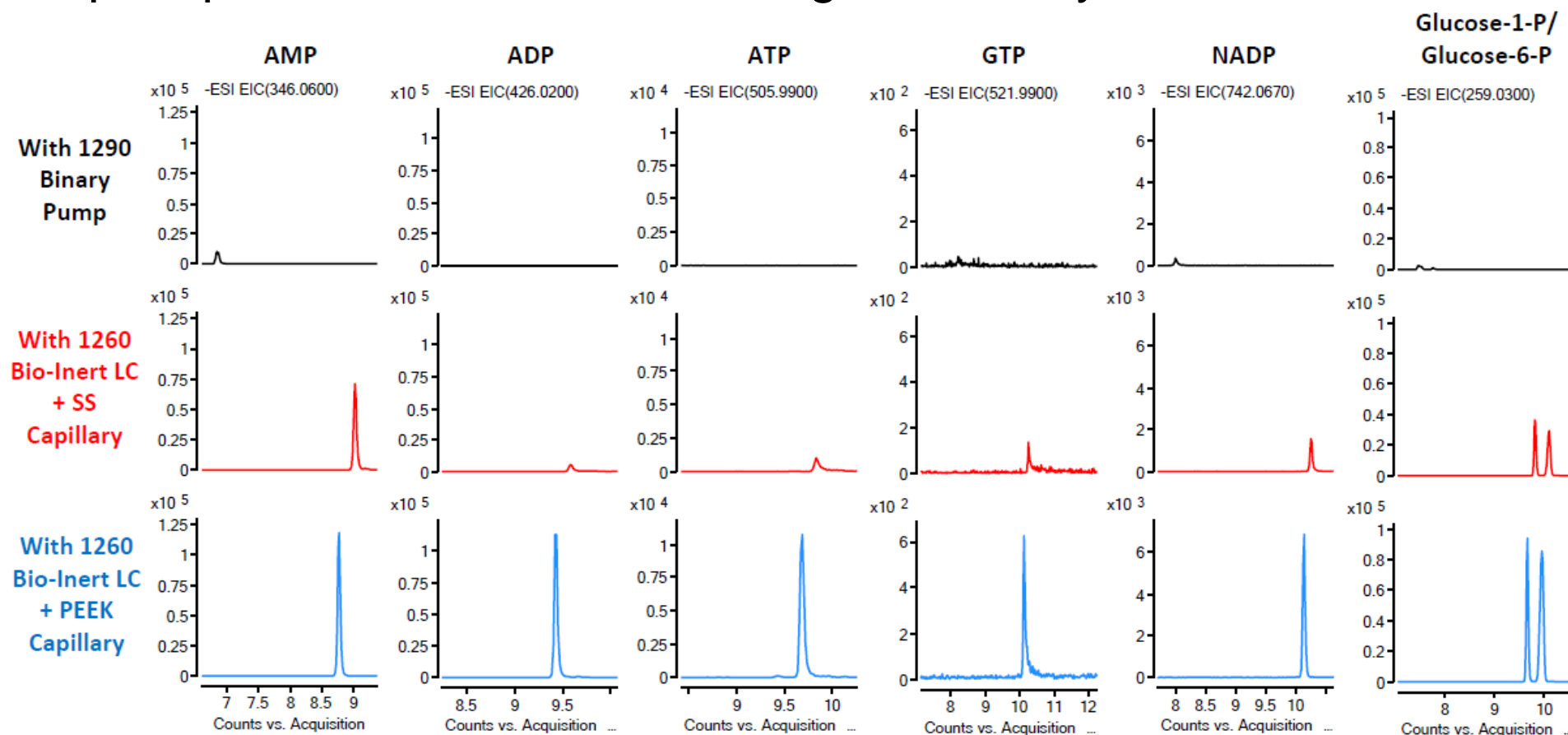
1. LC disconnected from MS and going directly to waste
2. IPA at 5 mL/min for 5 min
3. Water at 5 mL/min for 5 min
 - Flow at 0.5 mL/min for 1 hour
4. 0.5% phosphoric acid in 90% acetonitrile/10% water at 5 mL/min for 5 min
 - Flow at 0.1 mL/min overnight (at a minimum)
5. Water at 5 mL/min for 5 min
 - Flow at 0.5 mL/min for 1 hour
6. Mobile phase at 5 mL/min for 5 min
 - Flow at 0.25 mL/min for 1 hour
7. Reconnect LC to MS and proceed with analysis
 - Flow at 0.25 mL/min for 20 to 30 min

Improvements in Signal and Peak Shape



HILIC/MS Sensitivity with Bio-Inert LC

Nucleotide phosphates on a PEEK-lined Agilent InfinityLab Poroshell 120 HILIC-Z



The column used was Agilent InfinityLab Poroshell 120 HILIC-Z, 2.1 x 100 mm, 2.7 μ m (PEEK-lined stainless steel); A: 10 mM ammonium formate, pH 6.8 in water, B: acetonitrile + 10 mM ammonium formate, pH 6.8, 95-30% B in 10 minutes, 0.25 mL/min, 0.2 μ L injection (5 ng each on column), MS source: ESI, m/z 191.02, 346.06, 426.02, 505.99, 521.99, 742.067, 743.067, 259.03.

Bio-Inert Capillaries and Fittings

Stainless steel clad PEEK (PK/ST) capillaries union and kits

The novel design of the Agilent bio-inert PK/ST capillaries ensures a 100 % metal-free surface to avoid sample interaction, enhance resistance against corrosion, and minimize leaching of metal ions.

| Part Number | Description |
|-------------|--|
| G5667-81000 | Stainless steel clad PEEK capillary, 0.17 mm id, 105 mm long, with two removable UHP-FF fittings |
| G5667-81001 | Stainless steel clad PEEK capillary, 0.17 mm id, 150 mm long, with two removable UHP-FF fittings |
| G5667-81002 | Stainless steel clad PEEK capillary, 0.17 mm id, 200 mm long, with two removable UHP-FF fittings |
| G5667-81003 | Stainless steel clad PEEK capillary, 0.17 mm id, 300 mm long, with two removable UHP-FF fittings |
| G5667-81004 | Stainless steel clad PEEK capillary, 0.17 mm id, 400 mm long, with two removable UHP-FF fittings |
| G5667-81005 | Stainless steel clad PEEK capillary, 0.17 mm id, 500 mm long, with two removable UHP-FF fittings |
| 5500-1276 | Quick Connect stainless steel clad PEEK capillary, 0.17 mm id, 280 mm long (for Quick Connect fitting) |
| 5500-1277 | Quick Connect stainless steel clad PEEK capillary, 0.17 mm id, 500 mm long (for Quick Connect fitting) |



PK/ST capillary (p/n G5667-81000)



InfinityLab Bio-inert Quick Connect column heat exchanger with fittings (p/n G7116-60009)



Mounting tool for UHP-FF fitting and InfinityLab Quick Turn fitting (p/n 5043-0915)

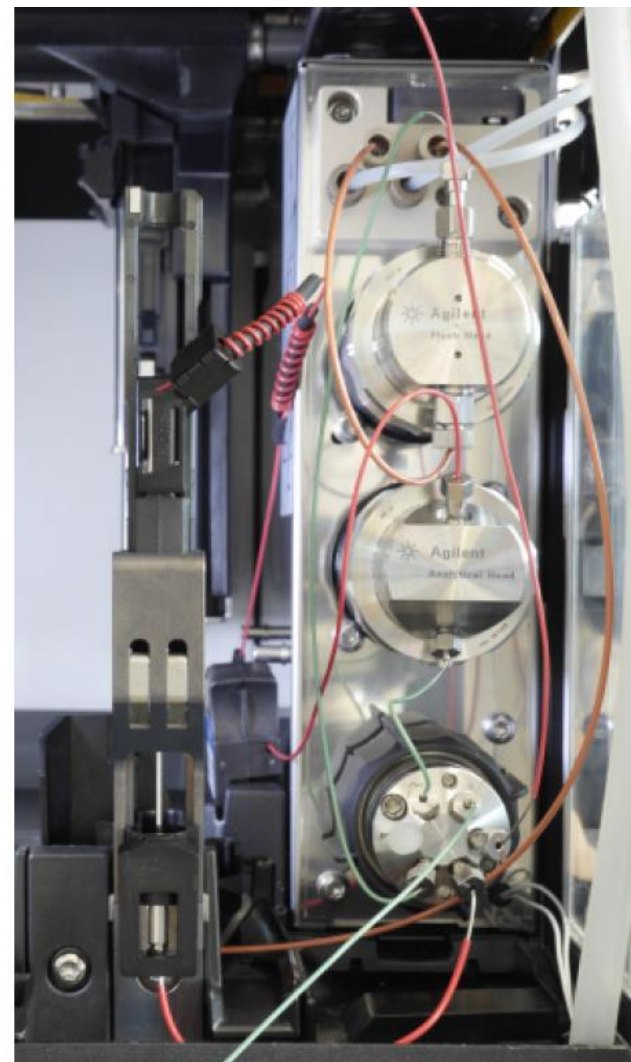
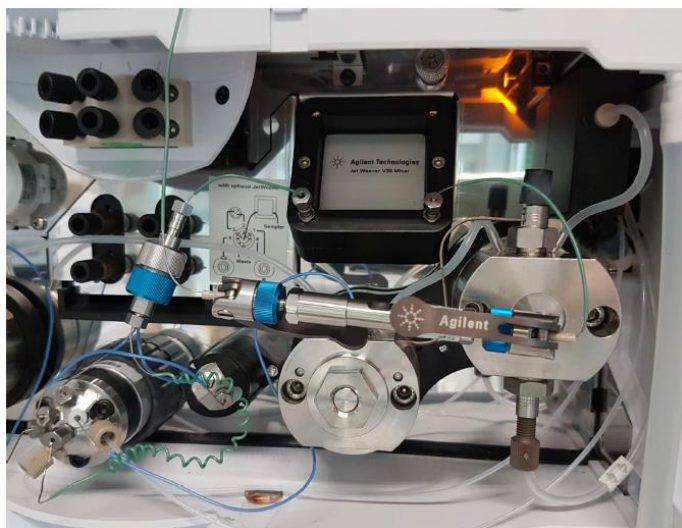
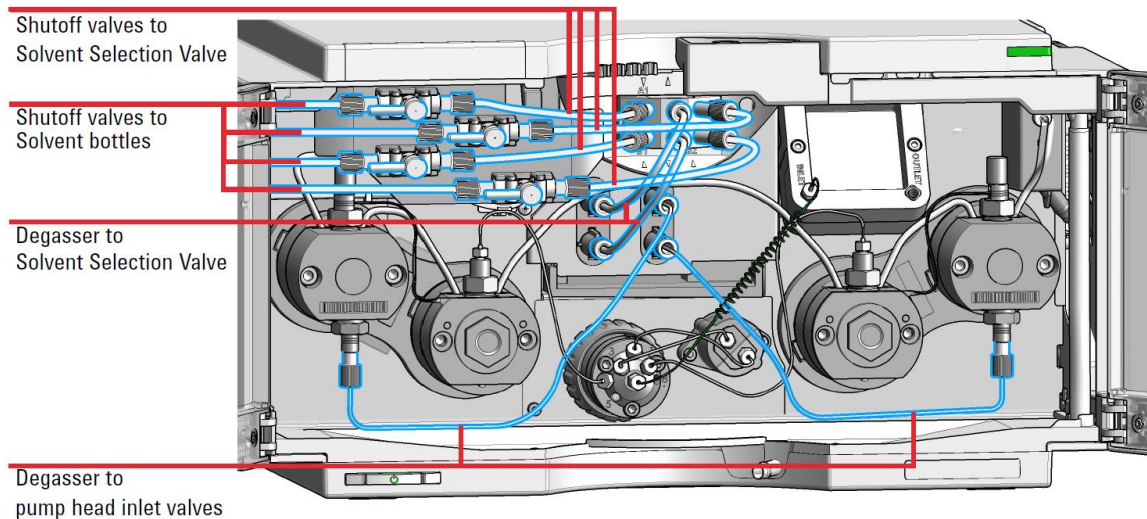
Fittings and union for PK/ST capillaries

The default fitting for PK/ST capillaries is the UHP-FF fitting. For column connections, InfinityLab Quick Connect and Quick Turn fittings are recommended due to their spring-loaded design ensuring zero dead volume.

| Part Number | Description |
|-------------|--|
| 5067-5695 | UHP-FF fitting, bio-inert |
| 5067-5966 | InfinityLab Quick Turn fitting* |
| 5067-5965 | InfinityLab Quick Connect fitting**—for column connections, only usable with Quick Connect capillaries and bio-inert Quick Connect column heat exchanger (G7116-60009) |
| 5067-4741 | Bio-inert union |
| 5043-0915 | Mounting tool for UHP-FF fitting and Quick Turn fitting |
| 5043-0924 | Front ferrule for Quick Connect and Quick Turn fitting |

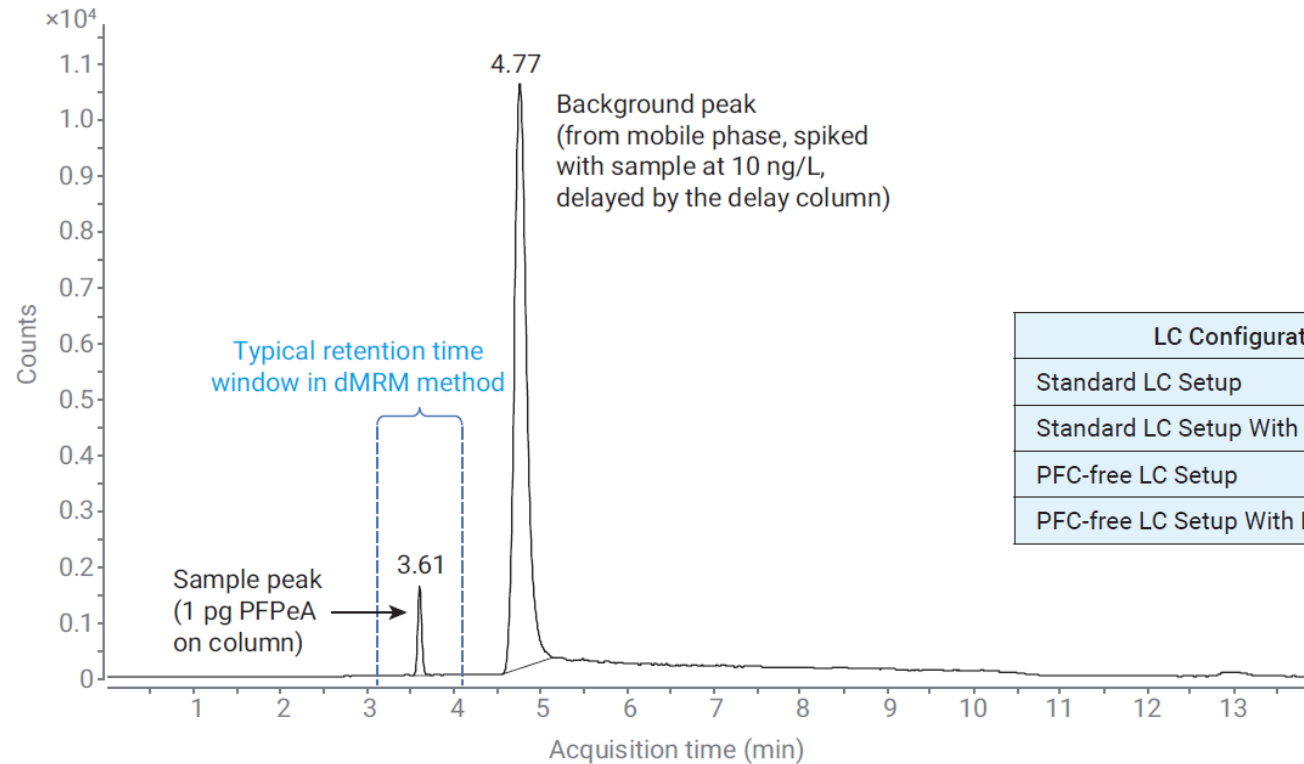
InfinityLab PFC-Free Kit

1290 Infinity II high-speed pump and multisampler



InfinityLab PFC-Free Kit

1290 Infinity II high-speed pump and multisampler



| LC Configuration | PFHpA Background (fg) | PFNA Background (fg) |
|-------------------------------------|----------------------------|----------------------------|
| Standard LC Setup | >3,000 | >500 |
| Standard LC Setup With Delay Column | 48 | 48 |
| PFC-free LC Setup | 20 | 37 |
| PFC-free LC Setup With Delay Column | <2 (below detection limit) | <7 (below detection limit) |

InfinityLab PFC-Free Kit

Other Agilent LCs

| Module | Recommendations | Trade-offs |
|--|--|---|
| Agilent 1290 Infinity High Speed Pump (G4220A) | Convert the module as described for the 1290 Infinity II High Speed Pump in "PFC-Free HPLC conversion kit - Installation and Use Instruction" <i>Optional (SN DEBB06078 and higher or SN DEBAA06133 and higher):</i> Exchange black PTFE wash seals with yellow PE wash seals (0905-1718). | None |
| Agilent 1260 Infinity II/Infinity Binary Pumps (G7112B/G1312B) and older Binary Pumps | Use a PEEK adapter 1/4-28 to 10-32 (0100-2298) to connect solvent lines to active inlet valves. Remove the PTFE filter from the manual purge valve. Install a InfinityLab Quick Change inline filter (5067-1602) to the purge valve outlet. Install a delay column between the inline filter and the injection valve. If present, exchange the black PTFE pump seals with yellow PE pump seals (0905-1420). <i>Optional:</i> If present, exchange the black PTFE wash seals with yellow PE wash seals (0905-1718). | Increased gradient delay volume, causing increased retention times. Limited pressure range. |
| Agilent 1290 or 1260 Infinity II Multisampler without Multiwash Option or with Dual-Needle Option (G7167B or G7167A) | Replace the FEP wash solvent line from the peristaltic pump to the wash port with longer PEEK tubing from the multiwash tubing kit (remove the bigger nut and stick the end of the PEEK tubing directly into the peristaltic pump tubing; secure with a compression spring (1460-2763), if available). Replace the FEP wash solvent line connected to the peristaltic pump inlet with shorter PEEK tubing from the multiwash tubing kit (remove the steel screw and ferrule and stick the end of the PEEK tubing directly into the peristaltic pump tubing; secure with a compression spring (1460-2763), if available). Use a PP Union (5022-2155) to connect the bottle head assembly. | Potentially higher carryover. Limited pressure range (1260 Infinity II Multisamplers). |
| Agilent 1260 Infinity II Multisampler with Multiwash Option | Convert the module as described for the 1290 Infinity II Multisampler with multiwash option in "PFC-Free HPLC conversion kit - Installation and Use Instruction". | Limited pressure range. |
| Agilent 1290/1260 Infinity II Vial Samplers (G7129B/A) | Replace the FEP wash solvent line connected to the peristaltic pump inlet with shorter PEEK tubing from the multiwash tubing kit (remove the steel screw and ferrule and stick the end of the PEEK tubing directly into the peristaltic pump tubing; secure with a compression spring (1460-2763), if available). Use a PP Union (5022-2155) to connect the bottle head assembly. The other FEP solvent line from the peristaltic pump to the needle wash well cannot be replaced with PEEK (too stiff). <i>Alternative:</i> use wash vials to wash the needle. | Some background from the nonreplaceable FEP solvent line may occur. Lower needle wash efficiency, and therefore potentially higher carryover, when using wash vials as alternative. |
| 1290 Infinity Autosampler (G4226A) | Replace the FEP wash solvent line connected to the peristaltic pump inlet with shorter PEEK tubing from the multiwash tubing kit (remove the steel screw and ferrule and stick the end of the PEEK tubing directly into the peristaltic pump tubing; secure with a compression spring (1460-2763), if available). Use a PP Union (5022-2155) to connect the bottle head assembly. <i>Alternative:</i> use wash vials to wash the needle. | The FEP solvent line from the peristaltic pump to the wash port cannot be replaced easily; some PFAS background may occur. Lower needle wash efficiency, and therefore potentially higher carryover, when using wash vials as alternative. |
| Older Autosamplers (G1367E etc.) | DO NOT USE TEFZEL ROTOR SEALS For wash solvent line replacement, see 1290 Infinity Autosampler (G4226A). <i>Alternative:</i> use wash vials to wash the needle. | The FEP solvent line from the peristaltic pump to the wash port cannot be replaced easily; some PFAS background may occur. Lower needle wash efficiency, and therefore potentially higher carryover, when using wash vials as alternative. |

Reduce PFAS Background with the Agilent PFC-Free* HPLC Conversion Kit

An ideal solution for trace level PFAS analysis with LC/MS/MS

Authors

Matthias Kamuf, Marcus Wälz, and Andreas Borowiak
Agilent Technologies, Inc.

Introduction

Per- and polyfluoroalkyl substances (PFAS) are a group of persistent organic pollutants, widely found in the environment.¹ To protect people from exposure to these pollutants international, national, and regional agencies such as the United States Environmental Protection Agency (US EPA) and the International Organization for Standardization (ISO) provide methods for trace-level analysis of these compounds. For example, US EPA methods 533 and 537.1, as well as ISO method 21675 can be used for the analysis of drinking water with liquid chromatography/tandem mass spectrometry (LC/MS/MS).

High-performance liquid chromatography (HPLC) instruments in their standard configuration contain per- and polyfluorinated compounds (PFCs), including fluoropolymers such as PTFE, PFA, etc. These materials are used because of their chemical inertness, ensuring the compatibility of the LC instruments with a broad range of acids, bases, and organic solvents. However, during the production of PFC, per- and polyfluorinated alkyl substances (PFASs), such as perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), or replacement chemicals with similar properties are used as processing agents. Traces of these PFAS processing agents can remain in fluoropolymers. When running PFAS analysis at the ppb level and below, using LC/MS/MS instruments, the PFAS leaching from the LC instrument during operation can cause an increased background. This increased background can have a severe impact on meeting the required quantification and detection limits set by regional and national regulations. Therefore, it is up to the user to take the necessary steps to minimize the impact of the LC/MS system on the analytical results. Two recommendations from the US EPA are (1) to replace standard solvent lines with alternative ones made of PEEK and (2) to use a delay column, which can help to further reduce the background, especially if it is caused by the mobile phase.

Publication number 5994-2291EN

Resources on the Web

[InfinityLab fittings on Agilent.com](https://www.agilent.com/chem/infinitylab/fittings)

[InfinityLab LC Supplies catalog](#)

[Product catalog](#)

[Less Stress. More Reliable Connections](#)

[Product flyer](#)

[Agilent Bio-inert Capillaries and Fittings flyer](#)

[Product overview](#)

[Agilent InfinityLab UHPLC Fittings flyer](#)

[Technical overview](#)

Your Essential Resource for
INFINITYLAB LC SUPPLIES

Agilent Technologies

Less Stress. More Reliable Connections.

Agilent InfinityLab Quick Connect Fittings

Perfect system connections for HPLC and UHPLC systems. Properly connected fittings are one of the top reasons for longer testing cycles, loss of resolution, and overall poor chromatography. Now, with Agilent InfinityLab Quick Connect fittings, you can be sure you're getting a perfect system connection, every time.

- Truly finger-tight connections: no special training is needed, so differences in user style will not affect your chromatography.
- Spring-loaded design: now you can make zero-dead-volume connections with LC columns—so easy as pressing a lever.
- Reliable and reusable: InfinityLab Quick Connect fittings are long-lasting, resistant to heat, and are stable up to 1300 bar (18,950 psi) even after 200+ reconnections.
- Fast, easy connections: save time and trouble, now also for standard HPLC, with 0.17 mm ID and 0.25 mm ID capillaries.

Agilent InfinityLab Quick Connect fittings deliver superior chromatographic performance.

Agilent InfinityLab Quick Connect fittings belong to the InfinityLab family—an optimized portfolio of LC instruments, columns, and supplies designed to work in perfect harmony. Combined with Agilent OpenLAB software and Agilent Chemical Services, Agilent InfinityLab provides you with end-to-end support to make every day more productive. Learn more at www.agilent.com/chem/infinitylab.

3 simple steps... 1 perfect connection

Step 1: Insert capillary into the fitting and push the lever down.

Step 2: Push the lever up to lock the capillary in place.

Step 3: Push the lever down to release the capillary.

The proprietary Agilent design features a spring-loaded mechanism to make dead-volume and a truly tight connection.

Agilent

ULTIMATE EFFICIENCY FOR BIOMOLECULE ANALYSIS

Agilent Bio-inert Capillaries and Fittings

Together, Agilent bio-inert capillaries and fittings and the 200 Infinity II Bio-inert LC system, provide a 100% metal-free sample flowpath, reducing adsorption and loss for sensitive, low-abundance samples.

- **Reliable analysis of biological samples:** no contact between your sample and metal surfaces, minimizes unwanted surface interactions and leads to optimal sample recovery, peak retention, and peak shape. Ideal also for underrepresented GC-MS and LC-MS analysis.
- **High robustness:** high salt tolerance (1 M) and wide pH range (0.12, shown here 14).
- **Promotes automation:** up to 600 bar.
- **Less metal leaching:** less leaching of heavy metals (Fe, Ni, Cu, etc.) and their adducts to minimize baseline contamination in LC-MS/MS and LC-MS.
- **Fast, easy, and reliable volume connections:** FRET allows standard steel capillaries with InfinityLab Quick Connect fitting for long-lasting, zero-dead-volume and reusable volume connections.

Agilent InfinityLab bio-inert capillaries and fittings, columns, valves, and supplies designed to work together to provide superior chromatographic performance. Agilent InfinityLab bio-inert capillaries and fittings are available in a variety of lengths and diameters. Agilent InfinityLab bio-inert capillaries and fittings are available in a variety of lengths and diameters. Agilent InfinityLab bio-inert capillaries and fittings are available in a variety of lengths and diameters.

Thin-layer steel-coated PEEK (PEEK/ST) capillaries resist and block

The novel design of the Agilent bio-inert PEEK capillaries creates a 100% metal-free surface to avoid sample interaction, enhance retention against corrosion, and minimize leaching of metal ions.

| Part Number | Description |
|-------------|--|
| 020877-0100 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0101 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0102 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0103 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0104 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0105 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0106 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0107 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0108 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0109 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0110 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0111 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0112 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0113 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0114 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0115 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0116 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0117 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0118 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0119 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |
| 020877-0120 | InfinityLab bio-inert PEEK capillary, 0.17 mm ID, 100 mm long, with new stainless steel fittings |

Agilent Technologies

Agilent InfinityLab UHPLC Fittings

Technical Overview

2015 F&E 100 AWARD WINNER

STOP THE PRESSES! Agilent Quick Connect fittings earned the prestigious F&E 100 Award 2015. For more than 50 years, the award of F&E magazine has chosen the 100 "most technologically significant products introduced into the marketplace over the past year". Once again, an Agilent product is in for the best of excellence.

AWARD WINNER F&E 2015

InfinityLab Quick Connect won The Analytical Scientist Innovation Award 2014 because it is the only true finger-tight UHPLC fitting stable to 1,300 bar that can be used dry and over again without loss of performance.

Introduction

Chromatographers working with HPLC and UHPLC are often challenged by problems such as peak tailing, peak broadening, high mobile phase wear, and so forth. One common cause for these problems that is often overlooked and costs much time in troubleshooting is poor fitting connection. Dead volume or loose fittings in tubing connections can greatly affect the performance and reproducibility of chromatographic analysis, especially with modern HPLC and UHPLC columns [1, 2].

Fitting connection requirements

Fitting connections can have a very large impact on the peak shape of analyses. An ideal fitting connection should feature:

- Zero dead volume between tubing and receiving part
- Ability to remain tight under ultra-high pressures and elevated temperatures
- Reconnection over long-term use, preventing tubing leakage
- Ease of use

Agilent Technologies

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