

An Agilent Septum is Not Just a Septum

White Paper

The septum is one of the three main components of your sample containment system, consisting of the vial, septum, and cap.

The septum is highlighted in red in Figure 1.

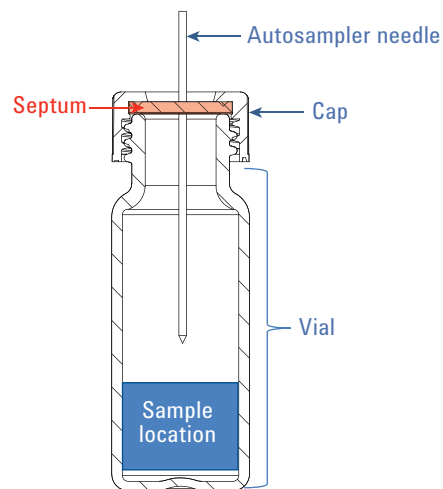


Figure 1. A basic illustration of an Agilent sample vial, highlighting the septum.



The septum forms a barrier between your sample analyte in the vial and the outside atmosphere. This barrier protects your sample from external contamination while allowing a needle (from a manual or automatic syringe) to enter the vial, and extract the sample for the next stage of separation.

Septa can be made from a range of materials including PTFE, silicone, red rubber, fluoroelastomers, and butyl to name a few. The materials are layered together in one of three options:

- **Single layer:** Usually made from red rubber or PTFE for one use only
- **Bi-layer:** Made from two distinct materials – one to create a barrier (usually PTFE) and one to allow for resealing (usually silicone)
- **Tri-layer (also known as a sandwich septum):** Still made from two distinct materials – usually silicone surrounded on both sides by PTFE

Choosing the correct septum material is vital, as it will interact with the analyte in your sample matrix as well as the sampler needle.

Choose a material that is as inert as possible to your sample analyte and makeup solvents. Table 1 shows the range of septum materials and their corresponding compatibilities to a range of common solvents used in sample preparation.

Table 1. Septa chemical compatibility.

Solvent	PTFE	PTFE/Silicone	PTFE/Silicone/PTFE*	PTFE/Red rubber	Fluoroelastomer	PTFE/Butyl
Acetonitrile	✓	✓	✓	✓		✓
Hydrocarbons (hexane, heptane, methane)	✓		✓	✓	✓	
Methanol	✓	✓	✓	✓		✓
Benzene	✓		✓		✓	
THF	✓		✓			
Toluene	✓		✓			
DMF	✓	✓	✓			✓
DMSO	✓	✓	✓			✓
Ether	✓	✓	✓			
Chlorinated solvents (methylene chloride)	✓		✓		✓	
Alcohols (ethanol)	✓	✓	✓	✓	✓	✓
Acetic acid	✓	✓	✓			✓
Acetone	✓	✓	✓			
Phenol	✓	✓	✓		✓	✓
Cyclohexane	✓		✓	✓	✓	

*PTFE/Silicone/PTFE has the same chemical compatibility of PTFE only until punctured.

What Differentiates Agilent From its Competitors

Agilent has one of the largest serviceable install bases of LCs and GCs, and is the market leader in GC technologies. Working with our instrument design teams, as well as with customers who are experts in each industry, gives Agilent the insights to innovate and improve existing products. This ensures that Agilent will provide the best septum for any application.

As a worldwide leader in chromatography solutions, Agilent is constantly improving products to deliver the best possible performance and analytical outcomes for our customers.

The following is a list of common issues you may face that can be attributed to the septum material.

- **Leaching:** Materials from the septum contaminate the sample matrix
- **Adsorption:** The adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid to a surface
- **Absorption:** A sample analyte adheres to the septum material
- **Coring:** A needle piercing the septum removes septum material
- **Sticking:** A needle sticks to the septum while piercing
- **Septum push-through:** A needle pushes the septum out of the cap and into the vial

The Agilent range of cap septa products will improve your lab productivity and operational efficiencies.

Septa Conditioning, and What You Should Know

One of the biggest issues caused by the septum material is siloxane bleed (the source of the siloxane bleed is the silicone itself, and is hard to avoid completely). Siloxane leaching, or bleeding, increases due to stress on the septum caused by injecting, increasing temperature, interacting with a broad range of solvents, or a combination of all three. For some applications, this is not an issue, as you may not be detecting in this range, but if you are, you may have issues. The Agilent certified range of septa have developed an industry-leading conditioning process that limits siloxane bleed, improving analytical sensitivity, lab productivity, and operational efficiencies. Make sure to ask for Agilent certified septa next time you order.

FAQs - Questions That Arise from the Septum Selection Process

Will my application require repeat injections from the same vial or storage of the sample?

Resealability is an important factor to consider when selecting septa. PTFE/red rubber septa are not recommended for multiple injections or for samples that need to be stored for further analysis. When applications require a longer time between injections or any type of standard additions, PTFE/silicone septa are always best.

What force is required to penetrate the septum?

Generally, silicone septa are more easily pierced than red rubber or butyl septa. For thicker, hard-to-pierce septa, a small gauge (23 gauge) needle may be required, or a stronger S-needle can be used. Preslit septa are the best option for easy penetration, reducing the likelihood of coring.

All Agilent Certified septa are designed for optimal use with a broad range of autosamplers and for proper fit in the caps.

Table 2 will help you decide which combination best suits your sample and application. Make sure that you are aware of the solvent, temperature, and sample composition before deciding.

Table 2. Cap and septum chemical compatibility.

	High performance septa	Thin PTFE	PTFE/Silicone*	PTFE/Silicone/PTFE*	PTFE/Red rubber	Fluoroelastomer	Butyl
Temperature range	40 °C to 300 °C**	Up to 260 °C	-40 °C to 200 °C	-40 °C to 200 °C	-40 °C to 90 °C	-40 °C to 260 °C	-50 °C to 150 °C
Use for multiple injections	No	No	Yes	Yes	No	No	No
Price	More expensive	Very economical	Economical	Most expensive	Very economical	Economical	Economical
Resistance to coring	Excellent	None	Excellent	Excellent	None	None	None
Recommended for storage	No	No	Yes	Yes	No	No	No
Best for	High temperature headspace applications	Superior chemical inertness, short cycle times, and single injections	Most common HPLC and GC analyses, not as resistant to coring as P/S/P	Superior performance for ultra trace analysis, repeat injections, and internal standards	Chlorosilanes, more economical option for single injections	Chlorinated solvents, higher temperatures	Organic solvents, acetic acids, impermeable to gases

* Agilent silicone is platinum cured (versus peroxide cured), making it more inert and less likely to interact with samples.

** For up to 1 hour.

Agilent Does Provide Better Septa

We recently improved the consistency of the pierce force of our septa materials to provide even better performance.

Our proprietary compositions should provide you the best performance of any cap-septum on the market. This improves the performance of your instrument's autosampler and reduces downtime related to unexpected needle or seat replacement, as well as, lowering costs and improving throughput.

Information on this development can be found at www.agilent.com/chem/septa

Know your Needle

The autosampler or manual syringe needle will define which septum you should consider. It is vital you understand that one septum will not work for all needles. The following needle features effect which septum you should use.

- **Tip style:** HP, Bevel, LC, Side, or other unique design
- **Material composition of needle:** Stainless steel, ceramic, and so forth
- **Injection speed:** rapid (GC) or slower (LC)
- **Injection volume:** 0.5 µL to 5 mL
- **Outer diameter of needle:** 23-26 s, and so forth

Still Unsure What You Need?

If you need help making this important decision see our online guides, including our selection tool and cross reference tables, or you can email or call us. Our sales team, supported by our technical support colleagues, will help you find the best possible solution to help achieve your analytical and business goals.

Good Luck with your application.

For More Information

These data represent typical results. For more information on our products and services, visit our Web site at www.agilent.com/chem.

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