Maximize Performance and Minimize Maintenance with Genuine Agilent LC Spares

Comparing LC instrument spares from Agilent and other vendors

Technical Overview

Introduction

Regular replacement of crucial parts can help keep your HPLC systems at optimum performance, reduce system downtime and repair costs, as well as extend your instrument's life time. However, these benefits can only be achieved when using high-quality parts that are durable, clean, and fit perfectly into the system.

We inspected different LC instrument spare parts from Agilent and other vendors. The results show deficiencies in parts from other vendors, including:

- Inconsistent materials
- Contamination issues
- Shorter life time
- Outdated design

Therefore, use of parts not from Agilent could cause premature instrument failure, increase downtime, and deliver inaccurate or false results.

Agilent Technologies

Solvent inlet filters

Solvent inlet filters represent the first barrier for retaining particulates, precipitation, microbes from mobile phases, buffers, and salt solutions. Filters are significant in preventing system blockage, pressure increase, and contamination.

p/n 5041-2168

Pore size

A good solvent glass filter should have a defined, homogenous pore size to effectively block particulates above a certain size, while letting mobile phases through without significant pressure increase. Too large pore size leads to deficiency of filtration, while pores that are too small can cause pressure increase, resulting in solvent pumping difficulties. Inspection of Agilent and other vendor solvent glass filters by scanning electron microscopy (SEM) shows uniform pore sizes and smooth particle surfaces in the Agilent filter. In contrast, other vendor filters had inconsistent particle and pore sizes (Figure 1). The small particles or particle fragments shown on the other vendor filter could be flushed into the flow path, blocking the pump frit, capillaries, valves, or columns.

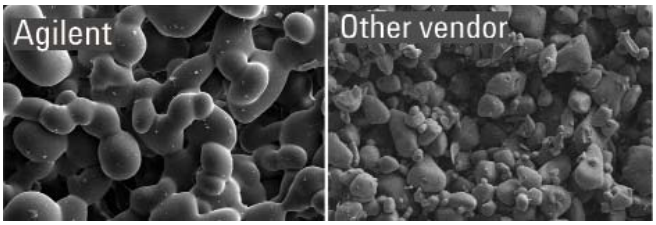

Figure 1. SEM image of solvent inlet glass filter from Agilent and another vendor, showing the superior pore-size homogeneity of the Agilent product.

Cleanliness

Cleanliness of parts is vital for avoiding system contamination. Agilent solvent filters are packed in ultraclean antistatic bags with an inner metallic coating that does not release contaminants such as plasticizers or antioxidants. LC/MS analysis (Figure 2) shows that filters not from Agilent, packed in normal plastic packs, can cause extra peaks during analysis. Erucamide, a common slip agent used in polyethylene films, is one such example.

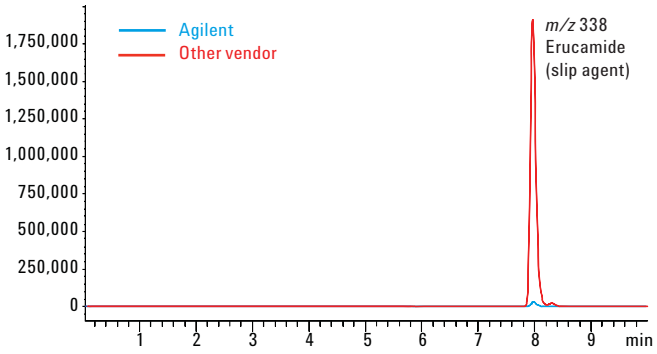

Figure 2. Overlay of LC/MS chromatograms of a soaking solution from an Agilent and other vendor solvent inlet filter, revealing the absence of packaging contaminant in the Agilent filter.

Agilent solvent filters also include a calibrated edge that fits perfectly into Agilent solvent inlet tubes, and additional packing with a specially shaped tray to avoid damage or breakage during transportation (Figure 3).

Figure 3. Superior packaging of Agilent solvent inlet filters, compared to other vendor packaging.

PTFE frits

The PTFE frit is another crucial part in the flow path that prevents particulates and microbes from getting into the system. It is important that frits maintain their shape up to the pressure limit of the system, since collapse or abrasion of the frit can release PTFE particles, resulting in blockage or loss of analysis efficiency. SEM inspection (Figure 4) reveals that sizes of PTFE particles in Agilent frits are much more uniform than frits from other vendors. If the frit is abraded, particles that are too large can block the flow path, while particles too small can pass through the column inlet frit, getting into the column, or even reach the detector causing contamination of the flow cell. In contrast to alternative frits, Agilent frits are designed to have a defined particle size to avoid these issues.

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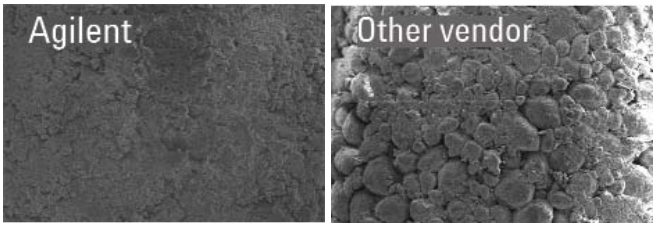

Figure 4. SEM image showing the superior uniformity of Agilent frits.

Pump piston seals

The piston seal is an essential part of the pump that directly impacts its performance, which depends on many design characteristics.

p/n 5063-6589

Spring tightness

Seal springs have to apply a constant force that complies with the tolerances of the instrument. Springs that are too soft can cause diffusion of air bubbles into the pump head, resulting in pressure ripple and air in the column. Springs too hard can lead to more abrasion between seal and piston, leading to significant decrease in the seal's lifetime. Agilent seals use specially designed springs that maintain optimal strength to ensure perfect sealability and longevity. Comparison with third-party seals (Figure 5) clearly shows differences in size, space, and density of the spring coils.

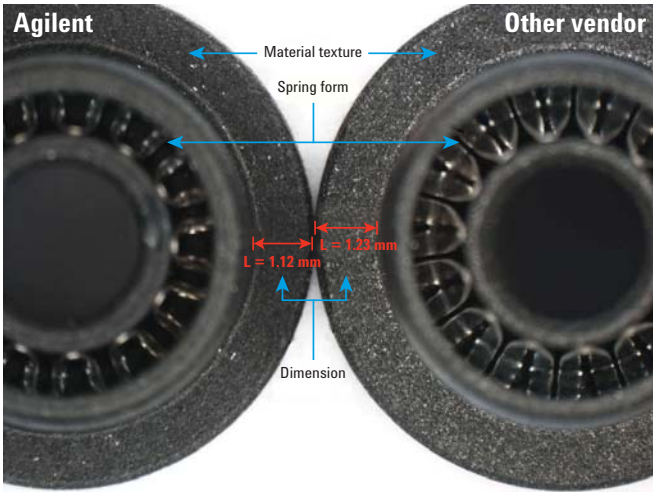

Figure 5. Micrographs showing difference of Agilent and third-party pump seals in spring form, material texture, and dimensions.

Material

Agilent seals are manufactured from a proprietary polymer blend with optimized elasticity, firmness, and hydrophobicity, which have large effects on pressure ripple, cold-flow behavior of solvents, and removal of air bubbles. Difference of materials of Agilent and third-party seals is apparent in Figure 5, based on the different color and material texture between the seals.

Agilent seals also feature optimal functionality at a wide temperature range from 4 to 60 °C, to adapt to different temperature conditions in different regions. Another feature is that we use specific copper-free manufacturing tools instead of common brass tools, to avoid copper contamination of the system. Therefore, use of third-party seals that clearly have different designs, materials, and features than Agilent seals can result in high risk of compromising your instrumental and analytical efficiency.

Outlet check valves

The outlet check valve has profound impact on pressure stability and pump flow. The valve has to work quickly, accurately, and reliably to achieve a precision eluent flow without disturbance such as pressure drop or pressure ripple.

The original design of the Agilent outlet check valve had a cylindrical seat and separate gold seal. The cylindrical seat was limited in its resistance to high pressure and alternating pressure loads, resulting in limited life time. In addition, the separate gold seal cap could be deformed by pressure loads due to the ductility of gold, causing leakage so that cap had to be retightened and sometimes changed.

Agilent therefore developed a new design for its outlet check valve to enhance durability and reliability. The new generation outlet valve has a unique double-coned seat to resist the highest pressure ranges, as well as an integrated gold-plated seal to minimize tolerance of seal edge geometry (Figure 6). In addition, since a gold seal cap is no longer required, there is no need to change the gold seal, which makes this part maintenance free.

In comparison, the outlet check valve from another vendor still uses the older design, resulting in risks of higher pressure ripple, poorer flow and retention time precision, as well as shorter life time and more maintenance.

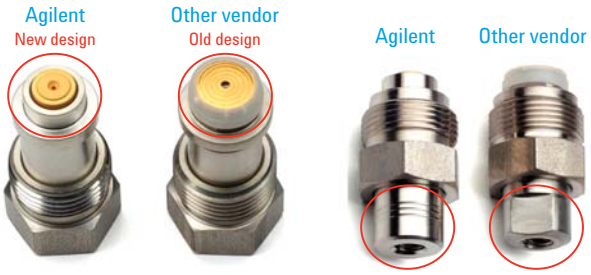

Figure 6. Top and side views of Agilent and third-party outlet check valves, showing the improved design of the Agilent valve.

Injection needles and needle seats

The injection needle and needle seat need to match perfectly to minimize sample carryover and ensure a leak-free flow path. Comparison of Agilent and third-party needle seat assemblies shows large differences in design. While the other vendor still uses the older design, Agilent introduced a design in 2011 with more robust material, improved performance, higher reliability, and larger pH range (0 to 13) (Figure 7). The conical geometry at the center of the needle seat also reduces sample dispersion. In addition, Agilent needles and needle seats are thoroughly tested to guarantee full functionality for more than 30,000 injections.

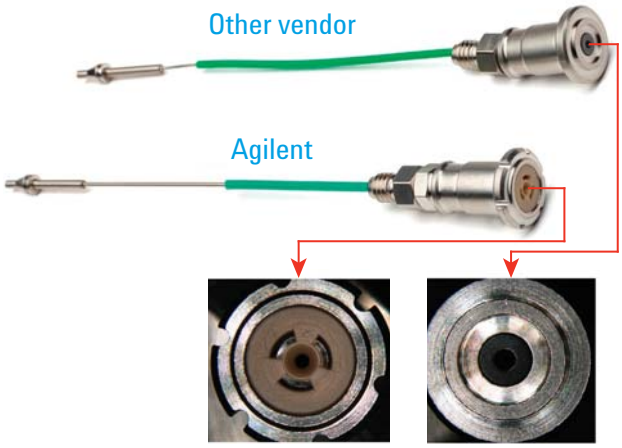

Figure 7. The superior design of Agilent needle seats.

Agilent uses an ultraclean plastic cap to protect the needle tip from collision and abrasion, contamination, and blockage through particulates (Figure 8). In comparison, there was no proper protection on the third-party needle.

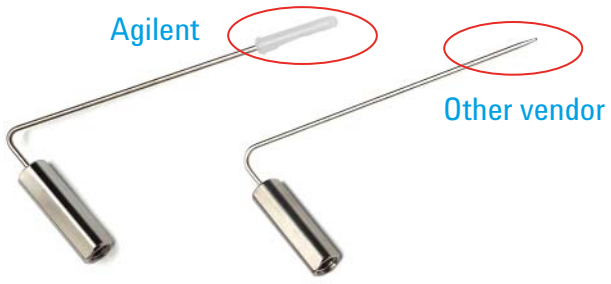

Figure 8. Better protection of the Agilent needle tip prevents damage.

Rotors

The rotor is a highly stressed part of the autosampler that is constantly switched back and forth, sliding over the stator. Its durability and life time is governed largely by the material and surface finish. Comparison of Agilent and third-party rotor seals revealed major differences in these aspects.

p/n 0100-1853

Surface smoothness

Microscopic inspection (Figure 9) shows the consistent flat surface of Agilent rotor seals, while scratches, flecks, and a jagged hole edge are clearly evident on the third-party rotor seal. The flecks indicate inconsistent material composition, and the scratches and jagged edge can definitely affect the sealing of the rotor to the stator, resulting in leakage or increased sample carryover.

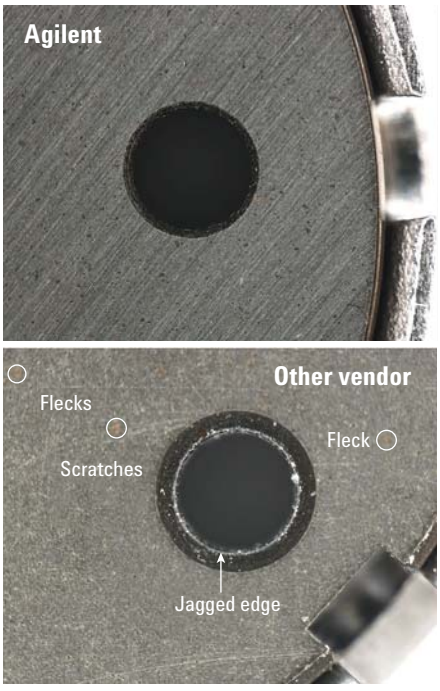

Figure 9. Photomicrographs showing the superior smoothness and integrity of the surface of an Agilent rotor seal.

Lifetime

Agilent rotors are rigorously tested and guaranteed for at least 30,000 injections. After 30,000 switch cycles, the Agilent rotor surface still seemed flat and consistent, and the contacting stator surface appeared clean (Figure 10). In contrast, the third-party rotor already showed severe surface damage and a contaminated stator surface after 26,000 switch cycles (Figure 11). Therefore, shorter lifetime and potential carryover and leakage are expected when using third-party seals.

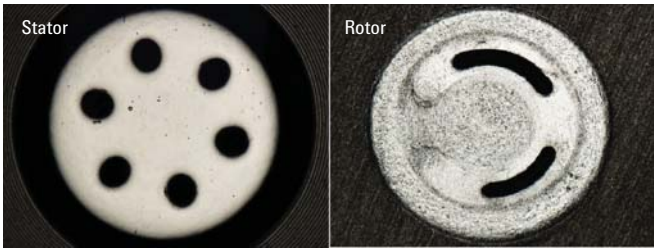

Figure 10. Stator and rotor after 30,000 switch cycles of an Agilent rotor seal, with clean and flat surfaces.

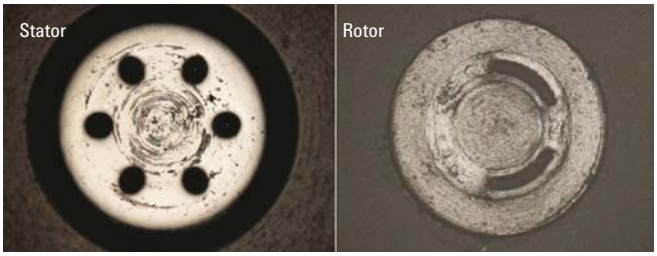

Figure 11. Stator and rotor after 26,000 switch cycles of a third-party rotor seal, showing early damage.

Packaging

Scratches and flatness of rotor seal surfaces can also result from poor packaging. Agilent rotor seals are packed in shape-stable plastic boxes to avoid surface damage and deformation of the seal during storage and transportation, while third-party rotor seals are packed in normal plastic bags without special protection (Figure 12).

Figure 12. Superior protective packaging of Agilent rotor seals.

To maximize instrumental and analytical efficiency, always use Agilent high-quality parts

All Agilent instrument spare parts are meticulously engineered to fit perfectly in your systems, precisely manufactured to yield consistent and reproducible results, and rigorously tested to provide the highest durability and reliability. Use of Agilent parts ensures that you achieve the optimal performance with your instruments and columns and avoid unnecessary maintenance.

Be proactive and save time and cost with preventative maintenance

Preventive maintenance is an important tool for ensuring instrument availability and maintaining best peak performance, while keeping instrument costs for your Agilent HPLC systems low. On average, you can reduce the incidence of unexpected repairs by 35% and reduce repair costs by 14%, while decreasing downtime by 3.4 days/year. (See Agilent White Paper 5990-5938EN).

For more information

www.agilent.com/en-us/services/analytical-instrument-services/repair-maintenance/crosslab-preventive-maintenance

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