Simple Tips for Maintaining LC Instrument Performance

Mark Powell
Applications Engineer
Overview

- Know the flow path of your instrument
- What is in your solvent bottle?
- Capillaries and fittings
- Pump care
- Injector care
- Filters and filtration
- Detector care
  - UV
  - MS
- Consider an Agilent service contract
Your Instrument’s Flow Path

- Where can blockages to flow occur?
- Where are the consumables that need to be replaced on a regular basis?
- Where can leaks occur?
- What can I do to reduce or anticipate potential problems with the LC?
Your Instrument’s Flow Path

Solvent cabinet
Degasser
Pump
Autosampler
TCC
Detector

Solvent cabinet
Detector
TCC
Autosampler
Pump/Degasser
What is in Your Solvent Bottle?

- Use only quality HPLC or MS grade solvents
- These do not need to be filtered
- Buffer and salt solutions do need to be filtered
- Filter porosity: 0.45 or 0.2 µm
- Make sure the filter material is compatible
- Avoid algae/microbial growth
  - Frequently replace the mobile phase with a clean bottle
  - Adding some organic to aqueous mobile phases can inhibit growth
  - Consider avoiding light exposure
- Can cause degasser problems
- Can be a source of ghost peaks
What is in Your Solvent Bottle?

- Solvent inlet filter
- Not a replacement for good mobile phase hygiene
- Glass solvent inlet filter (20 µm), 5041-2168
- Stainless steel solvent inlet filter, 01018-60028
- Stainless inlet filter recommended for LCMS
Agilent A-Line Stay Safe Cap

Main Features

- Venting valve for mobile phase
- Charcoal filter for waste container
- Time strip

Advantages

- Eliminates harmful solvent vapors
- Keeps solvent concentration constant
- Keeps constant pressure in bottle
- Prevents twisted tubing
- Allows easy solvent refill
- Allows easy tightening
## Agilent A-Line Stay Safe Cap

<table>
<thead>
<tr>
<th>A-Line Quick Stay Safe Caps and Accessories</th>
<th>Part Number</th>
</tr>
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<tbody>
<tr>
<td>A-Line safe cap GL45 1 port 1 vent vlv</td>
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<tr>
<td>A-Line safe cap GL45 2 ports 1 vent vlv</td>
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<td>A-Line safe cap GL45 4 ports for waste</td>
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<td>A-Line 6L waste can + GL45 4 ports cap</td>
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<td>2 Ports waste collector, PTFE</td>
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<td>A-Line safe cap starter kit</td>
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</table>
Degasser Care

- Check for bubbles in outlet lines
- Avoid blockages by flushing out buffer salts with water when changing mobile phases
- When switching solvents, make sure they are miscible
- Do not leave the degasser for an extended period of time with aqueous mobile phase to avoid microbial growth
- Unused channels should be flushed with water to remove any buffers, and left in organic solvent
Pump Care – Flow Path

- Proportioning Valve
- Inlet Valve
- Pump Head
- Outlet Valve
- Purge Valve
Pump Care

- Pressure ripple is a measure of pump performance
- Convenient way to assess condition of your pump
- Value should be stable
Pump Care
Proportioning Valve

- Solvent selection valve on binary pump
- Gradient valve on quaternary pump
- Allows the pump to vary solvent mixtures and form gradients
- Not much routine maintenance required here
- Avoid blockages and leaks by flushing out buffer salts when changing mobile phases
- Issues can lead to baseline problems and poor retention-time precision
Pump Care
Inlet Valve

Active inlet valve

14 mm wrench
8710-1924
Passive inlet valve

14 mm wrench
8710-1924
Pump Care
Inlet Valve

• If pressure ripple is unstable, the active inlet valve cartridge may be dirty

• Inlet valve issues can lead to
  • poor pump performance
  • detector baseline noise
  • unstable system pressure
  • poor retention-time precision
Pump Care
Outlet Ball Valve

14 mm wrench
8710-1924
Pump Care
Outlet Ball Valve

• A failing outlet ball valve causes backflow of solvent
  • poor pump performance
  • detector baseline noise
  • unstable system pressure (pressure ripple)
  • poor retention-time precision
• Outlet valves on older Agilent LC’s have a separate gold seal cap, which can still be replaced
• However, the current valve design has an integrated gold seal
Pump Care
Pump Head

Seals

Pistons (plungers)

0905-1420, Polyethylene (normal phase)

5063-6589, PTFE (reversed-phase)

0905-1719, for 1290

5064-8211
Pump Care
Pump Head

- Perform seal wear-in procedure after installation of black reversed-phase seals
- Replace on a regular basis, before there is a problem
- Set up a replacement schedule for your instrument based on usage and mobile phase composition
- Leaking pump seals can lead to
  - poor pump performance
  - unstable system pressure (pressure ripple)
  - Detector baseline noise
  - poor retention-time precision
Pump Care
Purge Valve

14 mm wrench

Seal cap
5067-4728

PTFE frits
01018-22707
Pump Care
Purge Valve

• Dirty frit in the purge valve often a source of high pressure
• A pressure drop of >10 bar across the frit (5 mL/min water with purge valve open) could indicate a blockage
• Change after changing pump seals and seal wear-in
Pump Care
1290 Infinity System

Solvent selection valve
Outlet valve
Pump head assembly
Passive inlet valve

Degasser
High pressure filter assembly
Purge valve
Pump Care
1290 Infinity System

Hole
Filter frit
Seal cap

01018-22707
5067-4728
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<tr>
<th>Description</th>
<th>Comments</th>
<th>Part Number</th>
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<tr>
<td>Cartridge for active inlet valve 400 bar</td>
<td>For G1310A, G1311A, G1312A, G1376A, G2226A, G1312C</td>
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<td>Cartridge for active inlet valve 600 bar</td>
<td>For G1312B</td>
<td>G1312-60020</td>
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<td>Bio-inert active inlet valve</td>
<td>For G5611A</td>
<td>G5611-60025</td>
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<td>Bio-inert cartridge for active inlet valve, 600 bar</td>
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<td>Passive inlet valve for 1290 quaternary pump</td>
<td>For G4204A</td>
<td>G4204-60022</td>
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<td>1260 Infinity LC inlet valve, type N</td>
<td>For normal phase applications on 1260 Infinity/1200 Series/1100 Series pumps</td>
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<td>1290 Infinity LC inlet valve, type N</td>
<td>For normal phase applications on 1290 Infinity pumps</td>
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<td>Valve assemblies (inlet/outlet) for prep pumps</td>
<td>For G1361A</td>
<td>G1361-60012</td>
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<td>Passive inlet valve</td>
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<td>Passive inlet valve for 1290 binary pump</td>
<td>For G4220A, G4220B</td>
<td>G4220-60022</td>
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<td>Seal cap</td>
<td>Not for outlet ball valves with integrated seal</td>
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## Outlet Valve Parts

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<th>Description</th>
<th>Comments</th>
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<tr>
<td>Outlet valve, 600 bar</td>
<td>For all 1260 Infinity, 1220 Infinity, 1200 Series and 1100 Series analytical pumps</td>
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<td>Outlet valve 1290 Infinity pump</td>
<td>For 1290 Infinity pumps</td>
<td>G4220-60028</td>
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<td>1290 Infinity LC outlet valve, type N</td>
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<td>Bio-inert outlet valve</td>
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<td>Valve assemblies (inlet/outlet) for prep pumps</td>
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<td>G1361-60012</td>
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<tr>
<td>Seal cap</td>
<td>For all purge/inlet/outlet valves without integrated seal</td>
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</tbody>
</table>
Your Instrument’s Flow Path

- Solvent Bottle
- Degasser
- Pump
- Injector
- Column Compartment
- Detector
Autosampler Care

• Two main types
  • Standard: gripper arm moves vial to needle
  • Well Plate (HiP): needle arm moves to the sample

• Five main maintenance points:
  • Needle
  • Loop capillary
  • Needle seat
  • Injection valve rotor seal
  • Metering device seal
Autosampler Care
Standard ALS

- Loop capillary
- Metering pump
- Needle
- Injection valve
- Needle seat
Autosampler Care
Well Plate ALS (HiP)
High pressure sometimes indicates a plugged needle or needle seat
Autosampler Care

- Exchange the rotor seal after approximately 30,000 to 40,000 injections, or sooner depending on your specific sample and mobile phase
- or when injection reproducibility or leakage indicates wear
- Rotor seal wear is often a cause of sample carry-over
- Exchange the metering seal when autosampler reproducibility indicates seal wear
Autosampler Care

Stator ring (not available for all valves)

Rotor seal

Bearing ring / isolation seal

Stator face (400 bar and bio-inert only)

Stator screws (not available for all valves)

Stator head
Autosampler Carryover

• **Common sources**
  • Exterior of needle (use needle wash)
  • Worn needle seat
  • Worn rotor seal
  • Poorly made fitting
Autosampler Carryover

Top view

Wear, e.g. scratches

Side view

2. Sample
Autosampler Carryover

Badly installed capillary, dead volume, will create carry-over!
Autosampler Care

1. Remove the two capillaries from the metering-head assembly.

2. Remove the two fixing bolts, and pull the head assembly away from the sampler. Notice that the closed side of the metering head faces upwards.

3. Remove the two fixing bolts from the base of the metering head assembly.

4. Disassemble the metering head assembly.
## Common Autosampler Kits

<table>
<thead>
<tr>
<th>Description</th>
<th>Comments</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>For G1329A, G1313A autosamplers</td>
<td>Includes rotor seal, needle seat, needle, finger caps</td>
<td>G1313-68703</td>
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<tr>
<td>For G1329B autosamplers</td>
<td>Includes rotor seal, needle, needle seat, pump seals, finger caps</td>
<td>G1329-68719</td>
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<tr>
<td>For G1367A/B autosamplers</td>
<td>Includes needle, needle seat, rotor seal, peristaltic pump</td>
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<td>For G1367C/D autosamplers</td>
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</tbody>
</table>
Autosampler Care

- Agilent autosamplers use wide opening (9 mm) vials
- Choose Agilent Certified vials
  - Tested for full compatibility
  - Vial neck and shoulder are proper height
  - Competitors do not meet our exact specifications
  - Choose bonded caps to prevent septum push-through
Bonded Caps

Press fit vs Bonded

Groove and ridge for press-fit septum

Better bonding surface without groove and ridge
Bonded Caps

• In most cases, Agilent bonded screw caps perform much better than standard non-bonded screw caps
• No septum push-through
• There is no adhesive or other chemical used in this process
• Extensive chemical/material testing confirms that there are no extractables or leaching into the samples from the septum or cap

<table>
<thead>
<tr>
<th>Non-bonded cap</th>
<th>New bonded cap</th>
<th>Septa material</th>
<th>Cap color</th>
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<tbody>
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<td>5182-0717</td>
<td>5190-7024</td>
<td>PTFE/red silicone</td>
<td>Blue</td>
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<tr>
<td>5182-0720</td>
<td>5190-7021</td>
<td>PTFE/white silicone</td>
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<tr>
<td>5183-2076</td>
<td>5190-7023</td>
<td>Pre-Slit PTFE/silicone</td>
<td>Blue</td>
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<tr>
<td>5181-1211</td>
<td>5190-7025</td>
<td>PTFE/red silicone</td>
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<td>5182-0721</td>
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</tbody>
</table>
Your Instrument’s Flow Path

- Solvent Bottle
- Degasser
- Pump
- Injector
- Column Compartment
- Detector
What causes high pressure?

• Particulates in mobile phase
  • Improperly filtered buffer solutions
  • Buffer precipitation
  • Microbial growth
  • Seal debris

• Particulates in the sample
  • Precipitated sample
  • Insoluble matrix components

Common blockage points

• Purge valve frit
• Autosampler needle/needle seat
• Column frit
Filtration
Filter Selection

- Consider the particle size of your column
- Inlet frit on columns with particle size 2.7 or larger is nominally 2 µm
- Smaller on sub-2 µm columns
- Choose 0.2 µm filters when using sub-2 µm columns
- 0.45 µm acceptable for larger particle size columns
- Check the compatibility of the filter with your mobile phase/sample solvent
### Filtration

**Legend**

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<th>Compatible</th>
<th>PP</th>
<th>PES</th>
<th>CA</th>
<th>PTFE</th>
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**Solvents**

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<tr>
<td>Methanol, 99%</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methyl acetate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylene chloride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*CA and GF membranes in MBS housing for 28 mm size

Contact time: 24 hours at 30 °C

Chemical compatibilities can be influenced by various factors. Therefore, we recommend that you confirm compatibility with the final user setup to filter for contaminants and filter the fluid once more.
Filtration – Agilent Captiva

filtrationselectiontool.chem.agilent.com

5991-1230EN
Filtration
In-Line Filters

RRLC in-line filter
0.2 μm pore size filter, max 600 bar
4.6 mm ID, 5067-1553
2.1 mm ID, 5067-1551

1290 Infinity LC in-line filter, 0.3 μm,
1200 bar, 5067-4638

• In-line filters can help extend the life of your column
• Not intended to be a replacement for good sample cleanup
Capillaries

- Capillary internal diameters
  - 0.17 mm ID
  - 0.12 mm ID
  - Color coded
- Know what is on your instrument
- Replace with the same ID and length
- Tubing volume and system volume
- Changes can affect peak shape and retention times

<table>
<thead>
<tr>
<th>Internal diameter (mm)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.015</td>
<td>Orange</td>
</tr>
<tr>
<td>0.025</td>
<td>Yellow</td>
</tr>
<tr>
<td>0.05</td>
<td>Natural PEEK</td>
</tr>
<tr>
<td>0.075</td>
<td>Black</td>
</tr>
<tr>
<td>0.1</td>
<td>Purple</td>
</tr>
<tr>
<td>0.12</td>
<td>Red</td>
</tr>
<tr>
<td>0.17</td>
<td>Green</td>
</tr>
<tr>
<td>0.20/0.25</td>
<td>Blue</td>
</tr>
<tr>
<td>0.3</td>
<td>Grey</td>
</tr>
<tr>
<td>0.50 to 0.53</td>
<td>Bone white</td>
</tr>
</tbody>
</table>
Capillaries

0.12 x 105 mm Red Tubing (1.2 µL)

0.25 x 700 mm Blue Tubing (34.4 µL)

QC Test Conditions:
- 55% CH₃CN
- 45% H₂O
- Isocratic, 0.6 mL/min
- 1 µL injection of QC Mix
- 23 °C
- 254 nm

QC Mix (in elution order):
1. 5 µg/mL uracil
2. 200 µg/mL phenol
3. 25 µg/mL 4-chloro-nitrobenzene
4. 40 µg/mL naphthalene

In 50/50 MeCN/Water

- 0.12 x 105 mm Red Tubing
- 0.25 x 700 mm Blue Tubing
- 2.1 x 50 mm, 1.8-µm Eclipse Plus C18
- Peak broadening when larger volume tubing installed between autosampler & column
- 43% of the efficiency is lost with too much extra column volume
Fittings

- Problems with improper stainless steel tubing connections
  - Source of leaks
  - Mistaken for chromatography issues
- Different manufacturers supply different types of fittings
- Use the fittings recommended for your system
- Agilent LC systems use Swagelok-type fittings for many instrument connections
Fittings

Swagelok

Parker

Valco

Waters (non-Acquity)

Rheodyne

Upchurch (IDEX)

0.090 in.

0.130 in.

0.090 in.

0.170 in.

0.080 in.

0.090 in.
Fittings

Figure 2: Examples of incorrect (A, B) and correct (C) fitting connection

- This will broaden or split peaks or cause tailing
- It will typically affect all peaks, but especially early eluting peaks
- Possibly cause of carry-over
Fittings

Proper Fit
Fittings

Fitting Mismatch

Mixing chamber
Fittings

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

Graph showing elution time vs. mAU with two lines representing different fitting connections.
Swaging Fittings

Step 1
Select a nut that is the right length for the fitting.

Step 2
Slide the nut over the end of the tubing.

Step 3
Carefully slide the ferrule components on after the nut. Finger-tighten the assembly while making sure the tubing is completely seated in the bottom of the end fitting.

Step 4
Use a wrench to gently tighten the fitting by 1/4 to 1/2 turn where you want to connect it; this will force the ferrule to seat onto the tubing. Do not over-tighten!

Step 5
Once you are sure your fitting is complete, loosen the nut and inspect the ferrule for correct position on the tubing.

¼ in wrench 8710-0510
A-Line Quick Connect Fitting

- Finger tight up to 1300 bar
- Spring loaded design
- No tool needed
- No overtightening
- Works for all column types
- Removable and reusable
- Consistent ZDV installation
- Hand tighten the nut, then depress the lever

Spring pushes capillary constantly towards receiving port

Guaranteed zero-dead volume
A-Line Quick Connect Fitting

Chromatogram overlap before and after 200 reconnections

- No visible change of chromatogram after 200 reconnections.
- Tailing factors and theoretical plates stayed constant within the experimental allowance through the reconnection procedures.
A-Line Quick Turn Fitting

- Finger tight up to 600 bar
- Up to 1300 bar with a wrench
- Spring loaded
- Compact design
- Works for all column types
- Removable and reusable
- Consistent ZDV installation
A-Line Fittings
A-Line Fittings
## A-Line Fittings

### A-Line Quick Connect Fittings

<table>
<thead>
<tr>
<th>ASSEMBLIES</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel 0.075 x 105 mm</td>
<td>5067-5961</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.075 x 150 mm</td>
<td>5067-6163</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.075 x 220 mm</td>
<td>5067-6164</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.075 x 280 mm</td>
<td>5067-6165</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 105 mm</td>
<td>5067-5957</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 150 mm</td>
<td>5067-5958</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 220 mm</td>
<td>5067-5959</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 280 mm</td>
<td>5067-5960</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 105 mm</td>
<td>5067-6166</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 150 mm</td>
<td>5067-6167</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 220 mm</td>
<td>5067-6168</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 280 mm</td>
<td>5067-6169</td>
</tr>
</tbody>
</table>

### A-Line Quick Turn Parts

<table>
<thead>
<tr>
<th>FITTINGS AND FERRULES</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Turn LC Fitting</td>
<td>5067-5966</td>
</tr>
<tr>
<td>Front Ferrule</td>
<td>5043-0924</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAPILLARIES</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel 0.075 x 105 mm long socket</td>
<td>5500-1198</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.075 x 150 mm long socket</td>
<td>5500-1232</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 105 mm long socket</td>
<td>5500-1188</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 150 mm long socket</td>
<td>5500-1189</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.12 x 180 mm long socket</td>
<td>5500-1233</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 200 mm long socket</td>
<td>5500-1190</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 280 mm long socket</td>
<td>5500-1191</td>
</tr>
<tr>
<td>Stainless Steel 0.12 x 500 mm long socket</td>
<td>5500-1192</td>
</tr>
<tr>
<td>Stainless Steel 0.17 x 105 mm long socket</td>
<td>5500-1193</td>
</tr>
<tr>
<td>Stainless Steel 0.17 x 150 mm long socket</td>
<td>5500-1194</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 180 mm long socket</td>
<td>5500-1234</td>
</tr>
<tr>
<td>Stainless Steel 0.17 x 200 mm long socket</td>
<td>5500-1195</td>
</tr>
<tr>
<td>Stainless Steel 0.17 x 280 mm long socket</td>
<td>5500-1196</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 380 mm long socket</td>
<td>5500-1235</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 400 mm long socket</td>
<td>5500-1236</td>
</tr>
<tr>
<td>Stainless Steel 0.17 x 500 mm long socket</td>
<td>5500-1197</td>
</tr>
<tr>
<td>NEW Stainless Steel 0.17 x 700 mm long socket</td>
<td>5500-1237</td>
</tr>
</tbody>
</table>
Your Instrument’s Flow Path

- Solvent Bottle
- Degasser
- Pump
- Injector
- Column Compartment
- Detector
Detector Care

UV Detectors

• Two types
  • VWD
  • DAD/MWD
• Simple Maintenance
  • Lamp replacement
  • Flow cell cleaning or replacement
• Keep in mind the pressure rating of your flow cell – another detector fraction collector in the flow path will increase the backpressure on the flow cell
• Avoid using flow cells with quartz windows at pH 9.5 or greater
• Make sure the flow cell contains 5 or 10% organic to prevent microbial growth when not in use
• Avoid leaving buffer solutions in the flow cell which can crystallize
Detector Care
UV Detectors - VWD

Lamp

Flow Cell
Detector Care

UV Detectors – DAD and MWD

Lamp

Flow Cell
Detector Care

UV Detectors

Max-Light cartridge (G4212A/B)

DAD on 1290/some 1260 systems
Detector Care
Lamps

- Agilent Lamps
  - Designed and certified for Agilent detectors
  - Much narrower aperture providing increased light intensity and decreased noise
  - Higher signal-to-noise ratio
  - Typical lamp life is 2000 hours
- When changing a lamp:
  - Turn the lamp off first (hot)
  - Do not touch the glass bulb
  - Any deposit in the lightpath can affect performance
- Wait 10 minutes for warm-up
# Common Lamp Part Numbers

<table>
<thead>
<tr>
<th>DAD/MWD detector</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1315A/B and G1365A/B</td>
<td>Long life deuterium lamp</td>
<td>5182-1530</td>
</tr>
<tr>
<td>G4212A/B</td>
<td>Long life deuterium lamp (8 pin) with RFID tag</td>
<td>5190-0917</td>
</tr>
<tr>
<td>G1315C/D and G1365C/D</td>
<td>Long life deuterium lamp with RFID tag</td>
<td>2140-0820</td>
</tr>
<tr>
<td>G1315A/B/C/D and G1365A/B/C/D</td>
<td>Tungsten lamp</td>
<td>G1103-60001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VWD detector</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1314A/B/C and 1120/1220</td>
<td>Long life deuterium lamp</td>
<td>G1314-60100</td>
</tr>
<tr>
<td>G1314D/E/F</td>
<td>Long life deuterium lamp with RFID tag</td>
<td>G1314-60101</td>
</tr>
</tbody>
</table>
## Detector Care

### MS Detectors

<table>
<thead>
<tr>
<th>Operation</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush the nebulizer</td>
<td>Daily after use to flush the tubing, valves, and nebulizer</td>
</tr>
<tr>
<td>Replace the nebulizer needle</td>
<td>When plugged</td>
</tr>
<tr>
<td>Clean the spray chamber</td>
<td>Daily or when carryover is suspected</td>
</tr>
<tr>
<td>Check the rough pump fluid level</td>
<td>Check weekly for color and level; replace every six months</td>
</tr>
</tbody>
</table>
Rough Pumps

MS40+ pump
Oil 6040-1361

Edwards pump
Oil 6040-0834
Detector Care
MS Detectors

Clean Source  After SPE  After PPT
Summary

• Please refer to the manual for the maintenance details on the specific modules in your system
• Some parts you will want to replace on a regular basis, before there is a problem
• Some should be kept on hand in case there is a problem, but do not necessarily need to be replaced frequently
• Develop a maintenance routine that works for you

• Contact (US & Canada)
  • LC-column-support@agilent.com
  • 800-227-9770
## Typical Schedule*

### PUMPS

<table>
<thead>
<tr>
<th>Item</th>
<th>Typical Schedule</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent inlet filter</td>
<td>Replace every 6 - 12 months</td>
<td></td>
</tr>
<tr>
<td>PTFE frits in purge valve + gold seal</td>
<td>Every 12 months</td>
<td>When changing the seal, check the piston for scratches--replace if scratched</td>
</tr>
<tr>
<td>Piston seals</td>
<td>Every 12 months</td>
<td></td>
</tr>
<tr>
<td>Inlet valve cartridge, outlet ball valve</td>
<td>Every 24 months</td>
<td></td>
</tr>
</tbody>
</table>

### AUTOSAMPLER

<table>
<thead>
<tr>
<th>Item</th>
<th>Typical Schedule</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle and needle seat</td>
<td>Every 12 months</td>
<td></td>
</tr>
<tr>
<td>Rotor seal</td>
<td>Every 12 months</td>
<td></td>
</tr>
<tr>
<td>Metering device seal</td>
<td>Every 24 months</td>
<td></td>
</tr>
</tbody>
</table>

### COLUMN COMPARTMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Typical Schedule</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column switching valve rotor seal</td>
<td>Every 12 months</td>
<td>A-line fittings last a lot longer than traditional fittings</td>
</tr>
<tr>
<td>Column fittings</td>
<td>Every 5 to 10 column changes</td>
<td></td>
</tr>
</tbody>
</table>

### DETECTORS

<table>
<thead>
<tr>
<th>Item</th>
<th>Typical Schedule</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamps</td>
<td>Every 2000 hours</td>
<td>Watch for a noisy baseline</td>
</tr>
<tr>
<td>Flow cell</td>
<td>Check cleanliness every 6 months</td>
<td>Low light intensity could be caused by a dirty flow cell</td>
</tr>
</tbody>
</table>

*Adjust according to your samples, conditions, and performance goals
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• 800-227-9770 (Toll Free US & Canada)
  • For LC columns
    • Select option 3, then option 3, option 2
  • For GC Columns
    • Select option 3, then option 3, option 1
  • 916-608-1964 (fax)
• www.agilent.com/chem
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Is it the column, method or instrument

October 14, 2015 – 11:00am

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Superficially Porous Column Chromatography Options

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2. By entering some information about their analysis (i.e., instrument type, sample type, pKa of sample, hydrophobicity of sample, etc.)
3. By compound look-up
4. By USP code.