Introduction

Cap liners, also called vial septa, are selected according to the type of sample being analyzed. All vial septa contain small quantities of organic materials that might be detectable with the analytical instrumentation being used. For most GC-MS and other high-sensitivity detectors, Phenomenex recommends septa materials with the Cert+ designation; these are the cleanest and highest-performing products in the Verex line. Cert+ septa contain the very lowest levels of contaminants to minimize interference with the analysis, and are guaranteed to give excellent results with all major LC-MS and GC-MS instruments.

Chemical compatibility of septa materials is of a general nature, often measured by the degree of swelling and other effects the chemical has on the material, and should be used only as a general guide. Compatibility within a chemical class can vary according to the molecular weight of the solvent, other components in the sample, the temperature, as well as other factors. We recommend to try different vial septa materials to determine the best one for your combination of sample type, solvent and analytical detector.

Silicone/PTFE is the most widely used material combination for septa used in vial closures (caps and seals). Verex Cert and Cert+ products are specially prepared from the highest quality raw materials, manufactured and tested through multi-step processes, to provide cleanest possible closures for your samples.

Butyl rubber/PTFE septa are used with ketones and acids, and where silicone-containing septa do not perform well.

Both types of silicone and butyl rubber septa have a **PTFE barrier** layer which faces the sample, which reduces the contact between the sample and the silicone and butyl rubber.

Before the PTFE layer is punctured, the chemical compatibility properties of the PTFE will determine the solvent compatibility. It is only after the closure is punctured that the septa material will determine compatibility (see table below). Phenomenex recommends ***"once and done"*** with all caps and vials. Reusing caps and vials opens up the possibility of contamination, from solvent (liquid or vapor) interacting with the septa material as well as the atmosphere. This may seriously impact your analytical results, causes by sample contamination, chemical reaction, or evaporation. Both qualitative and quantitative errors may result, requiring time consuming, expensive, and frustrating troubleshooting and re-work. You can test to see if contamination is apparent on the second or later analyses from a vial from a vial closure that has undergone multiple injections. If contaminates don't show up, or the injection needle does not plug from septa coring, then it maybe you can get away with it. However, it is better to use these consumables the way they are intended: "once and done".

Sample storage times and temperature exposures before analysis will also influence the extent to which septa materials might be transferred into the sample. Good practice suggests that avoiding long storage times and elevated temperatures are prudent points to follow. Also, volatile components can be lost over long storage time, even with the best vial closures available today.

Chemical Compatibility Overview

Chemical	PTFE	Silicone	Butyl Rubber
Acids, concentrated	Excellent	Poor	Good
Acids, dilute	Excellent	Good	Excellent
Air and gas permeability	High	Moderate	Low
Alcohols	Excellent	Excellent	Good to excellent
Aliphatic hydrocarbons	Excellent	Poor	Poor
Alkalis	Excellent	Good to excellent	Good to excellent
Aromatic hydrocarbons	Excellent	Poor	Poor
Halogenated solvents	Excellent	Poor	Poor
Ketones	Excellent	Poor to good	Good to excellent
Water	Excellent	Excellent	Excellent

Septum Selection Guide

Septa Material	Advantages	Chemical Resistance	Applications	Max Temp
PTFE	Economical	Excellent	For single use only	225°C
PTFE/SILICONE	Excellent resealing capabilities	Excellent until punctured; Not suitable for chlorosilanes	Multiple injections then moderate resistance	200°C
Pre Slit PTFE/SILICONE	Reduces coring; Prevents vacuum from inside of vial	Excellent until punctured than moderate resistance	Multiple injections	200°C
PTFE/SILICONE/PTFE	Resistant to coring; Autoclavable	Excellent	Above average resealing; Multiple injections or applications with long periods between injections	200°C
PTFE/RED RUBBER	Economical	Excellent until punctured	Moderate resealability; Not recommended for holding samples for further analysis	90°C
Polyethylene	Economical	Good; Not resealable	For single injection use only	175°C
Polypropylene	Economical	Good; Not resealable	For single injection use only	175°C
Gray Chlorobutyl Rubber	Very Economical	Not suitable for chlorinated solvents alkanes, benzenes or cyclohexanes	Suitable for low pressure applications	100°C

Septa for use with general chromatography vials

PTFE/Red Rubber Septa:

PTFE/Red Rubber septa are the most popular and economical choice for general gas chromatography applications. These septa are used primarily for routine analysis in gas chromatography with FID, TCD and FPD detectors. PTFE/Red Rubber offers moderate resealability and excellent chemical inertness before puncture. The low durometer of red rubber allows for easy needle penetration even with thin bore GC needles. PTFE/Red Rubber septa are not recommended for multiple injections over long time periods or retention of samples for further analysis.

A pre-slitted PTFE/Red Rubber septum provides for easier needle penetration as well as to release the vacuum that forms when a large volume of sample is withdrawn from a vial. This septum provides chromatographic characteristics similar to that of a septum without a slit except that the ability to withstand exposure to aggressive solvents is slightly lessened.

Ordering Information

Description	1000/pk
Verex Seal, 11mm Diameter, Snap, PTFE/Rubber, natural	AR0-5646-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Rubber, silver	AR0-5740-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Rubber, red	AR0-5741-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Rubber, blue	AR0-5742-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Rubber, green	AR0-5743-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Rubber, gold	AR0-574G-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Rubber septa, blue	AR0-8942-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Rubber preSlit septa, blue	AR0-89A2-13

Septa for General Chromatography

PTFE/Silicone Septa:

High quality, pure silicone is laminated to PTFE to give a pure, highly inert septum with excellent resealing characteristics even after repeated punctures. PTFE/Silicone septa are the preferred product for use in most HPLC and GC applications where resealability and high purity are critical. Works well for applications where ease of needle penetration is important.

A PTFE/Silicone with slitted septum allows for easier needle penetration as well as to release the vacuum that forms when a large volume of sample is withdrawn from a vial. This septum provides chromatographic characteristics similar to that of a septum without a slit except that the ability to withstand exposure to aggressive solvents is slightly lessened. Pre-slit septa are highly recommended improving injection to injection reproducibility with autosamplers withdrawing greater than 50 µL of sample from a 2 mL vial, due to possible cavitation (vacuum).

Ordering Information

Description	1000/pk
Verex Seal, 11mm Diameter, Snap, PTFE/Silicone, blue	AR0-5652-13
Verex Seal, 11mm Diameter, Snap, PTFE/Silicone, natural	AR0-5656-13
Verex Seal, 11mm Diameter, Snap, PTFE/Silicone preSlit, blue	AR0-5672-13
Verex Seal, 11mm Diameter, Snap, PTFE/Silicone preSlit, natural	AR0-5676-13
Verex Seal, 11mm Diameter, Crimp, PTFE/Silicone, silver	AR0-5780-13
Verex Cap (pre-assembled), 10-425, w/ PTFE/Silicone septa, black	AR0-8057-13
Verex Cap (pre-assembled), 10-425, w/ Bonded-in PTFE/Silicone septa, black	AR0-8057-13-B
Verex Cap (pre-assembled), 10-425, w/ PTFE/Silicone preSlit septa, black	AR0-8077-13
Verex Cap (pre-assembled), 10-425, w/ Bonded-in PTFE/Silicone preSlit septa, black	AR0-8077-13-B
Verex Cap (pre-assembled), 13-425, w/ PTFE/Silicone septa, black	AR0-8357-13
Verex Cap (pre-assembled), 13-425, w/ Bonded-in PTFE/Silicone septa, black	AR0-8357-13-B
Verex Cap (pre-assembled), 24-414, w/ Bonded-in PTFE/Silicone septa, black	AR0-8557-13-B
Verex Cap (pre-assembled), 8-425, w/ PTFE/Silicone septa, yel, w/Flange 1000/Pk	AR0-8834-13
Verex Cap (pre-assembled), 8-425, w/ PTFE/Silicone septa, black	AR0-8857-13
Verex Cap (pre-assembled), 8-425, w/ Bonded-in PTFE/Silicone septa, black	AR0-8857-13-B
Verex Cap (pre-assembled), 8-425, w/ PTFE/Silicone/PTFE septa, black	AR0-8867-13
Verex Cap (pre-assembled), 8-425, w/ PTFE/Silicone preSlit septa, black	AR0-8877-13
Verex Cap (pre-assembled), 8-425, w/ Bonded-in PTFE/Silicone preSlit septa, black	AR0-8877-13-B
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone septa, red	AR0-8951-13-B
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone septa, blue	AR0-8952-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone septa, blue	AR0-8952-13-B
Verex Cert+ Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone septa, blue	AR0-8952-13-C
Verex Cert+MSQ Cap (pre-assembled), 9mm, Screw top, w/ Locked-Fit MSQ PTFE/Silicone septa, blue	AR0-8952-13-M
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone septa, natural	AR0-8956-13-B
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone septa, black	AR0-8957-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone septa, black	AR0-8957-13-B
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone/PTFE septa, blue	AR0-8962-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone/PTFE septa, black	AR0-8967-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone preSlit septa, blue	AR0-8972-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone preSlit septa, blue	AR0-8972-13-B
Verex Cert+ Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone preSlit septa, blue	AR0-8972-13-C
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone preSlit septa, black	AR0-8977-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ Bonded-in PTFE/Silicone preSlit septa, black	AR0-8977-13-B

Septa for General Chromatography (Cont'd)

PTFE/Silicone/PTFE Septa:

A layer of PTFE is laminated to each side of high purity, medium durometer silicone to form a septum that is the most resistant to coring while maintaining good resealing characteristics. The PTFE/Silicone/PTFE septum is recommended for the most critical applications such as ultra trace analysis or where there is a longer time between injections or for internal standard methods. PTFE/Silicone/PTFE septa provide superior performance with Agilent 1050, 1090, 1100, 1200 or any autosampler employing a large diameter, blunt tip needle.

Ordering Information

Description	1000/pk
Verex Cap (pre-assembled), 8-425, w/ PTFE/Silicone/PTFE septa, black	AR0-8867-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone/PTFE septa, blue	AR0-8962-13
Verex Cap (pre-assembled), 9mm, Screw top, w/ PTFE/Silicone/PTFE septa, black	AR0-8967-13

PTFE Septa:

A solid disk of PTFE offers superior chemical inertness against the most aggressive solvents. The thin membrane allows for easy penetration by most needles. PTFE septa are not resealable. They should be used with relatively short cycle times or single injection methods.

The PicoPure™ (PP) cap is made in one molded piece of inert, chemically resistant polyethylene. The starburst slits allows for easy needle penetration, even by large autosampler needles, such as on Waters and Agilent systems. Developed for high-sensitivity applications, especially in the LC-MS Market, the purity of this cap for extractables is well below the picogram range. This highgrade polyethylene does not have the contamination issues PTFE/Silicone septa show at low levels of detection, while also sealing exceptionally well. The PicoPure cap will puncture with far less force than needed to puncture a PTFE/Silicone septa, thus minimizing instrument wear and tear as well as downtime. The septa are not resealable and are intended for single use.

Ordering Information

Description	1000/pk
Verex Cert+ Cap (one-piece), 9mm Screw top, Polyethylene w/ Starburst preSlit, natural	AR0-89P6-13-C

Polypropylene (PP) Septa:

Polypropylene septa are offered as single piece caps where the septum is molded as a part of the cap. The surface for needle penetration is relatively thin allowing for use with thin gauge needles. Polyethylene septa are not resealable and intended for single injection use. No selections currently in the Verex line.

Viton Septa:

Viton offers the maximum chemical resistance for a wide variety of solvents. Viton has limited resealing capacity and should not be used for applications requiring multiple injections with long run times. Viton septa are highly recommended for use with chlorinated solvents. Due to its intrinsic hardness, Viton septa are not suitable for use with 32 gauge needles or high injection speeds. No selections currently in the Verex line.

Headspace Septa

Gray Butyl Septa:

The Gray Butyl septum with PTFE barrier is an economical solution for low temperature (100 °C), low-pressure applications. This septum is restricted for use with many solvents, and is not compatible with alkanes, benzene, chlorinated solvents or cyclohexane. Gray butyl offers good sealing characteristics for fixed gases and low molecular weight compounds.

Ordering Information

Description	1000/pk
Verex Seal, 20mm Dia., PTFE/Gray Butyl Rubber, Pressure Release, silver	AR0-52A0-13
Verex Seal, 20mm Dia., PTFE/Gray Butyl Rubber, magnetic cap	AR0-52C5-13

Ivory PTFE/Red Rubber Septa:

PTFE/Red Rubber Septa offer good solvent resistance, good resealing characteristics and resistant to coring. They are an economical choice where a PTFE barrier is desired. The recommended operating temperature range for this septum is –40 to 100 °C. PTFE/Silicone septa are an excellent choice for the analysis of volatile organic compounds at low concentrations or operation at higher conditioning temperatures. The septa are manufactured for low background, low permeability and the highest performance of any headspace septum. Septa pre-sfitted into aluminum seals are recommended to minimize handling prior to injection. PTFE/Silicone septa provide excellent re-sealing characteristics and broad chemical compatibility. The recommended operating temperatures are between –60 and 200 °C.

Ordering Information

Description	1000/pk
Verex Seal, 20mm Dia., PTFE/Silicone Press. Release, silver	AR0-5220-13
Verex Seal, 20mm Dia., PTFE/Silicone, silver	AR0-5250-13
Verex Seal, 20mm Dia., PTFE/Silicone, magnetic cap	AR0-5255-13

Gray PTFE/Molded Black Butyl Septa:

This molded septum features a PTFE faced center surface that does not extend to the edges of the septum. The PTFE center area provides good resistance to a wide variety of solvents. The center puncture area is resistant to coring and will reseal even after several punctures. The black butyl outer sealing edge conforms well to the rim of the vial affecting a more positive seal. The operating temperature range for this septum is from –20 to 125 °C. No selections currently in the Verex line.

Black Rubber Septa:

Black rubber septa are molded from a higher density rubber compound compared to the standard red rubber. This septum has characteristics similar to the gray butyl stopper with a slightly smaller temperature range of –20 to 100 °C. The Black Rubber septum is an economical choice for applications where reduced levels of vapor penetration are desired. Black rubber septa should be used with sturdier injection needles. No selections currently in the Verex line.

Headspace Septa

PTFE Aluminum Foil:

Aluminum backing on this septum provides an effective vapor barrier along with high temperature compatibility. The operating temperature range for this septum is –60 to 220 °C. No selections currently in the Verex line.