White Paper

WHY GC SEPTUM INSTALLATION MATTERS

ABSTRACT

GC inlet septum correct selection, handling and installation are important to maintain optimal analytical performance.

The septum must be replaced regularly: optimised gentle septum piercing is needed in modern high-throughput labs to keep the instrumentation downtime for maintenance to a minimum.

Moreover, the septum replacement procedure represents a critical and error-prone phase, hence HTA has recently introduced a dedicated test to check the correctness of this task.

GC SEPTUM

MAIN FUNCTIONS

The GC septum is a **leak-free seal** located at the top of the injection port that allows sample injection while maintaining a stable carrier gas pressure inside the GC system. Moreover, it is structured to handle repeated perforations operated by the syringe needle during sample introduction.

SELECTION

Choosing the right GC septum is important to optimise function and performance.

The choice of the septum depends on its **properties such as material, penetrability and resistance to thermal degradation**. Different septa can be selected according to specific applications, analytical methods and injection techniques.

First, the temperature of the injection port determines the required resistance of the septum to thermal degradation. **Low-temperature septa** are generally made of softer silicone formulations for better resealability and usually have a longer lifetime than high-temperature septa. However, septum bleeding is more pronounced and they are usually more prone to damage. **High-temperature septa** are made of slightly harder silicone formulations that support higher temperatures and produce less bleeding/contamination.

STORAGE AND HANDLING

Regarding septum storage and handling, it is recommended to store septa in their shipping box with the cover closed to avoid contamination by volatile compounds in the air.

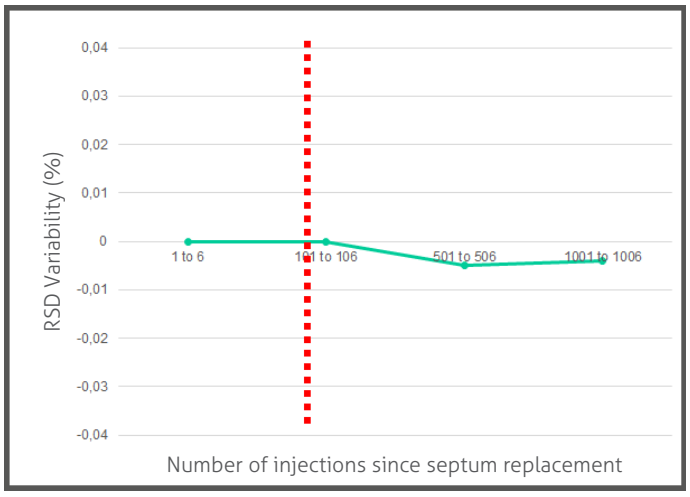
During installation, **the septa must be handled with clean forceps or by hands wearing clean powderless gloves**. It is important to avoid touching the septum with bare hands or powdered gloves because contaminants such as oils, perfumes, creams, and soaps present on fingers can be absorbed into the septum and released during GC analyses.

GC SEPTUM REPLACEMENT: HOW NEW TECHNOLOGIES DEVELOPED BY THE HTA R&D TEAM MAKE THE DIFFERENCE

REPLACEMENT FREQUENCY NEEDS

Regarding routine maintenance, **injection port septa should routinely be replaced**. GC manufacturers typically recommend changing the septa after 30–50 manual injections or 75–100 autosampler injections. Furthermore, septa should be replaced more frequently when using large-diameter needles or needles with burrs or hooks. For completeness, it is of note that 75–100 injections were acceptable in the 1990s but not today, as recent technological improvements have reduced the current GC analysis time increasing the number of samples processed daily. The "old" required replacement frequency is indeed no more acceptable: efforts have been made to reduce it.

Modern autosamplers, as HTA autosamplers, have optimised gentle piercing algorithms that allow to significantly increase the septum lifetime up to 1000 injections (see the graph below for reference).



CONSEQUENCES OF INCORRECT INSTALLATION

Septum installation/replacement in the GC injection port is a critical phase because it represents the most **error-prone step**.

First, it is important to follow the septum and GC manufacturers' instructions when installing/replacing a septum. However, even if instructions are carefully followed, septum installation can be incorrect because the septum nut tightening features a certain variability: this is not an "on/off" system, it requires a rough adjustment of the septum compression on most inlets.

Incorrect septum installation can have severe consequences.

A **loose septum** can lead to carrier gas leaks and pressure fluctuations but is generally easily detected by the GC pressure monitoring system.

Excess septum compression is more complex to overcome.

An overtight septum can result in **syringe needle damage** in the worst-case scenarios, thus causing a bent needle or shorter needle life due to anomalous wear.

Other issues may arise, for example, a septum nut over-compression can cause **increased septum coring** and even **septum splitting issues**. Such issues **reduce the septum lifetime** and cause the accumulation of septum fragments in the liner or the GC column. Furthermore, increased **septum bleeding** due to the over-compression can result in discrimination during injection, elevated baselines (for isothermal analyses), baseline disturbances, or even ghost-peaks (from the degradation products of the siloxane polymers) that appear into the final chromatogram, interfering with the identification and quantification of target analytes.

THE GC INLET SEPTUM TEST TO AVOID EXCESS SEPTUM COMPRESSION

Considering the above-mentioned problems occurring from an overtightened GC septum, technology that can regularly check for this event is desirable.

Thus, the HTA R&D team has developed an innovative technology[1] to detect anomalies in GC inlet septum compression after septum replacement. HTA autosamplers provide the ability to **check whether the septum is correctly compressed or overtightened**.

The septum test can be started by tapping a simple icon on the autosampler virtual/physical touch screen and **takes just 1 minute**. This test is available using both headspace gas-tight syringes and standard liquid syringes.

The GC inlet septum test can **increase autosampler syringe lifetime** because it reduces the eventuality of needle damage and system contamination due to septum bleeding/coring, ultimately **significantly improving the analytical data** due to the lower frequency of ghost peaks and baseline rise.

The GC septum test is one of the cutting-edge functionalities that make HTA autosamplers the best fit for enthusiast chromatographers.

[1] Patent pending

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